A GENDERED ANALYSIS OF HEALTH FROM THE IRON AGE TO THE END OF THE ROMANO-BRITISH PERIOD IN DORSET, ENGLAND (MID TO LATE 8TH CENTURY B.C. TO THE END OF THE 4TH CENTURY A.D.).

by

REBECCA CATHERINE REDFERN

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This study is dedicated to the memory of my grandfather.

‘Urn Burial’

“Born to these gentle stones and grass,
The whole of himself to himself:
Cheek by jowl in with the weasel;
Caesar no ghost but his passion.

An improvement on the eagle’s hook,
The witty spider competitor,
Sets his word’s strength against the rock,
No foot wrong in the dance figure –

So by manners, by music, to abash
The wretch of death that stands in his shoes:
The aping shape of earth – sure
Of its weight now as in future”

(Hughes 2003, 71).

Abstract

This thesis focuses upon the osteological evidence for adult health in Dorset, England during the Iron Age and Romano-British period (N= 270). The study employed a standardised method of recording to collect data from 21 sites, which was analysed at the population level. The data was discussed using a combination of social archaeology and a medical ecology approach, which enabled the evidence for health and well being to be understood in terms of society and environment, and how these changed over time. The approach also permitted comparison to national and European health patterns, and sought to challenge existing interpretations of both periods.

Iron Age health reflected the agrarian based economy of that period, in addition to social and environmental buffers and stressors, such as violence and the engendering of children. The Romano-British data demonstrated statistically significantly differences for many aspects of health, such as dental disease. The influence of environmental and socio-cultural change was reflected in the life-ways of the region, with a decrease in the evidence for violence, and an increase in tuberculosis. In comparison to national data, the region displayed heterogeneity in many aspects of health through time, particularly the prevalence of trauma, as well as evidence for continuity, particularly for agrarian life-ways. However, overall, the consequences of Roman colonisation could be identified.

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ADDENDUM

Please note that the site name Greyhound Yard should read Albert Road.

Albert Road – a Romano-British cemetery near the western gate to *Durnovaria*, dating from the mid-to-late 3rd century A.D.

Stacey, L.C. 1987 The excavation of burials at 8 Albert Road, Dorchester; interim report. *Proceedings of the Dorset Natural History and Archaeological Society* 108, 184.

CHAPTER 1.0 – INTRODUCTION TO THE RESEARCH QUESTION

1.1 Introduction

This research examines the health-statuses of adult individuals who lived in the modern county of Dorset during the Iron Age (mid to late 8^{th} century B.C. to 1^{st} century A.D.) and Romano-British period (1^{st} century to end of the 4^{th} century A.D.). The research investigates the palaeopathological evidence for health in each period, enabling data to be compared temporally.

Health-statuses are examined at the population scale using a medical ecology approach, which aims to include all identifiable variables, such as food resources, technology, and society (McElroy and Townsend 1996, 24, 26). The approach provides an integrated framework to interpret the osteological evidence for health and disease by allowing the inclusion of life course, feminist, masculinity, and gender theories.

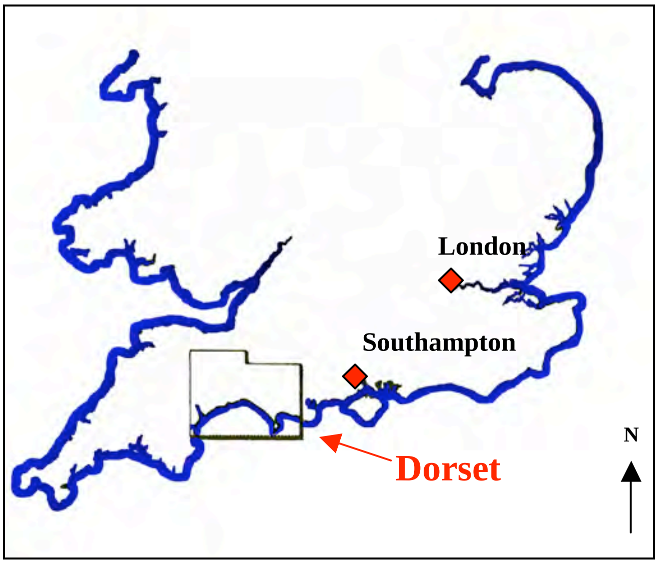
The study was undertaken because no detailed regional investigation of these archaeological periods using human remains had been completed. Our knowledge of Iron Age health is poor, the health of Romano-British communities has not been examined at the regional scale, and no study has specifically addressed the transition to the Romano-British period in terms of health (cf. Larsen 1994).

1.2 Area of study

The modern county of Dorset (Figure 1) is situated in the southwest of England and is bordered by the counties of Hampshire, Wiltshire, Somerset, and Devon and to the south, the English Channel. The region is 2652 km^2 in area and because of the underlying geology is formed into three distinct landscapes (Figure 2).

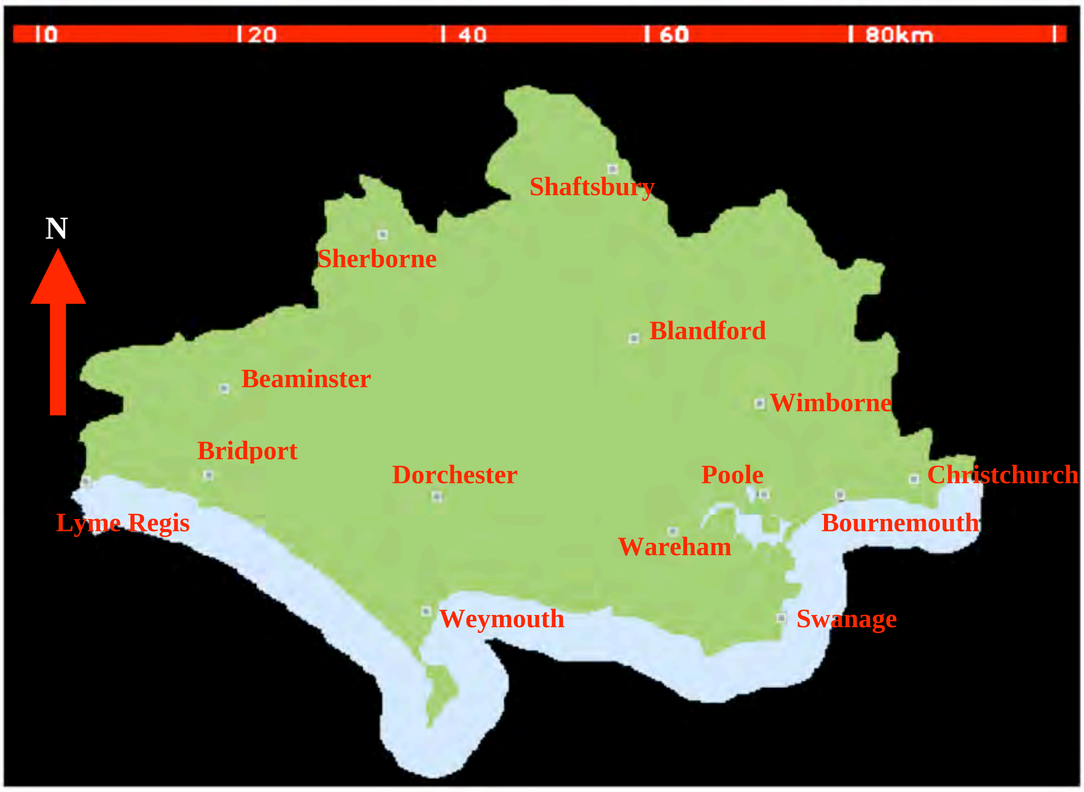
Figure 1: Maps of Dorset

1a. Location of region



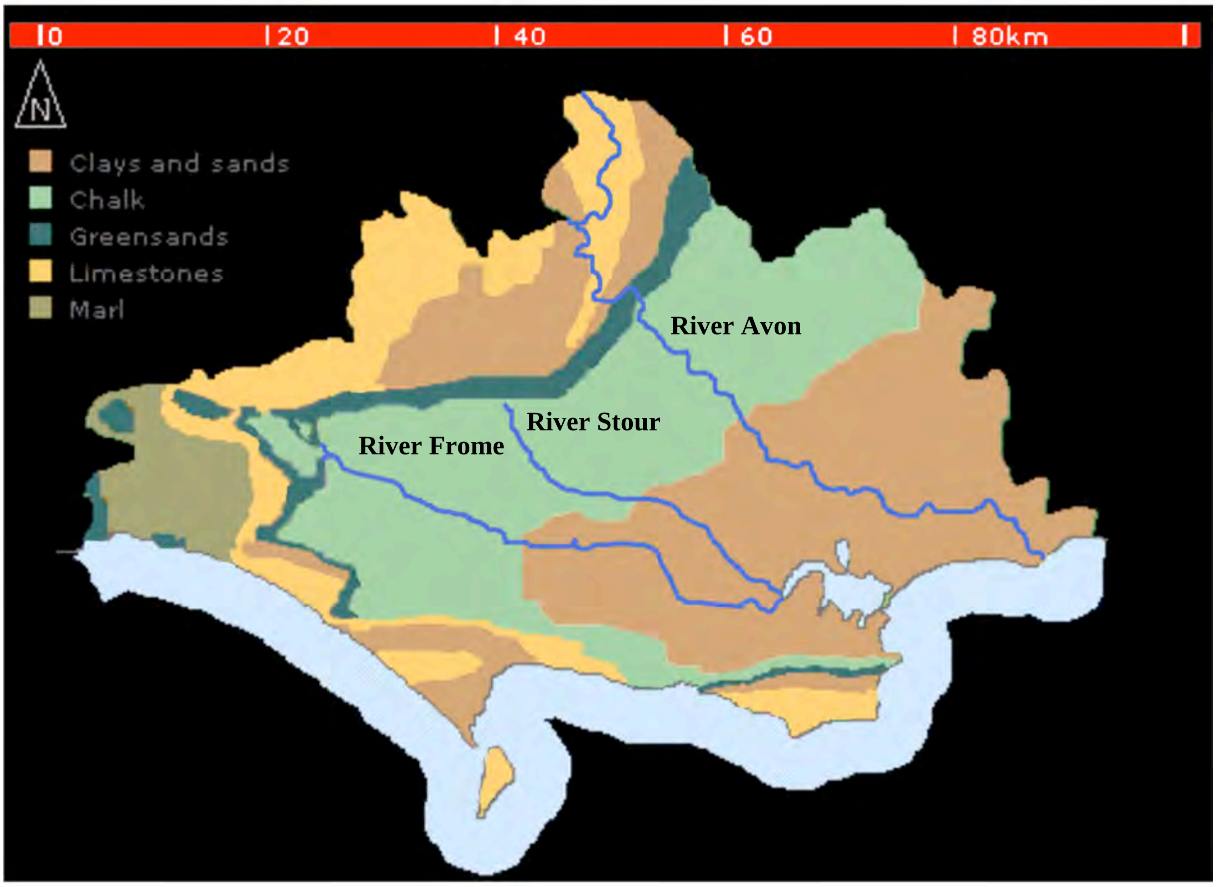
(after Hearne and Birbeck 1999, xii Figure 1)

1b. Map of region



(after http://www.imagesofdorset.org.uk/countymap.htm)

Figure 2: Geological map of Dorset



(after http://www.imagesofdorset.org.uk/geologymap.htm)

The centre of the region is formed of cretaceous chalk; in the west and south are limestones, sandstones, and clays, and to the east clays, gravels and sandstones, upon which heath-lands have developed. The region has three large river systems, namely the Avon (east), Stour (central) and Frome (south and west), with the majority of water joining the sea at Poole Bay (Gale J. 2003, 16-17).

The county is ideally suited to a population based level of analysis, because on present evidence, it is the only region in Britain where inhumation was continually practiced throughout the middle to late Iron Age and Romano-British period (Whimster 1977, 1981;

Wait 1985; Esmonde Cleary 1987). The geology promotes a high standard of bone preservation (Bryant 1990, 35), and Dorset has a long history of archaeological excavations (Gale, J. 2003), many of which have focused on burial areas and settlements providing a large population sample. However, as many early excavations did not curate or recover the human remains encountered very little of the human material excavated before 1950 is available for study. The context of the material excavated over the past 50 years has, to a certain degree, been governed by the urban development of Dorchester, alterations in agricultural practices, natural landscape erosion, road and building construction (e.g. the Tolpuddle bypass) and the research-led excavation of sites (Groube and Bowden 1982, 8-26; Woodward pers.com). Despite this work, the archaeology of Iron Age and Romano-British Dorset is not wholly understood and many areas remain poorly investigated. For example, Iron Age west Dorset is described as a "black hole" and coastal Dorset as "unsorted" (Haselgrove et al. 2001, 25).

1.3 Aims of the research

This research aims to

- Examine health through time at the population level of analysis,
- Apply age, gender, feminist, and masculinity theories to achieve a more nuanced understanding of health-statuses through time and
- Apply a medical ecology model to understand disease exposure and prevalence in relation to changing settlement and socio-cultural frameworks.

1.4 Objectives of the research

- Obtain a new insight into past health-statuses based upon gender and biological sex,
- Produce a regional study of changing health through time and
- Provide new data on health in Iron Age and Roman Britain at the regional level.

1.5 Outline of earlier osteological work in Dorset and Iron Age and Romano-British research agendas

The following section summarises earlier studies of Iron Age and Romano-British samples from Dorset, providing an overview of how human remains are treated in research agendas published by the academic community.

1.5.1 Iron Age

The integration of human osteology within Iron Age studies remains poor, and is compounded by the un-critical use of older or 'out-of-date' osteological reports in research (e.g. Watts 2005). Human remains have been included in a recent research agenda (Haselgrove et al. 2001) and their value for understanding health, society, culture, and environment explicitly stated (Haselgrove et al. 2001, 12-14). However, a lack of integration with other cultural evidence remains. It is considered that the situation arises from the limited research conducted within the osteological community and the inability to recognise many Iron Age mortuary practices. A number of recent publications have shown that once scientifically tested, many previously undated inhumations are from the Iron Age (Haselgrove et al. 2001; Hey et al. 1999)

The understanding of Iron Age populations in Dorset rests upon the interpretations of the Maiden Castle (Wheeler 1943) and Poundbury Camp samples (Farwell and Molleson 1993). Isolated and small cemeteries have been excavated over the past 50 years, although the dissemination of this information is very limited and many individuals had not been properly recorded. Unfortunately, many samples (although published) were subsequently re-buried or lost, e.g. seven individuals from Pins Knoll, Litton Cheney (Bailey 1967). During the last 20 years, excavations associated with construction of bypasses in the region (e.g. Smith et al. 1997) and town development in Dorchester (e.g. Davies et al. 2002) has increased the numbers of individuals with secure contexts for study.

Despite the region generating the largest sample of Iron Age individuals in Britain, very little research had been undertaken (e.g. Smith 1984) and many publications have relied upon very old osteological assessments (e.g. Watts 2005). None of the available information has been synthesised into achieving a greater understanding of this period and the data generated from site reports has been neglected.

1.5.2 Romano-British Period

Our understanding of Romano-British health has for many years, relied upon the samples from Poundbury Camp (Farwell and Molleson 1993) and Cirencester, which have come to dominate Romano-British archaeology. Recent research agendas (e.g. James and Millett 2001) have not included human remains and at a conference held in 2002, to discuss the future of Roman Archaeology (‘Whither Roman Archaeology?’), they were not included in the debate and their value not acknowledged (see also James 2003a). The situation is compounded by poor knowledge or lack of familiarity with human osteological data, displayed by many working in the field. For example, Reece (2000) in a recent publication on

Roman burial (Pearce et al. 2000) makes several promising observations, such as recognising the small contribution of human osteology to the volume. Reece (2000) also highlights the importance of integrating the osteological data into the interpretation of a cemetery (Reece 2000, 270-721). Nevertheless, instead of advocating stable isotope research to investigate Romano-British populations (e.g. Budd et al. 2003), Reece (2000) states that stature differences, non-metric traits, and “skeletal differences” need to be used (Reece 2000, 271-272). Such a statement demonstrates a lack of familiarity with current osteological and archaeological science publications, despite his calling on human osteologists working on Roman material, to have a working knowledge of Romano-British research (Reece 1982).

Romano-British burial contexts have been frequently discovered during the development of Dorchester, most famously by Thomas Hardy during the construction of his house ‘Max Gate’ and Hardy includes Roman burials in the novel ‘The Mayor of Casterbridge’. Isolated burials have also been discovered during building works elsewhere in the county, but until relatively recently many of these samples were either re-buried, not curated, or have been subsequently lost. Osteological studies in Dorset have been dominated by the Poundbury Camp sample, which has been the basis for many palaeopathological studies (e.g. Stuart-Macadam 1985) and until the 1980’s and 1990’s, it remained one of the few samples that demonstrated Iron Age continuity. However, the construction of Tolpuddle and Dorchester bypasses increased the number of individuals available for study outside Dorchester, and provided further evidence for continuity in burial from the Iron Age, which in some cases extended into the sub-Roman period (e.g. Tolpuddle Ball). The cemeteries from Dorchester and Poundbury Camp also provide information on the variation in burial practice in one locale, and importantly for the purposes of this study how the sample from Poundbury

Camp contains many examples of palaeopathology that are atypical within Dorset (e.g. osteomyelitis).

1.6 Archaeological background

The following sections provide information on the periods under investigation, namely environmental setting, settlement, economy, and burial practice.

1.6.1 Iron Age Dorset (late 8th century B.C. to 1st century A.D.)

The modern county of Dorset was inhabited by the Durotrigians whose territory (based on coinage distribution) extended from the River Avon in the east, the River Axe to the west and the River Brue in the north (Gale, J. 2003, 125-126). They were defeated by Vespasian and the Legion II Augusta in 44 to 46 A.D. (Cunliffe 1975, 99). It should be noted that we only know the population as Durotrigians, because of the Roman sources and therefore, the name does not necessarily mean they were a unified group (Millett 1997, 55; Cunliffe 2004, 52-53).

1.6.2 Society and culture: gender and stereotype

Our understanding of past social structure, occupations and roles in the Iron Age has been inferred from grave-goods and other archaeological evidence, or based upon the classical or primary texts and later insular Celtic sources. These sources focus upon the powerful members of 'barbarian' tribes, because they were seen as useful to the Romans and therefore much of the information is skewed towards high status roles, for example Druids. They are also biased, because they contain static descriptions of communities who were re-organizing themselves subsequent to Roman contact and internal disputes (James and Rigby 1997, 7, 57). Despite this evidence, our understanding of social structure, age-related transitions and responsibilities is very poor, allowing only generalisations about these communities. The majority of the evidence suggests that Iron Age society was hierarchical and organised by a framework of status and honour. Age transitions within society are also poorly understood (Champion 1997, 90), especially the age at which adulthood was attained. Life course studies have not been employed to analyse the available evidence and the archaeological basis for many interpretations are grounded in assumptions of what should be found. This is most clear in discussion of non-adults, “most regions show a significant under-representation of young people, which may suggest that the very young were thought of as a separate category” (Champion 1997, 90). Champion’s (1997) statement also emphasises the periphery nature of human remains in attempts to understand Iron Age society.

British Iron Age tribes had strong regional identities and their social structures probably varied significantly (Haselgrove 1999, 2001; Haselgrove et al. 2001, 23), with Dorset being noted as having an archaeologically prominent “cultural identity” (Haselgrove 1994, 3). However, in southern England, during the late Iron Age, power appears to have become centralised and controlled by a minority of individuals (Haselgrove 1994, 3; Gwilt and Haselgrove 1997, 7). Power may have been devolved using a framework of clients, based upon the agricultural economy and material goods. This may have allowed people to accrue status and power, enabling them to form their own client networks (Champion 1997, 92-93).

Work focusing upon the hillforts of Dorset, particularly Maiden Castle, suggests that significant social change took place during the Iron Age, with the introduction of iron in the first millennium B.C. forcing old social networks and communities to change and form groups, who consequently vied for control of productive agricultural land. This is evident in the proliferation of hillforts throughout the region. After this time, it is suggested that smaller groups coalesced to solve inter-tribal conflict, allowing a group of individuals who frequently engaged in violence to emerge. This change provoked further social alterations by allowing the development of powerful individuals, which is perhaps the reason why during the Roman invasion, Dorset was conquered gradually in comparison to other tribes in southern England (Sharples 1991a, 84-87; Haselgrove 1994, 3).

A range of occupations, identities, and roles existed during this period and many would have directly affected an individual's health. Prominent in both archaeological interpretation and literary sources is the warrior who is always, apart from the exception of Boudica, a man (Fraser 2002, see also Sweely 1999). Other high status roles include Druid, Priestess, Tribal leader/chief, and individuals with power based upon control of resources. These roles as with many aspects of Iron Age archaeology, can only identify the 'visible' members of the community. Other life-ways that may have been present to ensure the continuity and sustainability of communities are those such as healers or traders. These have been inadequately researched and receive limited analysis in interpretation and for the most part continue to remain 'invisible' in the archaeological record.

1.6.2.1 Iron Age females

> "One knows nothing detailed, nothing perfectly true and substantial about her. History scarcely mentions her" (Woolf 1992,57).

The determination of an individual's biological sex reflects Butler's (1990) observation "if one 'is' a woman, that is surely not all one is, the term fails to be exhaustive" (Butler 1990, 6). That is to say, in order to improve our understanding of past health-statuses, we must shift our understanding beyond binary divisions of society, health, and culture. This is a point emphasised throughout feminist anthropology, as there is no universal category of 'woman', because being female varies according to culture and social experience, despite females having similar experiences both temporally and spatially (Moore 2000, 189, 198). To a certain extent, it can also determine the interpretation and importance accorded to the study of ancient females. Our understanding of Iron Age females is polarised between two extremes, the minority as powerful queens, and the majority as unknown individuals. This is because female social agency is usually inferred from two sources, funerary treatment and primary sources, which have influenced our understanding of this section of the community from Victorian times. This can be demonstrated by the multitude of interpretations surrounding the Vix crater burial from Burgundy in France. Since it's discovery in 1950, the individual has been both male and female and their social role has run the gamut of interpretations, from transvestite priest to tribal ruler (Knüsel 2002, 278). In traditional and out-dated funerary analyses, female skeletons found with spindle-whorls were immediately associated with domestic and small-scale social and cultural interactions, perpetuating the 'Man-the-Hunter' model, rather than moving beyond simple binary stereotyping (Conkey and Spector 1984, 16; Conkey 2005). Despite continuing feminist re-interpretation, these stereotypes continue in our perception of the Iron Age. For example, Champion (1997) cites Cartimandua and the presence of richly furnished graves as evidence for female high status and then relies upon textual evidence from early Medieval Ireland, "the qualities valued in a woman were the traditional patriarchal ones of virtue, reticence and industry" (Champion 1997, 91; cf Hingley and Unwin 2005).

The primary sources have been found to stereotype females and to emphasise their behaviour as 'barbaric' and 'un-natural' in order to reinforce the 'civilised' view of gender hierarchies in the Mediterranean world (Arnold 1995, 153). This notion is also reflected in Roman art, particularly in the Claudius and Britannia relief (Ferris 2000, 55-58), and mirrored by the literary sources (Hingley and Unwin 2005, 58-61), which concentrate on female physique, particularly stature, strength, sexuality, and relationships with high status males. "A famous man, they say, formerly ruled Celtica [part of Gaul], to whom was born a daughter of gigantic stature … she, glorying in her strength and wondrous beauty, refused to marry any of her suitors, considering none of them worthy of her" (Diodorus Siculus, *Bibliotheka Historike* 5.24 cited in Koch and Carey 2003, 37-38). Of particular relevance to Britain, such stereotyping is also observed in Tacitus' writings on Cartimandua. The effects of Roman contact and colonisation upon her tribe are simplified by concluding that many actions resulted from complex relationships with her husbands (Tacitus, *Annals* 12.40 and *Histories* 3.45 cited in Koch and Carey 2003, 45-46) (see Hingley and Unwin (2005) for discussion of Boudica).

In 1991 at 'The Anthropology and Archaeology of Women Conference', a workshop discussed the effect of European contact upon female life-ways in the Americas. One of the first questions asked was, "what were the gender relations or, even more generally, what were lives of men and lives of women like in different places just before contact with Europeans?" (Levy and Claassen 1992,112). This question still remains to be asked of the British Iron Age (e.g. Watts 2005) and the lack of research in this area, has resulted in a largely unknown and poorly understood dataset.

1.6.2.2 Iron Age males

"Warriors mustered. They met together. With a single intention they attacked. Their lives were short. Their friends' grieving was long"
(extract from a Brittonic source cited in Koch and Carey 2003, 349).

Scott (1997b) notes "discussions about perceived past male experience [are] written in terms of modern male experience" (Scott 1997b, 8), an observation that can be found in interpretations of the British Iron Age, the majority of which focus upon power and materiality (e.g. Darvill 1995, 162-184). No Iron Age studies could be found which addressed differences between males or sought to elucidate the socio-cultural complexities affecting males in terms of age and gender. This is in stark contrast to the body of research on European (Iron Age) female experience and agency, and may reflect Scott's (1997b) assertion, that the British Iron Age is considered and discussed by the majority of researchers as implicitly male (e.g. Cunliffe 2004). Consequently, the reasons for analysing male experience are not revealed as urgent (see Conkey 1993, 45, 48; Wylie 1991). This approach continues androcentrism and reinforces the attitude that the male perspective is representative of the culture as a whole (Conkey and Spector 1984, 14-15) consequently information on male social statuses other than those associated with violence or power is absent.

As health status is inextricably linked to social status, the absence of information restricts interpretation of the male data and therefore this present study has become more reliant upon anthropological analogies, other archaeological samples, and the use of masculinity theory. The use of masculinity theory within the British Iron Age is applied with discretion, because although "all societies have cultural accounts of gender … not all have the concept 'masculinity' " (Connell 2001, 30). This is because it cannot be present without comparable concepts of femininity (Connell 2001, 31), though these do appear to be present in Dorset during this period.

The primary sources are focused upon male life-ways, experiences and power, which have created a stereotype, similar to that observed in Graeco-Roman art (Ferris 2000, 6-8, 86-98; see also Hingley 2005, 61-69). Compared to males on mainland Europe, British males receive limited description. Tacitus notes that they have large limbs, swarthy faces and are similar to the Gauls with regard to showing "hardihood in challenging danger, the same cowardice in shirking it when it comes close" (*Agricola* 11). Diodorus Siculus described the Gauls as being terrifying in appearance, prone to exaggeration, melodramatic, boastful and violent, but intelligent (Koch and Carey 2003, 12-13). Some status related differences are alluded to within the sources, reflecting the proposed clientage system operating in Celtic societies. Posidonius noted that high status males have moustaches and lower status males have beards (Cunliffe 1999, 107) and that companions or clients, were known as parasites or 'those who dine at another's table' (Athenaeus, *Deipnosophistae* 4.36 cited in Koch and Carey 2003, 11). Whitehead and Barrett (2001) note that men and boys take up localized and culturally specific signifiers to create identities, which in terms of masculinities, are subject to change through time, space and during their own life-times (Whitehead and Barrett 2001, 8, 20). Consequently, there are often a number of competing masculinities in any community (Whitehead 2002, 32), and information from the sources only provides possibilities, which are viewed with caution.

1.6.3 Settlements

Settlements during the Iron Age consisted of earthwork and banjo enclosures and hillforts, the enclosures were small agricultural units dispersed in the chalk-lands and coastal trading centres. Material culture and bioarchaeological evidence show that a wide range of activities took place, such as metalworking and the creation of secondary products from the agrarian economy. Hillforts also have evidence for metalworking, storage in granaries and settlement (Gale, J. 2003, 99-114). Seasonal settlements have also been identified and are often associated with craft specialisation (i.e. shale extraction and carving) (Dark and Dark 1998, 4).

The most widespread house type known from this period is the roundhouse, although turf houses and stone-walled houses have been found in Britain (Reynolds 1997, 198). Knowledge of these dwellings is based upon the distribution of post-holes and the recovery of wattle and daub. The buildings are characterised by a conical roof (an interpretation based upon the writings of Caesar), although other variations are possible (Reynolds 1997, 193-8).

Excavation at Pimperne Down (Dorset) revealed a dwelling, which upon reconstruction, was found to have a diameter of over 13 m. Reconstruction of the building demonstrated the resources and engineering skill utilised by Iron Age peoples. The building used 200 trees, 10,000 m^2 of coppiced hazel, over 10,000 kg of clay, 2000 kg of soil, 15,000 to 20,000 kg of thatching straw and a kilometre of binding and lashing (Reynolds 1997, 195-197).

The ritual nature of settlements and space in Dorset has been explored by, amongst others, Hill (1995a) and Fitzpatrick (1997). It is considered that this aspect of the living environment lies outside the remit of this thesis and is consequently not entered into, although it is acknowledged that it may have influenced the psychological perception of health and well being of many individuals (see Littlewood and Lipsedge 1987; Good 2003, 11).

1.6.4 Environment and climate

Climate during the Iron Age was characterised by wet and cold periods, until circa 150 B.C. when the climate became milder (Dark and Dark 1998, 18; Lamb 1981). The landscape of Dorset was a mosaic of grasslands, fields, and woods, with heath-lands situated near to the coast (Bell 1997, 149; Dark and Dark 1998, 30). During the early Iron Age, the woodlands regenerated from earlier Bronze Age activity, and close to the coast heath-land started to emerge (Dark and Dark 1998, 30). Roberts (N. 1989) describes this period, as one in which the first macro agricultural landscapes are produced and evidence from Rimsmoor bog in Dorset has shown that during the Iron Age, there is a dramatic rise in herb and grass pollen, indicating that agricultural activity intensified (Roberts, N. 1989, 147, 152).

1.6.5 Economy

The Iron Age economy in Dorset was based upon mixed agriculture (Hamilton-Dyer 1999, 196; Gale, J. 2003, 106-7). Analysis of the faunal remains indicates that cattle and sheep/goat herds were managed for many purposes such as milk, wool/skin, meat, and other secondary products (Hamilton-Dyer 1999, 197,199). Faunal remains have also shown that wild resources (duck, curlew and deer) formed a small part of the diet. A trend for small amounts of marine resources has been recorded across the south of England; with low-recovery rates observed even when extensive sieving has taken place (Buckland-Wright 1987, 129; Hamilton-Dyer 1999, 196). The emphasis upon dairy and terrestrial resources is supported by stable isotope tests on individuals from Poundbury Camp and a larger national study (Richards et al. 1998; Jay pers.com), in addition to a residue analysis of pottery from Maiden Castle (Copley et al. 2004).

The Durotrigians had extensive trade networks within Britain and Europe. This has been demonstrated at Hengistbury Head (located between Bournemouth and Christchurch), Hamworthy and Green Island (Poole Harbour) (Gale, J. 2003, 131). Hengistbury Head is one of the largest and best understood trading centres discovered and dates from the 2nd millennium, with more intensive activity occurring from 150 B.C. The harbour was surrounded by ramparts and extensive evidence for occupation and metalworking have been found. The trading commodities indicate that goods had been imported from the Mediterranean, northern France, and Britain. For example, pottery from Brittany, Armorican coinage, un-worked pieces of glass from the Mediterranean, lead from the Mendips (Somerset), silver ore from Callington (Cornwall) and perishable goods such as wine in amphorae from Italy, figs, corn and chamomile (Darvill 1995, 164; Gale, J. 2003, 131).

1.6.6 Burial tradition

The burial tradition of inhumation is one of the defining characteristics of the Durotrigians. In the early Iron Age, the deposition of human bone is dominated by the inclusion of portions of crania and limbs in settlement and hillfort locations (Wait 1985, 116). These pieces of human bone have evidence of secondary burial processing, suggesting that a less recoverable rite, such as excarnation was taking place.

The rites of single or multiple inhumations started in the middle to late Iron Age and were located in settlements, hillforts or in well-defined burial areas (i.e. Jordan Hill). Individuals were placed in crouched, prone, and extended positions, accompanied by grave goods of metalwork (jewellery and weaponry), pottery and joints of meat. Variations in funerary practice include, a chariot burial from Fordington, and a double burial at Lychett Minster of a female interred with a bronze bowl and glass beads, and a male interred with a sword, horse equipment and tankard (Blackmore et al. 1979; Taylor, A. 2001, 75). Such variations demonstrate the existence of a complex mortuary ritual that could be used to express a wide range of social concepts, such as age and gender (Arnold 2001, 213) (see Hamlin forthcoming).

The main clusters of burials between Dorchester and the Isle of Portland correspond to the later distribution of Romano-British burials and the identified pre- and post- Conquest settlements in south Dorset. In the west of Dorset, inhumation was not continued into the Romano-British period, a pattern also found in the north Dorset Downs, which are proposed to be an empty hinterland during this period (Whimster 1981, 42). In recent years our understanding of burial distribution has been improved by excavations conducted during the construction of the Dorchester and Tolpuddle bypasses. These have identified the use of burial areas in central and east Dorset, which date from the Neolithic to post-Roman period (Smith et al. 1997; Hearne and Birbeck 1999).

1.6.7 The Iron Age and Celts: a definition of terms

The terms employed in the discussion need to be clarified in order to avoid confusion when discussing the Iron Age. The term Celtic is not applied as a term of ethnicity (Jones 2002, 29-39), but is used when referring to peoples described by the primary sources, which provide accounts of European peoples outside the Roman Empire, or before their inclusion into it (this includes parts of Europe, Eurasia and the Mediterranean basin). In addition, the term Celtic is also used in the 6th century A.D. literature of Ireland and Wales, which has been shown to have relevance to Iron Age societies (Green 1997). It is acknowledged that this is a highly problematic term (Chapman 1992; James 1998, 1999a, 2002) and it is accepted that there are problems concerning the validity of applying the descriptions of cultural practice (Rankin 1996; Black 2001) to Britain (James 1998, 2001a). However, it is agreed with Arnold (1999) that without them, our understanding can be limited. In this study, the term Iron Age is not used interchangeably with Celtic. It is applied to the period in the British archaeological record when iron was in general use until the Roman conquest (Wells 2001, 35; James 2002, 182).

1.6.8 Romano-British period (43 A.D. to the end of the 4th century A.D.)

The Claudian invasion in 43 A.D. can be regarded as Britain's true introduction into the Roman Empire. The earlier invasion by Caesar in 55-54 B.C. enabled Britain to be considered part of the known world and incorporated into Roman geography. However, before the Claudian invasion Britons were not innocent of the Roman Empire, as many

British Tribes had formal treaties with the Emperor Augustus, there was frequent contact with Roman-controlled Gaul, and goods were traded from the Empire (Keppie 1991, 457; Millett 1994, 33-4). The conquest and subsequent colonisation of Britain are outside the parameters of this research and will not be referred to unless necessary.

Dorset was connected to the Roman Empire in a multitude of ways. Through the migration of people and settlement of veterans, development of urban centres, the provision of citizenship and the introduction of structured government extending up to the Emperor. It was connected to the rest of Britain, by the construction of roads linked to the Fosse Way, expanded trading networks, and men being drafted into the Army (Millett 1997, 53-89; de la Bédoyère 1999, 85-105; Ordnance Survey 2001). The regional centre was Dorchester or *Durnovaria*, which contained high status buildings, industrial areas, and a large bath complex (Woodward 1993).

1.6.9 Society and culture: gender and stereotype

Our knowledge of Romano-British society was for many years, based upon the numerous inscriptions found throughout the country (e.g. Birley 1979) and a macro view of past lives that were examined in isolation (e.g. soldiers). This approach relied upon very visible expressions of identity and occupation understood from a male perspective. For example, Birley's (1964) examination of life included sections on administration (see also Millett 1997). In recent years, with criticism of Romanization theory, the ways in which communities have been examined are dramatically different, rising from the shift in archaeological paradigms towards the greater inclusion of social theory. For example, Gardner's (2002) work examines the relationship between material practices, social identity categories, and the duality of structure. Significant work has also been undertaken on age identity and construction in Roman Britain, using biological and material culture to demonstrate that engendering of children had begun (Gowland 2001, 2002). There has also been a move to examine the construction of the social self/identity in combination of a greater appreciation for the heterogeneous nature of the Empire itself (e.g. Huskinson 2000; Laurence and Berry 2001; Hingley 2005).

The organisation and control of Roman Britain followed the methods employed elsewhere in the Empire. Millett (1997) describes it as "coercive" in that it depended upon on an "identity of interest" to be formed between the native leaders and the Roman authorities, so that they could be governed without the need of an occupying army (Millett 1997, 53). This is encapsulated by Tacitus' biography of Agricola, "His object was to accustom them to a life of peace and quiet by the provision of amenities … competition for honour proved as effective as compulsion … The unsuspecting Britons spoke of such novelties as 'civilisation', when in fact they were only a feature of their enslavement" (Tacitus, *Agricola* 21). During the Roman occupation, Dorset would have been governed as a city-state run by a council (derived from the local population), supervised by various levels of administration; with the focus of the region being *Durnovaria,* as the centre of the city-state or *civitates* (Wacher 1981, 134-137; Millett 1997, 54, 59). As the *civitates* and surrounding areas were managed by high-ranking members of the local population, existing power hierarchies were permitted to continue, compounded by the continuity of native laws, enabling the Roman administrators to rule a stabilised region (de la Bédoyère 1994, 20-21). Britain itself was ruled by a governor, drawn from a body of consuls at Rome and in 197 A.D. Britain was divided into *Britannia Superior* and *Britannia Inferior*; Dorset was part of *Britannia Superior* governed from London (Millett 1997, 76).

1.6.9.1 Romanization: the cultural interaction perspective

The understanding of the Roman impact upon Britain and the implications of its meaning upon 'native' society in Britain has been under review in recent years and its imposing and colonising aspects have been criticised (e.g. Webster 2001). Jones (2002) highlights the crucial point that for many years archaeological research created a rigid boundary between the Iron Age and Roman period, which had the effect of ranking the societies in terms of evidence for 'civilisation', for example literacy (Jones 2002, 29). Millett's (1990) theory of Romanization suggested that the Roman Empire 'fed' into existing hierarchical structures and that its acceptance was internally instigated. This theory has been expanded upon in recent times, by amongst others Webster (1996, 2001) and Hingley (1997, 2005). A discussion of Romanization theory lies outside the remit of this thesis. However, for the purposes of this research, several recent key suggestions about the incorporation of Britain into the Empire have been used to understand and interpret the data. Hingley's (1997) examination of resistance and domination in Roman Britain raises several points, which were felt to have particular resonance to understanding health in this period. Firstly, that the Roman conquest would not have been responded to in a universal manner within Britain, because the Iron Age communities had different identities (Hingley 1997, 87). Secondly that *civitates* also acted as centres of social control and their surrounding settlements may be viewed as a reaction to this control (by native leaders and Romans). The *civitas* could have been areas in which certain elements of Romanization were embraced (building techniques), but traditional ways may also have been continued (Fitzpatrick 1989; Hingley 1997, 93; Woolf, A. 1997). Thirdly, that the adoption of Roman culture and materials was individual dependent, as Hingley (1997) states, "adopt[ion] depended on an individual's background and context within the broader community and on the influences to which he or she was subjected during the Imperial experience” (Hingley 1997, 97).

Hill’s (2001) work on identity during the Roman period also affects interpretation of the osteological data. Hill’s (2001) research emphasises there was not a fixed Roman identity that could be adopted (see James 1999b for the adoption of military identity) and that it was understood and created differently according to place and period. We must assume that communities understood that the expression of identity could be through food, medical treatment, and personal hygiene and that they were meaningful. Importantly, Hill (2001) raises the point that people change identities throughout their lifetime (Hill 2001, 12-17). This can affect their life course, health, and exposure to disease. For example, Claudia Rufina lived in Rome during the 1st century A.D., during which time she married a friend of the poet Martial, who wrote of her, “though brought up among the sky-blue Britons, she has the spirit of the Latin Race” (cited in Birley 1964, 152).

Webster’s (2001) work on ‘resistant adaptation’ and Creolisation theory (Webster 2001, 218) moves the focus of interpretation away from elites and instead includes all members of society, in addition to rural and urban differences. This can be characterised by the use of Roman products, Webster (2001) suggests that although they may appear to be Romanized, they may have been used in native ways (Webster 2001, 219). This theme of questioning the context and culture in which Roman products may have been used has been undertaken on Roman medicine by Baker (2001, 2002a, 2002b). Baker (2002a) questions the homogeneity of Roman medicine within the Empire and her work suggests that treatment may have varied considerably in the provision of medical aid, the use of medical instruments and the understanding of medicine (Baker 2002a).

James (2001a) and Mattingly (2004) also explore new approaches to understanding society during the Roman occupation of Britain. Their analyses of Romanization raise several important points that have been used to discuss the results of this study. James (2001a) proposes that cultural change may have evolved without reference to Roman power (James 2001a, 205) and that mass culture maintained regional heterogeneities (James 2001a, 206). Mattingly (2004) proposes that the changes in socio-cultural materials indicates variations of Roman identity and what it meant to be non-Roman (Mattingly 2004, 9). The variation was not homogenous and was shaped by (amongst others) an individual's status, location, relationship with Roman power, and their origin, language, age, and gender (Mattingly 2004, 9-11). The most important conclusion from their work (based on the material culture), "different groups in Britain lived divergent lives, and many of them lived in rather different worlds from that conventionally emphasized by historians and archaeologists" (Mattingly 2004, 22). In conclusion, although the term 'Romanization' is used within this work it is used to encapsulate the multitude of ways that cultural interaction occurred during the Romano-British period.

1.6.9.2 Romano-British females

> "I shall not go back to the remote annals of antiquity to trace the history of woman; it is sufficient to allow that she has always been either a slave or a despot, and to remark that each of these situations equally retards the progress of reason" (Wollstonecraft 2004, 60).

It is posited within current research, that Romanization (see section 1.6.9.1) and incorporation of a society into the Roman Empire had a negative effect upon the status of females in 'native' or 'un-civilised' societies (Allason Jones 1999, 2005; Watts 2005). As outlined in section 1.5.2.1 the perspective of 'native' females to be 'barbaric' and their 'freer' position within society is frequently emphasised to reinforce the 'correct' prevailing status framework in the Mediterranean world (Arnold 1995, 153). With Romanization, females are supposed to have fewer social freedoms (Watts 2005, 74) a perspective challenged by many working on identity. For example, Laurence (2001) suggests that within the context of Roman colonisation, individuals had greater agency over constructing or presenting their identity (Laurence 2001, 2). Baker's (2003) review of research pertaining to Roman women raises several important points for Roman Britain. Principally, there is a shortage of published research addressing British material using feminist and gender theories, and interpretations based upon data from elsewhere in the Empire should be questioned. Additionally, the majority of interpretations are based upon elite women in Rome (Baker 2003, 141-143). Within the present study, it is accepted that women's lives were altered by the Roman invasion, but the interpretation of them becoming 'Roman' in the Mediterranean model or completely adopting Roman attitudes (e.g. Matthews 1991, 407-408; Watts 2005, 39-43) is viewed with caution. Above all, the treatment of women in much of the available contemporary literature for Britain maintains their ancient inferred 'universal' inferiority to males (Sissa 1994, 80; Baker 2003). These texts do not analyze the available evidence using feminist/gendered frameworks (e.g. Watts 2005), or recognise that age and gender change through the life course (see Derevenski 1997a, 487). Most crucially, despite many locales providing evidence for active female agency, diversity within the Empire remains inadequately discussed (see Monserrat 2000, 165; Baker 2003, 143).

Roman sources and information on females will be used with appropriate caution as, "the agent of feminist action constitutes and is constituted by both the moment of action and her capabilities, the tools at hand. These defining considerations … resolv[e] the paradox of producing change out of the paralysis of patriarchy" (Gero 2000, 37).

1.6.9.3 Romano-British males

"For many men their gender, as a key if not determining factor in their life experiences and history, remains unseen if not incomprehensible to them" (Whitehead 2002, 81).

Unlike the hypothesised change in female status with Romanization, none, or a limited degree of change is suggested for males (e.g. Birley 1964, 1979), reflecting an androcentric perception of the past (Moore 2000, 8) and to a certain extent, transplants of the *paterfamilias* model of Roman living (Hope 2000a) onto British communities e.g. Watts (2005). No study could be found which addressed changes in male status with Romanization, for example, how native men's lives compared to migrants, soldiers, or within their own community. Only broad changes at a national scale are discussed (e.g. Millett 1997). Hill's (2001) work on identity has gone some way to address the problem of changes in status. Nevertheless, an incomplete understanding of Romano-British society remains, which has implications for understanding health through time.

The most frequent discussion of the repercussions on male lives with Roman colonisation, centres on their conscription into the Roman Army (see James 1999b for discussion on the formation of a soldier identity). Millett (1997) suggests that "large-scale individual recruitment" took place and estimates that a minimum of 12,500 men were recruited up to the reign of Hadrian, these units were then stationed in Germany and Morocco (Mann 1996, 39-53; Millett 1997, 80). Their conscription would have radically altered the makeup of many communities and may have caused/aided the break down of traditional social frameworks, all of which may have had an effect upon well being and health.

Concepts of masculinity and their relationship to health (Sabo 1999) and the male life course are approaches that may aid the understanding of the palaeopathological data. As discussed in section 2.9.2, male health is intimately connected to concepts of masculinity

(World Health Organization 2001, 12). Masculinities are not static, they vary temporally and spatially, and are subject to change within an individual's life-span (Whitehead and Barrett 2001, 8). As changes in masculinity have been documented historically (Connell 2002), it is not unreasonable to hypothesise that they would change with the Roman colonisation and incorporation into the Empire. Therefore, changing masculinities may have influenced male health-status through time. Roman males have been a focus of intensive research, particularly because they are more 'visible' in the ancient sources and have been associated with popular areas of study, such as the Army and manufacturing. The more traditional approaches to understanding past males, are moving towards more nuanced studies which are grounded in age and gender theory (e.g. Harlow and Laurence 2002; Harlow 2004).

The status of males in the Roman Empire was always higher than that of females, because they possessed a male body, but differential ranking between men did exist (Foxhall 1998, 3-4). It is not clear the whether such ranking operated in Britain, although if present, may have led to the preferential treatment of males, as observed in many societies today (Hill and Ball 1999) and may be detectable osteologically.

1.6.10 Environment and climate

During the Romano-British period in England, the amount of woodland increased, due to the villa economies' exploiting the landscape to its full potential. The exploitation of natural resources within the English landscape also developed, through pottery and tile production, iron working, salting, mining, and woodland management (Dark and Dark 1998, 31-32, 114). The climate after 150 B.C. became much warmer, a trend noted by Roman writers who observed the northward expansion of vine and olive cultivation. This pleasant climate degenerated circa 80 A.D. when the weather became so cold rivers often froze (Lamb

1981, 56-57). By 400 A.D. the temperature continued to decline and a rise in flooding also occurred (Jones 1996, 188).

1.6.11 Settlement

The Romano-British period introduces the concept of urban and rural distinctions and divisions in settlement. The evidence available for interpretation is based solely upon excavated sites. Therefore, housing and settlement densities are unclear and interpretation is complicated by the lack of knowledge concerning relationships between rural and urban centres, the nature of land tenure, social organisation (e.g. who lived on villa estates?) and the continuity of Iron Age dwellings (Hingley 1989, 9, 151; Blagg 1990; McKay 1998, 186; Taylor 2001). Roundhouses continue from the previous period, and are found on many different site types for example villas, farmsteads, and urban areas. In some areas, they are superseded by corridor houses, suggesting Romanization or the influence of the military (Hingley 1989, 31-4; Blagg 1990). Other buildings in this period are constructed from stone and timber, both materials attested in Dorchester, although it is not always clear whether they had a domestic and/or industrial function (Woodward et al. 1993). These buildings are usually only recovered as floor plans and therefore ventilation, heating and roofing materials are not wholly understood. They typically take the form of L-shaped and courtyard houses, villa compounds, corridor houses and cottages (Hingley 1989, 35-60).

1.6.11.1 Rural settlement in Dorset

In Dorset, the rural settlement is suggested to be small villages of cottage style buildings, Iron Age ‘traditional’ farmsteads, and villa complexes. The majority of villas have been found in the alluvial valleys and clay-lands. Some are located in remote areas, away from roads or other settlements and they are widely dispersed throughout the region. The understanding of rural settlement has been limited by the small number of excavations and landscape surveys that have taken place (Field 1965; Groube and Bowden 1982, 48; Hingley 1989).

1.6.11.2 Urban settlement in Dorset

Urban settlement in Dorset was focused upon Dorchester, following the shift of political power away from the hillforts, most notably Maiden Castle. The development of urbanism is proposed to have begun in c.70 A.D., during the first decades of the Flavian period (69 to 96 A.D.), after initial military occupation dating to the pre-Flavian and Claudian periods (41 to 54 A.D.). The walled Roman settlement is known as *Durnovaria* (its name is included in the Antonine Itinerary) and unusually the name has no Tribal suffix. Due to its size and position, it is suggested to have been the *civitates* of the Durotriges and was occupied for approximately 400 years (Woodward 1993, 359; Royal Commission on Historical Monuments England 1970, 531, 532). In Roman administrative hierarchy, the title *civitas* indicated that it was for non-citizens and contained formal civic buildings (de la Bédoyère 1994, 20; Adkins and Adkins 1998, 133; Millett 1997, 57).

Durnovaria was situated by the River Frome and connected by roads to London and Ilchester. Its location can be explained by Roman town planning, which cited towns near to rivers, roads, and existing strategic military sites. Well being and health were also considered when choosing a location (Salway 1992, 67-8). Excavations have shown that *Durnovaria* had several urban amenities including a forum, amphitheatre, and a large bathhouse, which may have been connected to a temple complex (Woodward 1993, 367). The water was supplied to the town via an aqueduct (Wacher 1981, 318-322; Esmonde Cleary 1987, 64-65).

The economic activities within the town have been identified as commercial, industrial and craft working, including metal working, bone working, fabric making and butchery. A possible urban farmstead has also been identified, suggesting land management of the surrounding areas (Woodward 1993, 375).

The organisation and density of buildings within *Durnovaria* is poorly understood, although excavation of a series of buildings fronting a street has shown that each property had a separate plot. In each plot, based on the arrangement of cesspits, wells and waste-pits, the boundaries could be reconstructed (Woodward 1993, 363). Urban dwellings have also been uncovered at Colliton Park. Excavations at this site revealed part of a larger house and uncovered a three-celled structure (23 by 15 m) with extension rooms east and west. It had a hypocaust, hearth, and oven. At Greyhound Yard, an L -shaped building with an enclosed courtyard, deep cistern for holding water and a hypocaust were also found. The L-shaped building was richly decorated with painted wall-plaster, moulded wall pilasters, and expensive mosaics. Other buildings in this area have latrine buildings and household drains (Woodward 1993, 365-366).

1.6.12 Economy

The military and immigrants, especially traders, revolutionised the existing economy by importing goods and through the influence of their own socio-cultural practices (van der Veen and O'Connor 1998,134-136).

The agrarian economy also changed with the introduction of new crops. The use of cereals continued and mineralised seeds from cesspits include plum/cherry, blackberry, figs, apples/pears, hazel nuts, cabbage/mustard, and pea/bean (Ede 1993, 73-77). Animal husbandry also expanded, with the introduction of mules and donkeys into Britain (Maltby 1981,160-182). The high number of pig elements recovered from *Durnovaria*, suggest that intensive pig breeding may have taken place (Maltby 1993, 325). Sheep rearing also continued, but the flocks were primarily being used for meat and wool instead of milk, and cattle herds were also kept (Maltby 1981, 160-182; Buckland-Wright 1987, 129-132). The exploitation of wild animals also continues as hares, wild birds and fish have been found at urban and rural sites (Hamilton-Dyer 1993, 77-81). There is also an increase in the range of marine wildlife exploited with the finding of molluscs, including amongst others, oyster and cockle shells (Allen 1993a, 82). The number of fish also increases and includes demersal and pelagic species (Hamilton-Dyer 1993, 78-79).

1.6.13 Burial tradition

In Roman Dorset, formal burial grounds were quickly adopted (Millett 1997, 124) and were located around towns, perhaps naturalising urbanism, as their place was determined during town planning (Esmonde Cleary 2000, 136). Inhumation practice also underwent change, with the majority of individuals buried in extended positions with some variation expressed through decapitation and prone rites (Leech 1980, 342). Gypsum or plaster coffin burials date to the late Roman period (Millett 1997, 128), and have been found at Poundbury Camp and the Crown Building (Sparey Green et al. 1981; Farwell and Molleson 1993). The practice involved the body being covered in gypsum and is suggested to be related to care of the deceased (Millett 1997, 128). At Poundbury Camp, the gypsum preserved body hair and lice (Jones 1993, 197-198).

The use of coffins was also introduced and a wide range has been found including lead, wood, and stone, with many graves also lined with stones or wood (Leech 1980, 341; Smith 1997, 293). High status individuals were often buried in mausoleums and one at Poundbury Camp included frescoes (Farwell and Molleson 1993, 52-59).

The burial tradition of including grave-goods also underwent a slight change, but continued to demonstrate gender and age differences (Hamlin forthcoming). The basic range of grave goods still included pottery, jewellery, and cuts of meat. Other goods found in the region include hobnails, sling stones, styli, and a table leg carved from local shale.

1.7 Approaches to the analysis of transition periods

The analysis of transition periods within British palaeopathology remains under-developed; no focused study could be found which addressed the health consequences of a socio-cultural transition upon health, despite substantial palaeopathological evidence demonstrating that health-statuses do change. For example, there is no comparable work Armelagos' (1990) review of the consequences upon health of prehistoric populations moving from hunter-gatherer to agrarian life-ways which notes that the intensification of agriculture resulted in poorer nutrition and an increase in infectious diseases (Armelagos 1990, 141). The Americas have generated a large body of bioarchaeological 'contact' literature concerning the effects of socio-cultural change upon a native population, as the conquest of the Americas from the fifteenth century A.D. had profound and devastating effect upon the contacted communities (Larsen 1994; Steckel and Rose 2002). Larsen's (1994) review of the consequences of colonisation observed (amongst others) changes in dental health, the pattern and prevalence of trauma, metabolic and infectious diseases, and demography (Larsen 1994, 130-137). Many of these changes have been observed in British transition periods, for example analysis of the post-Roman transition to the Anglo-Saxon period has demonstrated that the prevalence of infectious disease increases whereas, trauma and dental disease decrease (Roberts and Cox 2003, 220).

Comparison to contact literature is not made within the thesis, due to the considerable disparities in environment, culture, technology, society, and the substantial differences between the colonising groups. Nevertheless, the contact data does have findings of particular relevance to the Romano-British transition; that a uniform response was not observed, and many communities successfully adapted, recovered and continued despite significant environmental and socio-cultural transformations (Larsen and Milner 1994, 2).

In order to investigate the aims and objectives (see 1.3 and 1.4) of the study, building upon the bioarchaeological approaches used in contact studies, a medical ecology approach was employed, because it is sensitive to the diverse influences upon health and permitted the integration of social science theory, clinical and biological data, archaeological and bioarchaeological evidence.

1.7.1 Medical ecology approach

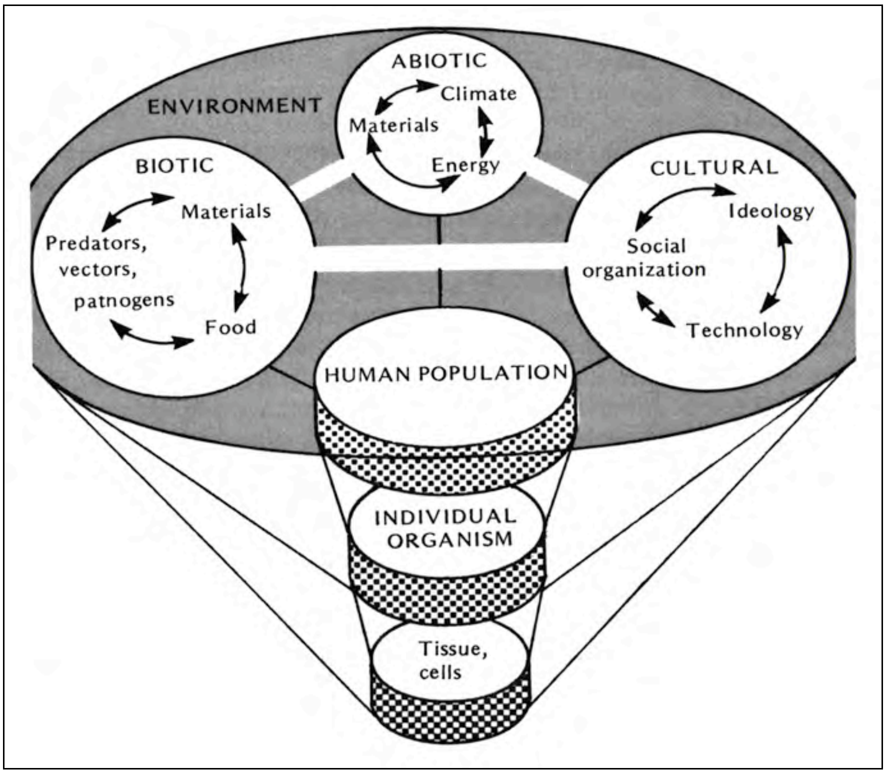
"Without integrating archaeological evidence with palaeopathology,
the final interpretation is almost useless" (Roberts 2002a, 3).

The discipline of medical anthropology is a crucial aspect of socio-cultural anthropology, as it concerns itself with understanding, recording, and investigating how the body, illness and health are understood and treated in living communities throughout the world, frequently contrasting Western and 'traditional' knowledge systems (Hylland Eriksen 2001, 253-254).

A recurrent framework within medical anthropology is a medical ecology approach. The approach is based upon anthropology, ecology, and medicine, relying upon multidisciplinary research and incorporating all intrinsic and extrinsic factors that influence health. It is suitable for studying large samples and the individual (McElroy and Townsend

1996, 7). The role of ecology is particularly important for the examination of past populations, because its study examines the relationship between humans (or species) and their 'total' environment (Brown 1998, 77) (see also Bush and Zvelebil 1991). McElroy and Townsend (1996) demonstrate that ecology can be divided into three areas that are both interdependent and interacting, namely the physical, abiotic and environment (biotic and cultural) (McElroy and Townsend 1996, 24. See also Armelagos et al. 1978; Armelagos et al. 1992) (Figure 3).

Figure 3: A drawing of the medical ecology model. The figure presents a schematic representation of the medical ecology approach, showing the numerous connections between the individual and their environment, which act as determining factors in health.



(after McElroy and Townsend 1996, 25. Figure 1.6)

Within the model, health and disease are produced or maintained by numerous interrelated causes in which no single mechanism is responsible for disease. Importantly, in the model, the environment includes the landscape and the local environment, which contains constructed and defined areas that are lived in and used according to socio-cultural conventions (McElroy and Townsend 1996, 26). The approach is particularly useful in the study of archaeology, because it aims to include all available variables, such as food resources, technology, gender, and age. As Roberts (2003) states, “health problems that appear in societies past and present are not random but appear in patterns and are determined by a myriad of endogeneous … and exogenous … factors” (Roberts 2003, 98). For example in this present study, evidence for violent trauma can be understood in relation to the socio-cultural environment. If the same variables are chosen, then populations or individuals can be systematically studied and compared (Wiley 1992; McElroy and Townsend 1996, 26), making this approach suitable for the present study. As the model concerns health and disease, these must be defined. Brown et al.’s (1996) discussion of the definition of disease provides numerous examples, and for the purposes of this study, it is defined as, “the temporary expression of maladjustment of an individual trying to cope with the challenges of his or her environment” (Brown et al. 1996, 187). Brown et al.’s (1996) definition has been chosen because it recognises, for example, that infection does not always lead to disease (e.g. tuberculosis), and additionally that a universally applicable ‘average’ state of health cannot be achieved because it varies culturally, thereby denying classification. For example in France people are diagnosed with diseases that do not exist anywhere else (Polunin 1977; Brown et al. 1996, 185-186; Brown 1998, 77; Moerman 2002, 77). This is particularly pertinent in palaeopathology, when what is regarded as ‘normal’ or diagnostic is often observer dependent (Roberts 2002a, 4). Health in this present study is defined as “a state of physical, mental and social well being and not merely the absence of disease or infirmity” (World Health

Organization website) and as with disease, is open to numerous cultural interpretations (Dubos 1995).

As the medical ecology model is based upon the inter-relatedness of many factors, those that can be shown to have a direct influence upon the osteological evidence for health, for example, biological differences between males and females; and how this is interpreted, such as with the use of social science theory, are outlined below.

1.7.2 Biology and health: differences between females and males

“By leaving male bodies unscrutinized, feminists have tended to reinforce the notion of the male as the unmarked sex, the human standard of perfection from which the female can only deviate”
(Schiebinger 2000, 14).

The study uses the phrase biological female/male to both reflect the determination of sex based on skeletal characteristics and the biological differences that exist between the sexes. Key differences between males and females in terms of immune status, life span, and stature are outlined below, as male biology and response to disease to a certain extent continue to be viewed as the ‘norm’ or, the standard to which females are judged. This can be exemplified in the treatment of serious diseases and the disease experience (Schiebinger 2000, 3; Donner 2003; Hallin 2003). However, this trend has come under scrutiny, and identified male health as an area of research, developed from and built upon the Women’s Health Movement (World Health Organization 2001, 12). The World Health Organization (2001) has shown that male health (as for females) must be examined in a life course perspective, which takes into account the role of masculinity, gender, and age (WHO 2001, 12-14).

1.7.2.1 Immune status

"Adaptability is the insignia of the female; survival rather than victory is her success" (Greer 2000, 419).

Clinical research has shown that females have a different immune response to disease compared to males, a trend observed throughout mammal species (Ortner 1998, 81, 2003, 114-118; McDade 2003, 109). The variation in immune response proposed to have developed as a response to pregnancy and its associated health risks (Ortner 1998, 81), although recent research has shown the immune system appears to be compromised during pregnancy (Doyal 2000). Ortner (1998, 2003) suggests that due to this enhanced status, females will have a lower prevalence of specific infectious disease and they are more likely to display chronic long-term infections compared to males (Ortner 1998, 88-89, 2003, 117).

Despite Ortner's (1998, 2003) model enabling us to have a greater understanding of the results obtained from skeletal samples, several problems remain with fully accepting this model. Medical research acknowledges that the more complex interactions of the immune system are not entirely understood, such as population and individual variation in immune development and function (McDade 2003, 121). Additional factors, such as the body's susceptibility and response to infectious diseases are genetically determined, and that immune response changes with age. Furthermore, the role of the environment, socio-cultural factors, and ageing are incompletely known (Effros 2001; Han et al. 2001).

1.7.2.2 Male and female differences in life span

"If men are to live as long as women do … they will need to change their unhealthy behavior" (Courtenay 2002, 311).

The disparity in biological status between males and females is also seen in the decreased life span of males from prenatal age, and throughout adulthood (Stinson 1985, 125; Overfield 1995, 177). The trend for a lower age-at-death has been observed both historically and in contemporary datasets (Stillion 1995, 47-48; MacIntyre et al. 1996). Stinson's (1985) work has shown that the higher rate of male death observed in stillborn infants varies according to the cause of death, but notes, "under stressful conditions, males are less likely than females to survive late gestation (Stinson 1985, 127). From birth, females tolerate environmental stress more successfully and during childhood are more capable of enduring diseases (Stinson 1985, 123-124), unfortunately, because of gender-based ranking of resources in childhood the role of male sensitivity to environmental stress cannot be assessed (Stinson 1985, 128). However, females usually experience more disease throughout life (Fisher and Booker 1998). Global studies have shown that even when socio-cultural frameworks disadvantage females, they will still have a greater life expectancy (Hazzard 2001, 451). This in turn, is also related to the increased life span observed for the majority of females, although MacIntyre et al. (1996) note that this conclusion is based on "anomalous or inconsistent findings [which are] not being noticed or seriously discussed" (MacIntyre et al. 1996, 623). Due to reasons not currently understood, females have lower mortality levels throughout life, as they are better adapted to survival (Austad 2001, 6). One social factor influencing early male age-at-death are 'un-healthy' concepts of masculinity such as machismo, which increases male involvement in high risk behaviour and therefore risk of death (Stillion 1995, 56-59; Kimmel 2004, 261; Sabo 2004). In conclusion, the ability of both sexes to sustain a long and healthy life, represents a complex interaction of socio-cultural factors, immunity, biology, and environment (Hanson 1999).

1.7.2.3 Stature differences between males and females

Stature represents a complex inter-play of nutrition and health during development, however it is also determined by under-lying biological sex differences. Male stature is influenced by their greater environmental sensitivity (Stinson 1985) and when conditions are favourable, males are on average, a few centimetres taller than females (Overfield 1995, 166). Long-term trends in male stature show variation in attained height (e.g. Maat 2002), which is suggested to reflect the role of plasticity in males, that allows them to adapt to environmental stressors and conditions, such as episodes of famine (Bogin 1999, 267). For example, analysis of prehistoric elite and non-elite stature in the southeastern and mid-western United States observed that elite males were taller than their non-elite counterparts; whereas the female data was not clearly divided (Larsen 1999, 19).

1.7.3 Interpretation of past communities: the role of age, gender, feminist, and masculinity theories

> " My real concern is with today and tomorrow, even though I seem to be leading you on an archaeological mission into the dim and distant past, to exhume the long-buried origins of reflexes that are nonetheless still with us" (LeDoeuff 2003, xv).

The inclusion of social science theory in palaeopathology and human osteology is very poorly developed in Britain, and when such studies are undertaken only particular age or gender groups are focused upon (e.g. Gowland 2000). Sofaer's (2006) review of the role of theory in osteoarchaeology has concluded that this situation has arisen from the academic separation of the skeleton, body and associated material culture, and the role of human osteologists as "service providers to those higher up the discipline hierarchy" (Sofaer 2006, 8-11). To a certain extent, the slow acceptance and utilisation of social science theories is reflective of the discipline of archaeology, which Arnold and Wicker (2001) note is still "a long way from redressing the more than two centuries of androcentric bias in the reconstruction of the past" (Arnold and Wicker 2001, vii).

1.7.3.1 Age theory: a life course perspective

The application of feminist methodologies to the analysis of age in archaeology, demonstrated that the adult world dominated our understanding of past communities and yet still remained under-theorized (Gowland 2002). Age theory was developed in the social sciences and therefore must be adapted for archaeological needs, particularly so for human osteology, due to the methodological problems associated with skeletal age estimation (Kemkes-Grottenthaler 2002; Usher 2002).

The social sciences have shown that there are three distinct categories of ageing, physiological, chronological, and social. Each of these aspects are determined and defined by particular socio-cultural associations (Binstock and George 2001). Gowland's (2002) research has shown that in archaeological work, particularly cemetery reports, age categories and their associations are used inter-changeably, for example infant and or baby (Gowland 2002). This is demonstrated in Gowland's (2001) life course analysis of the Romano-British cemetery at Lankhills (Winchester, England). A comparison of the biological, chronological, and social ages generated from analysis of the grave goods, indicated that children aged four to 12 years, and females in their twenties were inhumed with many cultural objects which had a strong association with femininity, a result conforming to the attainment of social adulthood in the Roman life course (Gowland 2001,161).

Archaeological research has sought to focus attention on poorly understood age groups, such as studies of childhood and infancy (e.g. Derevenski 2000). Unfortunately, this has led to a somewhat exclusive focus upon non-adulthood, at the expense of other groups, for example elderly men. To redress this situation, in line with other disciplines in the social sciences, a life course perspective must be used. This perspective does not assume group homogeneity, it accounts for inequalities, resolves inter/intra group differences, stresses evolving social identities, and the inter-dependence among lives (Hagestad and Dannefer 2001). It recognises that gender affects the timing of age transitions, some of which may bear no relation to biological changes, and importantly that different chronologies are experienced by men and women (Arber and Ginn 1995). The life course perspective emphasises three types of timing, individual timing of life transitions in relation to historical and cultural contexts, synchronisation of individual and family life transitions under varying historical and cultural contexts, and the impact of earlier life events as shaped by historical circumstances on subsequent ones (Hareven 2001,142). These types of analyses are possible within archaeology if a medical ecology approach is employed and particularly so in periods with a wealth of primary and secondary sources (e.g. Roman Period).

The life course approach also uses developmental and historical frameworks, which focus on the timing of life transitions and their impact upon inter-generational relationships. The use of such frameworks permits analysis of the life course in terms of cultural tradition, and family and community strategies for coping with and supporting older individuals (Hareven 2001,142). Research has shown that life course changes and timing have significant gender differences, which are shaped by historical, structural, and biographical impacts, for example disability, care giving, and employment (Hockey and James 1995; Moen 2001).

Physical anthropology studies have generated a large corpus of research that is relevant to osteology, particularly biological ageing processes. Cross-cultural anthropological research has shown that some age-related changes, common in industrial societies are not inevitable (i.e. osteoporosis), because the degree of change may be moderated by the environment (Ikels and Beall 2001, 131-132). This is an important consideration when interpreting periods of rapid technological change (e.g. Roman colonisation of Britain).

Age cuts across gender and socio-cultural differences, making it a useful tool in the analysis of past communities, such as the physiological process, a decline in activities and socio-economic changes. However, social changes may also result from external social and economic changes (Arber et al. 2003, 2-5). Hagestad and Dannefer (2001) have shown that a life course approach has increased the awareness of the interplay between macro-level social change and patterns of individual lives. For instance when major 'frame conditions' of life change or end (for example, the collapse of governments) reverberations are felt on all levels of life (Hagestad and Dannefer 2001, 8), as may have occurred after the Roman conquest. These changes can be tracked in literate societies, where primary sources are available and can be used to explain differential access to resources.

1.7.3.2 Feminist theory

Feminism as a theory in the social sciences is regarded by academia to be somewhat of an indefinable corpus, as it frequently contains many contradictions. Many of the contradictions have been brought to the fore by the research of lesbian, black, and male feminists (Whelehan 1999, 111). However, a leveller of all frameworks of feminism is the belief that women suffer from systematic social injustices because of their sex, and all have the primary intention to question all existing social institutions and customs (Whelehan 1999, 25, 41). Feminist research has played a crucial part in the development of qualitative and quantitative research, which is used to convey the 'reality' of an event, experience, or truth of a population (Brayton 1997,2).

Within archaeology, feminism was incorporated into post-processual theory, leading many researchers to question the value of 19th and 20th century stereotypes and androcentric interpretations and research directions, allowing discourse to fully represent women (Butler 1990, 4; Scott 1997a, 138; Gilchrist 1999, 1-23). The consequence of this inclusive research was to understand communities in biological terms of men and women and to recognise the elderly and non-adults in the past (Scott 1997b), as Nelson (2000) suggests that it "adds a measure of common sense to well-trodden ground" (Nelson 2000). Now in a post-post-Modern feminist environment, we seek to understand how cultures and societies were experienced in terms of sexuality and gender (Gilchrist, 1999). As Wicker and Arnold (1999) conclude, " we have moved beyond … the 'add women and stir' phase … to reach a more nuanced and integrated approach" (Wicker and Arnold 1999,1).

1.7.3.3 Gender theory

Gender theory as a daughter of feminist theory is more fluid and inclusive than feminism, as it includes women, men, and children. Most importantly, it seeks to appreciate the roles, implications, impact, and potential of male/female interaction (Handrahan 1999, 5, 7). Gilchrist (1999) has discussed the relatively long delay in the development of feminist thought into gender archaeology. Gilchrist (1999) suggests that the theory was dominated by universals, with empirical testing being placed at a higher 'status' compared to social issues (Gilchrist 1999, 26). It is regarded by the social sciences as, "a methodological and ideological element that is capable of transforming and enriching social science comprehension" (Handrahan 1999, 9). This 'element' increases the validity and reliability of research, because it eradicates the system of biological sex ranking (Handrahan 1999, 12) and denies biological imperatives (Whelehan 1999, 214), achieving a fairer understanding of past communities.

Gender theory is crucial to the interpretation of past societies because it cuts through identity, status, race, and biological sex (see Walker and Cook 1998). This, in the view of many social scientists enables more reliable and valid research (Handrahan 1999, 124). Therefore, gender theory seeks to investigate its expression in past societies and cultures, aspects of identity and most importantly in the differences between individuals. The emphasis upon difference allows for the inclusion of men in gender theory, a factor that has always been included in feminist thought.

1.7.3.4 Masculinity theory

The late inclusion of men in social theory may be explained by this observation, “research on men is as old as scholarship itself, but a focus on masculinity, or men as explicitly gendered individuals, is relatively recent” (Coltrane 1994, 41). The definition of masculinity theory encounters similar problems to feminism. Therefore, one of the most recent definitions of masculinity sociology outlined by Whitehead and Barrett (2001) has been applied to this study, “masculinities are those behaviours, languages and practices, existing in specific cultural and organizational locations, which are commonly associated with males and thus culturally defined as not feminine” (Whitehead and Barrett 2001, 15-16). Therefore, all aspects of a past community’s structuring frameworks can be analysed, as masculinities are not biologically real, they are culturally represented (Whitehead 2002, 34). Masculinity theory is not the same as masculinism, which accepts that there is a fundamental difference between men and women, it does not question the sexual division of labour and sanctions the dominant role of men in society and culture (Whitehead 2002, 97).

The research methods employed in masculinity theory are based on many feminist methodologies, for instance life histories (Drummond 1994, 100). Unfortunately, little research has been undertaken to place masculinities within archaeological theory (for example Scott 1997b). The lack of research makes us dependent upon contemporary social interpretations, which often have a questionable application to the past, particularly as they are addressing modern issues such as contemporary media and urban environments.

Analysis of our own and historical societies using masculinity theory, has raised key conclusions and ideas that can be used in archaeology. Firstly, manliness/masculinity is variable and subject to change within and across social groupings, and it reflects social conditions and dominant ideologies (Whitehead 2002, 1-17, 62). For example, Gilmore (2005) found that initiation rites are more violent for men, whereas those involving women are rarely so (Gilmore 2005, 192); and in China contemporary masculine identity promotes participation and support throughout pregnancy and childbirth (Du 2000). In contrast, during the British Empire, masculinity was viewed as being virile, valuing hardness and endurance (Whitehead 2002, 16).

An understanding of masculinity (as with femininity) is crucial, because it affects all levels of socio-cultural developments, encompasses all environments and spaces and it is a condition that must be achieved, rather than conferred by biological ageing (Gilmore 2005). Within archaeology it is now being valued, as it challenges the frequent in-grained belief of biological reductionism, which views past males as aggressive/violent, status driven, associated with power and wealth and having a lack of interest in dependants. Such a ‘gender-blind’ notion is rejected by many sociologists using masculinity theory, who have shown that there are no fixed patterns of predictable, biologically given human actions (Rogers 2000; Rose and Rose 2000; Whitehead 2002, 12-13).

1.8 Chapter summary

- The study examines the health-statuses of 270 Iron Age and Romano-British adult individuals from the modern county of Dorset, which is situated in the southwest of England.

- Dorset is ideally suited for the study, as it is only region in Britain where inhumation was continually practiced from the mid to late Iron Age (Whimster 1977, 1981; Wait 1985; Esmonde Cleary 1987).

- Health-status was examined at the regional scale using a medical ecology approach, allowing bioarchaeological evidence for diet and the environment to be integrated with socio-cultural evidence and social science theories (McElroy and Townsend 1996, 25).

- Iron Age research agendas highlight the valuable contribution that the analysis of human remains can make to interpretation, however this rarely happens, and publications continue to rely upon out-dated osteological reports (e.g. Watts 2005).

- Romano-British research agendas do not include human remains, nor is their role within analysis and interpretation acknowledged. Recent publications also display a lack of familiarity with current osteological research (e.g. Reece 2000, 271-272). Perception of health during the period still focuses upon the interpretation of Cirencester (Wells 1982) and Poundbury Camp (Farwell and Molleson 1993).

- Iron Age Dorset (late 8th century B.C. to 1st century A.D.) was inhabited by the Durotrigian tribe, made up of smaller localised communities. The society was most probably hierarchical, with a strong regional identity, reliant upon an agrarian economy (Haselgrove 1994, 3; Gale, J. 2003, 125-126). The landscape was a mixture of grasslands, fields and woods, supporting an agrarian mixed economy that focused upon cattle and sheep/goat (Bell 1997, 149; Dark and Dark 1998, 30; Hamilton-Dyer 1999, 196-199).

- The Romano-British period (43 A.D. to the end of the 4th century A.D.) saw continuation of Durotrigian socio-cultural and funerary practices, combined with considerable socio-cultural change that includes the development of the first urban centre, increased population migration, and the introduction of new foodstuffs and material goods (Wacher 1981, 134-137; Ede 1993, 73-77; Richards et al. 1998). The landscape saw an increase in woodland and greater exploitation of natural resources; the climate became warmer after 150 B.C. but by 80 A.D. the weather had become so cold that rivers often froze (Lamb 1981, 56-57; Dark and Dark 1998, 31-32, 114). The agrarian economy underwent change, with the intensive rearing of pigs in Dorchester, the use of sheep/goat flocks for meat and wool, and an increase in the exploitation of marine resources (Maltby 1981, 160-182, 1993, 325; Buckland-Wright 1987, 129-132; Hamilton-Dyer 1993, 78-79).

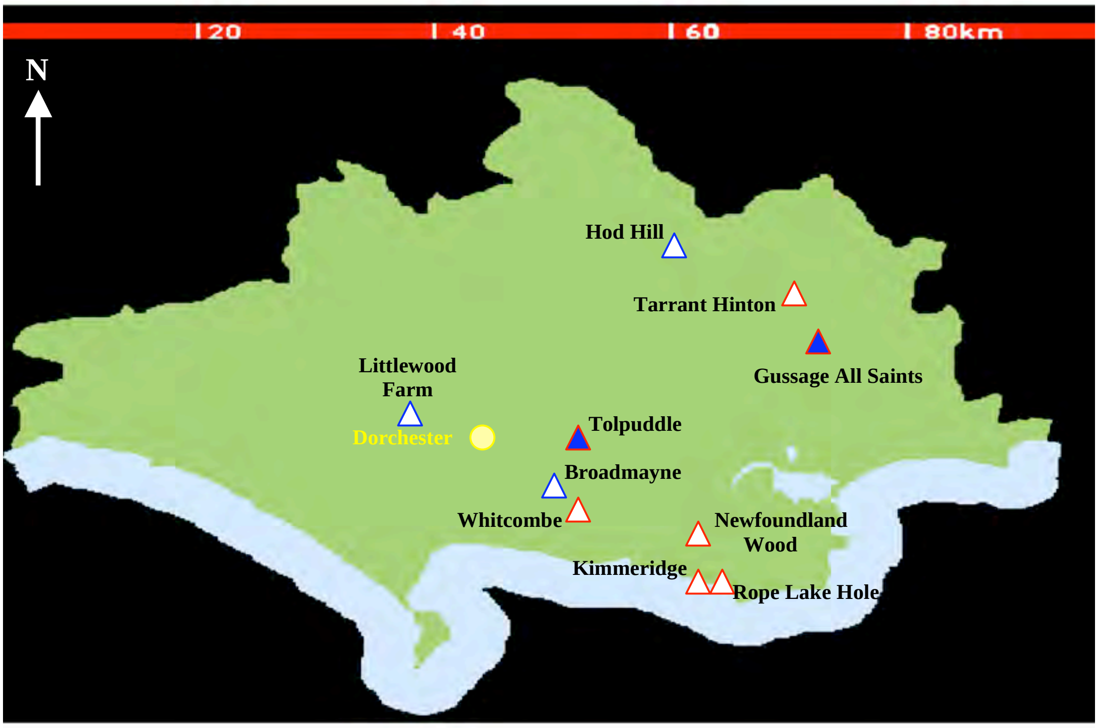
CHAPTER 2.0 – MATERIALS AND METHODS

2.1 Materials

The study included adult individuals recovered from sites within the modern county boundaries of Dorset that were published and/or had a site archive (section 2.2). The Gazetteer (Appendix 1) contains a site description, context, and any site-specific problems with the sample such as missing individuals or elements, and Figure 4 shows the site distribution within Dorset.

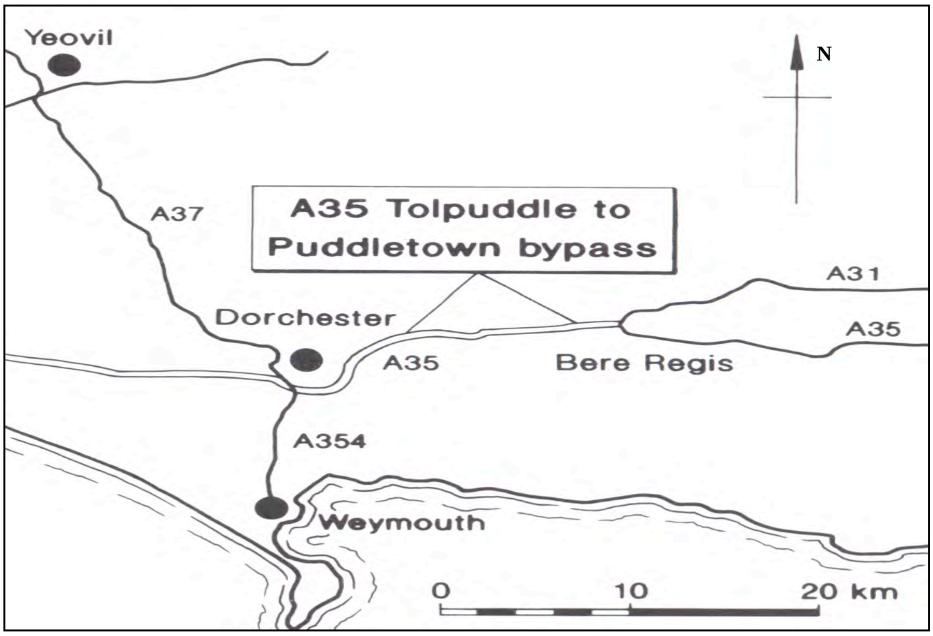
Figure 4: Location of sites used in the study

4a. Location of sites outside Dorchester and its environs



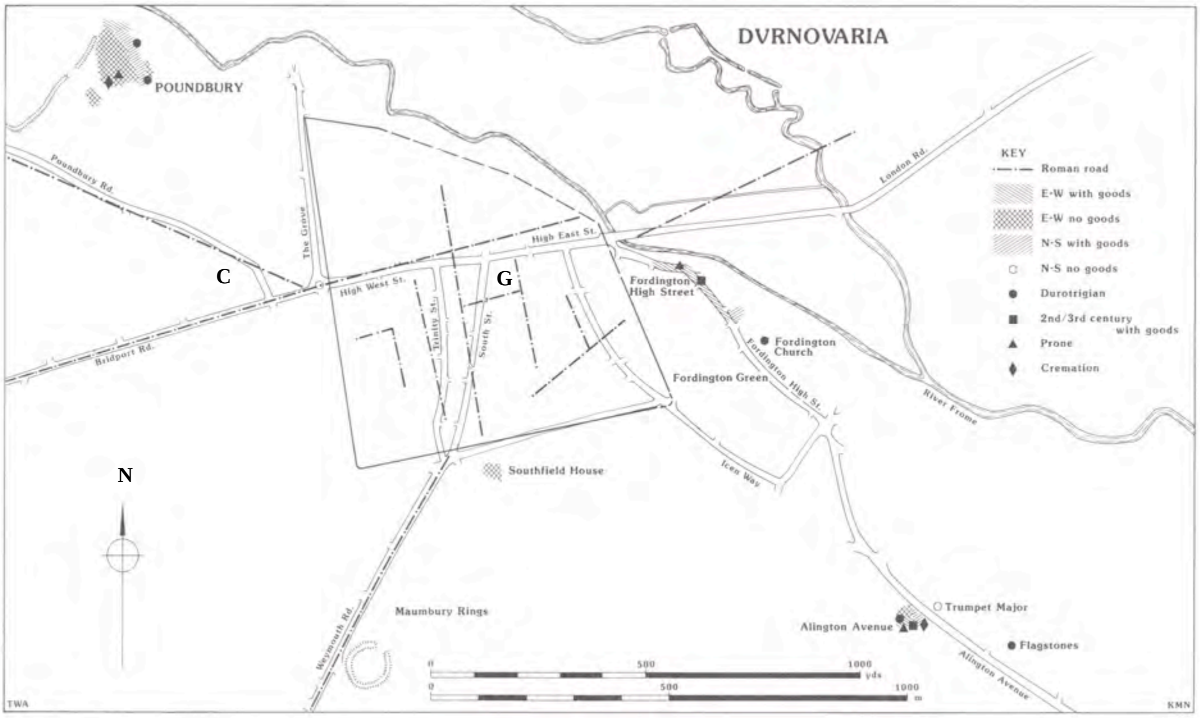
Key: △ Iron Age sites △ Romano-British sites ▲ Iron Age and Romano-British sites
(after http://www.imagesofdorset.org.uk/countymap.htm)

4b. The Tolpuddle to Puddletown bypass



(after Hearne and Birbeck 1999, xii. Figure 1)

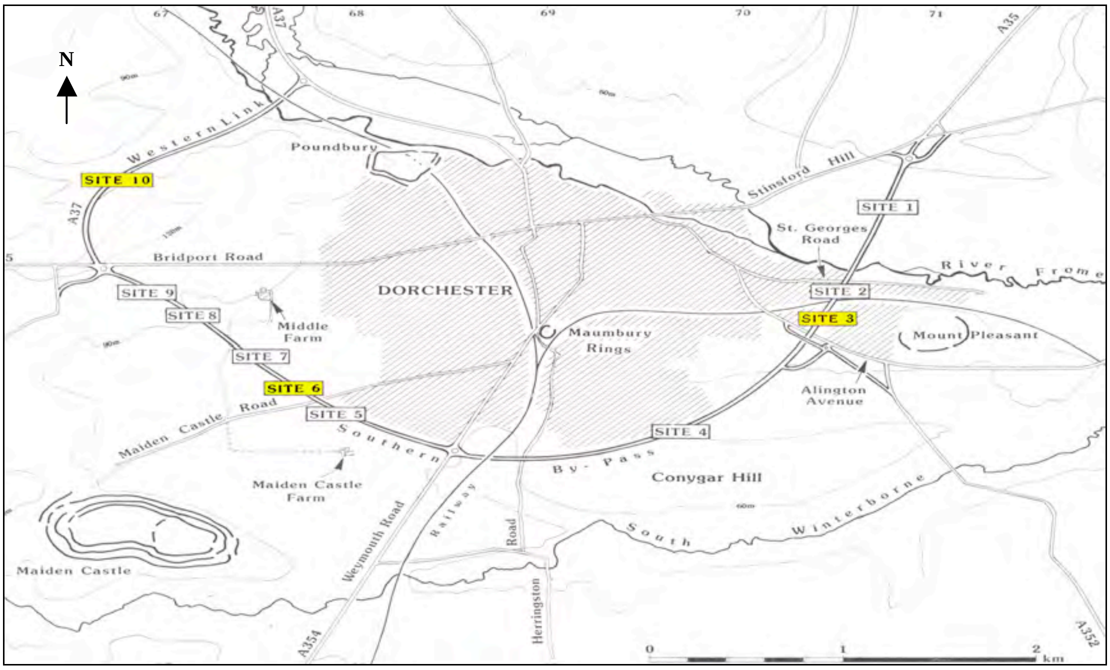
4c. Location of Iron Age (IA) and Romano-British (RB) cemeteries in Dorchester



Poundbury also includes the Pipeline site (IA and RB)
Fordington High Street = Fordington Old Vicarage (RB)
C = Crown Building (RB)   **G** = Greyhound Yard (RB)

(after Farwell and Molleson 1993, 238. Figure 139)

4d. Location of Maiden Castle and sites on the Dorchester bypass



Site 3 = Flagstones (IA) **Site 6 =** Maiden Castle Road (RB) **Site 10 =** Western Link (RB)
(after Smith et al. 1997, 2. Figure 1)

In order to maximise the sample size adult individuals recorded by, McKinley (1987, 1993, 1998, 1999) and Rogers (1993, 1997), were included only when their work was present in the site archive or accessible, the recording forms contained all the necessary information outlined in section 2.3, and the human remains were available for examination. When these factors were present the inventory data and femoral length measurement were used, and the pathology, age, and sex were re-recorded. The approach allowed sites to be included which had never been recorded, recorded at assessment level (e.g. Newfoundland Wood), or where un-reliable or insufficient reports existed (e.g. Whitcombe).

2.2 Criteria for inclusion in the sample

The number of sites reported to have human remains from the Iron Age and Romano-British periods in Dorset is very large (over 60 are reported by the Royal Commission on the Historical Monuments of England 1970). However, many sites had been re-buried or the human remains were lost or could not be located. Therefore, only sites that were in accessible locations, with an archive, curated human remains, and had been published or were being published were chosen. These sites (Appendix 1) are held by Dorset County Museum, the British Museum of Natural History, and the Duckworth Laboratory at the University of Cambridge.

In order for the human remains to be included in the sample they had to fulfil three conditions, be derived from articulated inhumations, from secure Iron Age to Romano-British contexts, and conform to stages zero to three of preservation (Buikstra and Ubelaker 1994, 98). The number of individuals available for study often differed from the published report due to taphonomic damage, in addition to numerous excavation and curation strategies and problems (these are detailed in Appendix 1).

2.2.1 Sampling strategy employed at Poundbury Camp

Only at Poundbury Camp was a sampling strategy employed, because the Romano-British sample was too large (N= 1442) to be recorded within the parameters of this research. The sampling strategy employed is detailed below,

- All adult individuals from the Late Iron Age to early Romano-British period were recorded,
- The Romano-British cemetery was treated as one sample and not sub-divided into separate areas or phases,
- Adult individuals who were truncated, disarticulated, only had skulls present, planned not excavated, not planned, not excavated, or poorly preserved were not included and
- The context numbers were then randomly selected by a third-party.

This provides N= 13 adults from the Late Iron Age to early Romano-British period, and N= 63 adults from the Romano-British cemetery, providing a total sample of N= 76 individuals.

2.3 Recording methodology

Due to the large sample size and the amount of time needed to record the individuals, a repeatable and accepted standard of data recording had to be employed. Those published by Buikstra and Ubelaker (1994) were chosen (see 2.6), because they permitted rapid recording and standard terminology (see Lovell 2000, 219-20), they are widely accepted within palaeopathology and removed the need for inter-observer tests. However, after a pilot study it was decided to tailor the standards to better fit the study. This was done because the level of detail advocated by Buikstra and Ubelaker (1994) was not necessary to fulfil the aims of the study (for example, the remains are not threatened with re-burial), the amount of time available to record the sample was restricted, and the amount of information recorded exceeded what was necessary to investigate the research questions. The adapted standard used is outlined below (see Appendix 2 for a copy of the recording form employed).

- **Element inventory–** as given, with the following exceptions
    - Metacarpals, metatarsals, carpals and tarsals were not sided or specifically identified unless they displayed a pathological change.
    - Hand and foot phalanges were not separated or sided.
    - Ribs were not sided, nor the first, second, eleventh and twelfth recorded as being present or absent, only the number of rib heads present were noted.
    - Cervical (third to seventh), thoracic and lumbar vertebrae were not assigned an anatomical position and the number present was calculated based upon the presence of the spinous process and/or centrum.

Dental inventory – as given, with the following exceptions

- Presence was only scored as ante- or post-mortem loss, not present/congenitally absent, crypt or erupted.
- Wear was recorded by shading the area on the tooth chart.

- Dental caries were recorded by shading the decayed area on the tooth chart.
- Abscesses were only recorded by dental location.
- Enamel hypoplastic defects were recorded as either a groove or a pit, and the location was drawn on the tooth chart and measured, following the protocol stated in Buikstra and Ubelaker (1994, 56-7).
- Cultural modification and micro-wear were not recorded.

Age changes in adults– as given, with the following exceptions

- Todd pubic symphysis method was not used.
- Cranial suture closure (apart from basio-sphenoid synchrondrosis see section 2.6.1) was not used.

Measurements– as given, with the following exceptions

- Dental measurements were not taken.
- The following cranial measurements were omitted, maximum cranial length and breadth, basion-bregma height, cranial base length and basion-prosthion length.
- Cranial arcs instead of chords were used due to the availability of equipment.

2.4 Adult sex determination methods

A multifactorial approach was used in order to take account of the differences in preservation and other taphonomic changes that were present in the sample. Macroscopic techniques were used because these can be rapidly recorded, and are easy to assess. The categories employed in the research are listed below,

- Male,
- Probable Male,
- Female,
- Probable Female

(after Buikstra and Ubelaker 1994, 21).

In the discussion, the results of the probable categories will be combined with those of the males/females. Individuals who could not be assigned a sex category were not included in the sample see 3.1.

2.4.1. Sexing methods employed

Pelvis

1. **Ventral arc** (Phenice 1969),
2. **Subpubic concavity** (Phenice 1969),
3. **Ischio-pubic ramus ridge** (Phenice 1969),
4. **Greater sciatic notch** and
5. **Preauricular sulcus**

(Buikstra and Ubelaker 1994, 16-19).

Cranium

1. **Nuchal crest**,
2. **Mastoid process**,
3. **Supraorbital margin**,
4. **Prominence of the glabella** and
5. **Mental eminence of the mandible**

(Buikstra and Ubelaker 1994, 19-21).

2.4.2 Discussion of adult sexing methods

2.4.2.1 Pelvis

Phenice's (1969) method (generated upon the Robert J Terry Collection curated at the Smithsonian Institution, National Museum of Natural History, Washington D.C.) is cited in Buikstra and Ubelaker (1994, 21) as it is easy to use and comparatively accurate. However, its validity has been questioned, particularly because Phenice (1969) did not publish the age data generated from his study (Lovell 1989, 117, 119). However, many studies questioning Phenice's method have been found to have serious flaws in their approaches and samples. Kelley (1978) used a population where the age and sex of the individuals was unknown and Sutherland and Suchey's (1987) analysis of the ventral arc did not test individuals aged over 30 (cited in Lovell 1989, 117).

MacLaughlin and Bruce (1989) have commented upon the works of Phenice (1969), Lovell (1989), and Kelley (1978), and concluded that Phenice's method introduced subjectivity, because the pelvic morphology only had to fulfil one of three criteria, consequentially influencing the objectivity of the method (MacLaughlin and Bruce 1989, 1390). In their test all three features were given a similar weighting and they introduced a 'intermediate' category (MacLaughlin and Bruce 1989, 1390). As the features identified by Phenice (1969): the ventral arc, the subpubic concavity, and the medial aspect of the ischio-pubic ramus are not described in detail within standard anatomical reference texts, so researchers are appraising differences in shape (MacLaughlin and Bruce 1989, 1390-1391). Nevertheless, the pelvic girdle is one of the most sexually dimorphic elements of the human skeleton, with a 95% accuracy rate when examined in isolation from a complete skeleton (Krogman and Iscan 1986, 259). The results of MacLaughlin and Bruce's (1989) test displayed a high degree of inter-observer error, which was related to the observer's level of osteological experience. Interestingly, this result contrasted with Lovell's (1989) findings (MacLaughlin and Bruce 1989, 1391).

Rogers and Saunders' (1993) test of Phenice's (1969) method on European material found a high degree of error in assessing the shape of the ischio-pubic ramus, because there is considerable overlap in male and female features. However, their tests showed that if several pelvic criteria (including the features identified by Phenice (1969)) were used in combination, for example the shape of the obturator foramen and the presence of the ventral arc, the level of accuracy increased to above 95% (Rogers and Saunders 1993, 1050-1053).

Sutherland and Suchey's (1991) research on the ventral arc included the analysis of pubic bone samples taken from autopsied cases of 399 American females aged between 30 to 99 years (Sutherland and Suchey 1991, 502). The authors concluded, "the small sample (n=4) in the 90s prevents conclusions from being drawn. Thus, the ventral arc would appear to be a useful sex discriminator on older as well as younger females" (Sutherland and Suchey 1991, 506). Based on the findings of these studies it is concluded that the ventral arc is reliable for use in this study. This is corroborated by Rogers and Saunders (1993), who ranked it first for accuracy and found that it had the lowest intra-observer error (Rogers and Saunders 1993, 1054).

Walker's (2005) analysis of the greater sciatic notch morphology demonstrated that its shape (independent of population) is linked to age. The sciatic notch reduces in width with age; hence, male morphology becomes more masculine until the age of 50 years (Walker 2005, 388). Walker (2005) also noted that male morphology was more variable, and the distribution of their shapes (using the Buikstra and Ubelaker (1994) scoring system) was biased towards female shapes (Walker 2005, 390). Importantly, Walker (2005) concludes that the age-related trend towards greater masculine morphology may account for the archaeological trend for a higher number of males to be present, especially in the older adult categories (Walker 2005, 391). The finding of Walker's (2005) study contrasts with Hager's (1996) analysis of the sciatic notch in Great Apes and Humans. Hager (1996) performed a pelvimetric analysis of sexual dimorphism, and found that there was a clear discrimination between male and female expression and males had a higher probability of misclassification (Hager 1996, 287-300).

2.4.2.2 Cranium

The cranium is also a reliable indicator of sexual dimorphism in the human skeleton, with a 90% accuracy rate when examined in isolation, although significant population variation does exist (Krogman and Iscan 1986, 259; Buikstra and Ubelaker 1994, 19). Weiss's (1972) research showed that there could be an "irresistible" temptation to assign a skeleton as male due to muscle markings, particularly in older individuals (Weiss 1972, 240).

Weiss (1972) concluded that however the data was divided there was always an excess of males, which he considered to be systematic, obvious, and statistically significant (Weiss 1972, 240-241).

Keen's (1950) analysis of cranial sexual dimorphism has shown that an individual's biological sex could be successfully determined using the prominence of the occipital crest and nuchal lines (Keen 1950, 69, 74-75). A recent study of the supra-orbital margin has demonstrated that examination of this feature had a 70% accuracy rate in sexing skulls (Graw et al. 1999, 95). Visual assessment, although recognised within osteology to be subjective, does satisfactorily compare with discriminate function analyses of the skull (e.g. Giles and Elliot 1962) (Walrath et al. 2004).

In human osteology there has been a shift away from the male/female standard, as there is now understood to be a wide variation in the range of trait expression within a population, which may change temporally and spatially, in addition to the influence of genetic and hormonal pathologies (Worthman 1995). In conclusion it is agreed with Schwartz (1995) that, "it is the responsibility of the investigator to approach each sample without preconceptions about what she/he will delineate as being diagnostic at either the population or sexually dimorphic level of analysis" (Schwartz 1995, 291).

2.5 Age determination methods

Determining the age-at-death of an individual can be achieved using a wide variety of macroscopic and microscopic methods (see Aiello and Molleson 1993). Microscopic techniques can provide a more accurate assessment of skeletal or dental age compared to macroscopic methods (Dudar et al. 1993; Kvaal et al. 1994; Carolan et al. 1997; Pfeiffer

2000). However, in this study macroscopic methods were employed, as it was not possible to sample the collections used, they are non-destructive, and data could be recorded rapidly.

A number of macroscopic methods were employed for adult ageing, as this is the most reliable approach (section 2.6.3). Research into osteological ageing has shown that all single age markers are inherently flawed, because they attempt to estimate physiological age from age-related degeneration of the skeleton (Mensforth and Lovejoy 1985; Saunders et al. 1992; Bedford et al. 1993; Kvaal et al. 1994; Kemkes-Grottenthaler 2002). In order to achieve an estimated skeletal age comparable to the chronological age of an individual, a multiple approach was employed as it could be applied to older adults, and is considered by the majority of researchers to be the most reliable approach (Bedford et al. 1993, 293). The adult age categories used in the research are listed below.

- **Young Adult**= 20 to 35 years,
- **Middle Adult**= 36 to 50 years and
- **Older Adult**= more than 50 years (Buikstra and Ubelaker 1994, 9).
- **Adult** = an individual aged over 20 years

2.5.1 Ageing methods employed

1. **Pubic symphysis degeneration**
   (Brooks and Suchey 1990 cited Buikstra and Ubelaker 1994, 21-38),
2. **Pelvic auricular surface degeneration**
   (Lovejoy et al. 1985; Meindl and Lovejoy 1989 cited in Buikstra and Ubelaker 1994, 21-38),
3. **Sternal end of rib degeneration**
   (Iscan and Loth 1986a, b) and
4. **Baso-Sphenoid synchrondosis**
   (Scheuer and Black 2000a, 59).

2.5.1.1 Pubic symphysis degeneration

The Suchey-Brooks methodology (Brooks and Suchey 1990 cited in Buikstra and Ubelaker 1994, 23-24) was employed to assess degenerative changes in the morphology of the pubic symphysis, as it can be applied to either sex, and it is regarded as one of the most reliable methods for determining skeletal age-at-death (Buikstra and Ubelaker 1994, 21). The visual matches (provided in Buikstra and Ubelaker 1994, 23-24) were used to obtain the best result.

2.5.1.2 Pelvic auricular surface degeneration

Tests of this method have shown that it can be applied to both sexes and it is of particular value in the analysis of archaeological samples, as the auricular surface has a higher frequency of preservation in comparison to rib ends, or the pubic symphysis (Lovejoy et al. 1985; Murray and Murray 1991).

2.5.1.3 Sternal end of rib degeneration

The sternal end of rib degeneration method (Iscan and Loth 1986a, 1986b) was used in order to assess skeletal age-at-death. The method was generated upon the fourth rib, however subsequent studies expanded its use for additional sternal rib ends, as the fourth rib can not always be identified or may have been taphonomically damaged (Dudar 1993; Loth et al. 1993; Loth 1995).

2.5.1.4 Baso-Sphenoid synchrondosis

The fusion of the baso-sphenoid synchrondosis was used in order to assist in the determination of adult-hood, as it indicates that the individual had completed adolescence, or was an older adolescent. It was recorded following the information provided by Scheuer and Black (2000a, 59).

2.5.2 Ageing the adult skeleton: a discussion of the problems

A key problem in ageing archaeologically derived individuals is the demographic trend for an over-representation of young adults and a lack of individuals aged over 50 years. It is hypothesised that this trend results from the method applied to the skeletal samples. That is to say, the age distribution of the samples reflects the age distribution in the modern population used to create the method (Mensforth and Lovejoy 1985; Usher 2002, 29). These problems are often complicated by the poor preservation of older individuals, as Walker et al. (1988) showed in their analysis of two cemeteries from Florida. Taphonomic processes can also influence the standards applied to a sample/individual.

The fundamental problem with age determination is the lack of ageing methodologies generated from archaeological individuals as we do not know the exact age and sex of the individuals available for study, or the normal demographics of an ancient cemetery sample. The situation is further complicated by research that suggests that age-related changes found in archaeological skeletal samples impede the use of skeletal ageing techniques derived from modern samples (Angel et al. 1986; Murray and Murray 1991). Hoppa's (2000) test of population variation in ageing at the pubic symphysis demonstrated that there are often significant differences between the reference and archaeological samples in the timing of age-related changes (Hoppa 2000, 190).

In gerontological clinical literature it is accepted that ageing is a highly individual phenomenon (Bryant and Pearson 1994), as decline has been shown to occur at a variety of idiosyncratic rates (Austad 2001, 4). Once maturation has been reached more variable and less distinctive changes occur (Kemkes-Grottenthaler 2002, 62) making determination of the rate of change difficult, as the degeneration of specific physical or physiological parameters must be measured and interpreted (Austad 2001, 4). For example, tests of the auricular surface technique (Lovejoy et al. 1985; Meindl and Lovejoy 1989) have shown it can under-age individuals by up to two age categories, especially for those over 50 years, and can consistently over-age younger adults (Murray and Murray 1991). The method is also influenced by ageing idiosyncrasies, as research has shown that bi-lateral differences in the expression of age-related change will be observed (Moore-Jansen and Jantz 1986).

The problem of ageing archaeological material is related to the three fundamental assumptions applied to any work using modern collections, that reported ages are biologically correct, the biological age markers are similar regardless of age and sex, and the representativeness and reliability of the reference collection is taken for granted and never tested (Usher 2002, 29, 41).

The analysis is also compromised by two unavoidable points, firstly no-one can state how much variation between chronological and maturational age occurs, and secondly, because of individual variation in development, life-way, and environmental effects. This variation is combined with genetic factors that can significantly influence the rate of skeletal maturation in the samples (Lampl and Johnston 1996, 346, 350). Therefore, no method will be 'perfect', as Maples (1989) concludes "age determination is ultimately an art, not a precise science" (Maples 1989, 320, 323). It is also important to recognise that because various parts of the skeleton will/may age at different rates there will be inter/intra population differences (Iscan 1989, 325). Additionally, the determined age reflects the average of all assessed indicators and does not imply that each individual age is accurate (Kemkes-Grottenthaler 2002, 60).

The multiple method approach is suitable for older individuals where differences between indicators are more marked (Bedford et al. 1993, 293), making it "one of the most accurate currently available for estimating skeletal age at death … help[ing] control for variation that may occur in any single age indicator … [and] demonstrates reasonably low interobserver error” (Bedford et al. 1993, 296).

2.6 Diagnosis and recording of palaeopathology

In recent years, the recording of human palaeopathology has been focused upon by British and USA professional bodies, in an attempt to create minimum standards and ensure repeatability. These attempts arose from a general recognition that data was being produced that could not be compared spatially or temporally, it frequently lacked sufficient detail, and could not be used to undertake large studies (Roberts and Cox 2003, 21-22; Roberts and Manchester 2005, 7).

From the outset of the present study it was recognised that the aims and objectives could only be investigated if the osteological data was recorded in a repeatable, systematic, and standardised format, allowing sufficient detail to be observed in order to make differential diagnoses, and construct a database. However, the present study had begun before standards created using British material were published (Brickley and McKinley 2004). Additionally, the recommendations published by the Paleopathology Association (Rose et al. 1991) did not include a recording form, and the recording standards employed for the ‘Health and Nutrition in the Western Hemisphere Project’ (Steckel et al. 2002; Steckel and Rose 2002) were not available when the study began and were not included later as they are not detailed enough. For example, active and healed lesions are not differentiated (Steckel et al. 2002, 89), which would have had repercussions for the interpretation of data and making palaeopathological diagnoses. Therefore, the widely accepted standards edited by Buikstra and Ubelaker (1994) were used (see also 2.3). These standards were written in response to the Native American Graves Repatriation Act (1990), and are not entirely suitable for British data as they address palaeopathology not commonly observed in British populations e.g. cranial modification. During the pilot study, it was found that the data collected for trauma was not wholly suitable for this present study, as radiography could not be routinely employed (see. 2.6.1), and the standards did not include codes for avulsion and oblique fracture types (Buikstra and Ubelaker 1994, 115). In response, additional systems were employed for recording sharp-force weapon injuries and fractures, which are described in section 2.6.8.

2.6.1 Radiography

The majority of the collections were curated at the Dorset County Museum and a radiograph machine was not available locally. In agreement with the head of curation at the Museum, only small elements (hands, feet and vertebrae) could be removed for radiography at St Bartholomew's Hospital (London) when a differential diagnosis was considered necessary. The Poundbury Camp sample had a radiograph archive that was used to determine diagnosis and where needed further elements were radiographed to permit a differential diagnosis. Radiographic analysis of elements displaying trauma is presented in section 2.6.8.1.

2.6.2 Metabolic disease

- **Cribra Orbitalia** and **Porotic Hyperostosis** - porosity of the cranial vault and or orbits. The degree of porosity and the state of activity is recorded (Stuart-Macadam 1989, 1992a, 1992b; after Buikstra and Ubelaker 1994, 115, 120-121).

2.6.3 Infectious disease

- **Periostitis**
  - **woven bone formation –** fibre-bone which consists of an irregular network of intermingled trabeculae (Buikstra and Ubelaker 1994, 182. Figure 92a, 136).

    - **sclerotic bone formation –** woven bone formation that has been subject to remodelling and is incorporated into the surrounding cortex (Buikstra and Ubelaker 1994, Figure 92b, 136).
    - **lamellar bone formation** - sclerotic bone formation that has undergone significant remodelling and incorporation into the surrounding cortex, but a margin is still visible. The surface is irregular and of variable thickness (Ortner 2003, 206; Buikstra and Ubelaker 1994, 118).

- **Tuberculosis**

  - **Vertebral tuberculosis –** located on, the vertebral body, posterior structures and anterior surface, additional evidence of infection can be observed on bone adjacent to the prevertebral tissues, and intervertebral disc space. It results in the destruction or erosion of the vertebra/e, contour irregularity, involvement of a single or multiple vertebrae, kyphosis, and ankylosis of the vertebral bodies (Resnick 2002a, 2524-2535).

  - **Tuberculosis of the femur –**isolated osseous foci, with destruction ranging from small cavitating lesions to larger triangular foci with central spongiosa sequestrum, or complete destruction. The articular surface can be maintained, as these are the longest preserved portions of the affected bone (Ortner 2003, 236-237).

2.6.4 Dental health

- **Ante-mortem loss** – a remodelled or remodelling tooth crypt, with adjacent teeth displaying contact facets, presence of wear on the opposing tooth, and available space in the dental arcade (Freeth 2000, 231).

- **Post-mortem loss** - the tooth crypt does not display remodelling (Freeth 2000, 231).

- **Caries –** destruction of the enamel and/or, dentine, and/or cement (Hillson 1998, 269-276).

- **Abscesses –** a fistula or broad pit around the root apex (Hillson 1998, 284-285).

- **Peridontal disease –** loss of alveolar bone, horizontally and/or vertically (Hillson 1998, 260-268).

- **Calculus –** mineralized plaque attached to the surface of a tooth (Hillson 1998, 255-260). Scored as absent, or a small, moderate, large amount (Buikstra and Ubelaker 1994, 56).

- **Enamel Hypoplastic Defects –** a deficiency of enamel thickness, which is normally smooth, white, and translucent. Divided into linear, pit and plane defect types (Hillson 1998, 165-167).

    - Due to variation in the timing of enamel deposition and number of observable teeth present in each individual, each tooth was recorded separately (Buikstra and Ubelaker 1994, 56-57). However, it is accepted that this results in a single population having two different peak ages of stress (Skinner and Goodman 1992, 162-166).

    - The Swärdstedt (1966) chart was used to determine the age at which the defect formed (provided in Goodman and Song 1999, 217). Problems associated with this technique are discussed in 4.2.2.3 (see Goodman and Song 1999; Simpson 1999; Reid and Dean 2000).

- **Impaction –** the tooth does not occlude normally with contact tooth or those in opposing jaw. Only recorded when the crown was visible, as impacted teeth may not emerge into the mouth (Hillson 1998, 113).

- **Congenital Absence** – recorded when there was no evidence of impaction, trauma, or disease (Hillson 1998, 113).

- **Supernumerary dentition –** presence of additional teeth (Hillson 1998, 114).

- **Deciduous retention** – an eruptional anomaly of the permanent dentition, allowing a deciduous tooth to remain (Hillson 1998, 114).

2.6.5 Developmental and Congenital anomalies

- **Dyschondrosteosis (Langer type dwarfism) –** a form of mesomelic dwarfism which causes severe hypoplasia of the ulna and fibula, curvature and thickening of the radius and tibia, displacement deformities of the hands and feet, and hypoplasia of the mandible (Online Mendelian Inheritance in Man # 249700; Langer 1967).

- **Madelung Deformity** - shortening and bowing of the distal third of the radius, which is accompanied by an oblique articulation with the carpus, and dorsal dislocation of the ulna. The ulna is longer than the radius, and the head is enlarged and distorted. Typically, the deformity occurs bilaterally (Aufderheide and Rodríguez-Martín 1998, 72).

2.6.6 Neoplasms

As radiography was only routinely available at the British Museum of Natural History, neoplastic changes were only recorded when they were visible macroscopically. However, when radiographs were available for analysis, they were also employed to aid diagnosis.

- **Osteochondroma**- a solitary lesion that develops in bones that form by endochondral ossification, and is typically observed in the femur, humerus, and tibia. The neoplasm typically develops near the growth plate on the cortex of the long bones. The lesion appears as a rounded outgrowth shaped by mechanical stresses, and has cancellous and cortical continuity with the affected element. The external surface of the neoplasm can be smooth and regular, or take on a cauliflower-like appearance. In long bones, the neoplasm rarely exceeds 40 mm in size, whereas in flat or irregular bones, they can grow to more than 400 mm (Resnick 2002 et al., 3870-3875; Ortner 2003, 508-509).

- **Metastatic osteolytic neoplasms –** it is characterised by multiple destructive lesions that are asymmetrically distributed in the axial skeleton and proximal segments of long bones, particularly affecting the thoracolumbar vertebrae, sacrum, os coxae, ribs, sternum, femora, humeri, and skull. The lesions vary in size, are poorly circumscribed, and can be identified in the medullary cavity, cortical, and cancellous bone. The disease can cause bone destruction, formation, or a mixed reaction. Additionally, pathological fractures of affected bones can occur, and in the spine cause kyphosis and ankylosis (Resnick 2002b, 2215, 2002c, 4274- 4344).

- **Multiple myeloma –** the disease is characterised by widespread symmetrically distributed destructive lesions with discrete margins, which are regular in size and often take on a punched-out appearance. The spine, ribs, skull, pelvis, and femur are most frequently affected; however, the appendicular skeleton can also be targeted. The widespread and often extensive destruction can lead to vertebral kyphosis and ankylosis, and pathological fractures of the ribs, sternum, clavicles, and tubular bones (Resnick 2002b, 2188-2215).

2.6.7 Circulatory disorders

- **Hypertrophic osteoarthropathy –** in the early stages of the disease, periosteal new bone formation affects the proximal and distal diaphyseal portions of the tibiae, fibulae, radii, and ulnae. Other elements that may also display periosteal lesions are the femora, humeri, metacarpals, metatarsals, and phalanges (not terminal). As the disease progresses periosteal lesions can impinge on the metaphyses and musculotendinous insertions, in some cases the lesions may affect the epiphyses. The periosteal lesions can take a number of expressions, laminated smooth layers, irregular areas of periosteal elevation, solid irregular periosteal cloaking with wavy contours, and cortical thickening with application of the periosteal bone to the outer surface of the cortex. Layered new bone is often observed, combined with remodelling into the surrounding cortex (Resnick 2002d, 4878-4876).

2.6.8 Trauma: definition and use of terms

In palaeopathological literature, the terms fracture, injury, and trauma are often used inter-changeably, and the discussion of trauma or injuries may include the grouping of sharp-force weapon injuries and blunt-force trauma. This arises from the numerous definitions of trauma in the forensic and palaeopathological literature. For example, Roberts (1991a) states “trauma can be defined as any bodily injury or wound” (Roberts 1991a, 226), Steinbock (1973) writes “results of trauma can be classified as: fractures, crushing injuries, bone wound caused by sharp instruments, and dislocations” (Steinbock 1973, 11), and Byers (2002) notes “trauma is a pathological category defined as injury caused to living tissue by an outside force” (Byers 2002, 254).

In order to consistently record, present, and discuss the data in this thesis, the term trauma is only used in the discussion of fractures caused by blunt force trauma as defined by Byers (2002), “caused by a force that has a wide area of impact on bone … typically these forces cause at least simple fracture wounds” (Byers 2002, 266). The terms injury and trauma do not replace fracture, and the term injury is only applied in the discussion of fractures as part of injury recidivism analysis/discussion, because it is the term given to the method. The term injury is otherwise exclusively used in reference to sharp-force weapon injuries, in order to separate the data from fractures and to show that they were caused by an instrument with a point or edge (Byers 2002, 266), following from the definition of injure, “to inflict bodily harm” Penguin English Dictionary (P.E.D 2004, 722).

2.6.8.1 Fracture recording

The definition provided by Lovell (1997) was followed, “a fracture consists of an incomplete or complete break in the continuity of bone” (Lovell 1997,141). These were observed macroscopically and where needed a hand lens was used. Outlined below is a summary of what was recorded in each case,

- **Macroscopic analysis**

    1. Element and side affected.
    2. Fracture position.
    3. Fracture type.
    4. State of healing.

5. Deformity,
   5a. Angulation and/or rotation,
   5b. Shortening (measurement compared to other element),
   5c. Poor alignment, overlap, and apposition.
6. Evidence of infection.
7. Evidence of underlying pathology.
8. Evidence of joint degeneration.

- **Radiographic analysis**

The British Museum of Natural History had an archive of radiographs from Poundbury Camp, which had been taken for the Molleson report (1993). These were studied and the following features based on Grauer and Roberts (1996), Judd and Roberts (1999), Judd (2000, 2002a), Jurmain (1999) and Roberts (1991, 2000a) were noted.

1. Fracture type.
2. Visibility of fracture line.
3. Cortical and cancellous continuity.
4. Evidence of shortening.
5. Evidence of infection.
6. Evidence of underlying pathology.
7. Evidence of joint degeneration.
8. Evidence of linear/rotational deformity (measured on radiograph).
9. Degree of overlap/apposition (measured on radiograph).
10. Degree of angulation (measured on radiograph).

2.6.8.2 Segment approach

The segment recording protocol provided by Buikstra and Ubelaker (1994) permitted the application of Judd’s (2002a) segment approach to fracture recording. However, because the majority of the sample had been recorded before Judd’s (2002a) publication advocating the ‘squares’ method (Judd 2002a, 1258-1259), the area of the epiphysis followed the definition given by Buikstra and Ubelaker (1994, 8). In order to succinctly display the fracture data, and achieve a greater understanding of the fracture type and mechanism, the approach was applied to other elements (e.g. nasal bones, ribs and metacarpals), following the definitions of Buikstra and Ubelaker (1994, 8). As the recording form based upon Buikstra and Ubelaker (1994) (Appendix 2) does not allow the recording of such elements by segment, the prevalence data is shown by the total number of elements observed.

2.6.8.3 Definition of fracture terms

In some instances, the fracture type could not be determined, and/or radiographic analysis was not available, therefore it was decided to use the term ‘complete’ following the fracture definition by Lovell (1997), to indicate that a fracture was present. In many cases of peri-mortem trauma, the fracture type could not be securely determined. This usually occurred when the fracture lines were obscured by post-mortem damage or because of conservation methods.

Where the fracture type could be observed macroscopically or radiographically, the terms listed below were used. This was because the coding provided by Buikstra and Ubelaker (1994) was not considered detailed enough for this study and was deemed unsuitable due to their use of the code ‘complete’.

- **Avulsion** = applied to the vertebrae. They were classified using the following criteria (after Maat and Mastwijk 2000), anatomical discontinuity, ‘bow-shaped’ superior border and ‘step-off’. Only those that had occurred in adulthood were recorded (Maat and Mastwijk 2000, 148-150).

- **Complete** = a fracture of undetermined type is present.

- **Comminuted** = where two or more fragments are produced, which compose the fracture (Roberts 1997, 131).

- **Compression** = crushing force (applied to non-cranial elements) (Lovell 1997, 141).

- **Depressed** = crushing force (applied to cranium) (Lovell 1997, 141).

- **Oblique** = a line at an angle to the long axis (Lovell 1997, 141; Resnick and Goergen 2002, 2711).

- **Osteochrondritis dissecans** = the separation of a small segment of articular surface (Apley and Solomon 2000, 47). The lesion has been classified as a fracture, following Resnick and Goergen (2002, 2689), however Rogers and Waldron (1995) suggest that although the lesion is most probably caused by trauma, it can be assigned to other pathology categories (Rogers and Waldron 1995, 28). Resnick and Goergen (2002) note it may be an inherited family trait, particularly at the knee joint, but emphasise the role of trauma (Resnick and Goergen 2002, 2689). The lesion does have a circulatory factor in its development, as it is produced by an interruption to the blood supply, causing the articular surface to collapse and separate (Oxford Concise Medical Dictionary 2000, 471; Roberts and Manchester 2005, 121).

- **Peri-mortem** = a fracture which occurs just before, at, or immediately after the time of death (White 1992, 9).

- **Transverse** = a line perpendicular to the long axis (Lovell 1997,141).

- **Spiral** = rotational and angular stress on long axis (Lovell 1997,141).

Where appropriate fractures were sub-divided into particular types,

- **Colles'** = distal segment is angulated posteriorly (Apley and Solomon 2000, 286).

- **Inter-condylar** = it rises through the olecranon fossa vertically and then terminates by traversing both columns in a 'T' or 'Y' shape (Glencross and Stuart-Macadam 2001).

- **Smith** = distal segment is displaced anteriorly (Apley and Solomon 2000, 287).

2.6.9 Sharp-force weapon injuries

- **Sharp-force** = discontinuity of the cortex, a puncture, incision or cleft (Byers 2002, 312; Symes et al. 2002, 404-8), which conforms to the criteria described by Boylston (2000a, 361) provided below.

    - Linearity,
    - A well-defined clean edge and
    - A flat, smooth, polished surface.

2.6.10 Injury recidivism: fractures and sharp-force weapon injuries

In a clinical setting, individuals with a history of fractures and injuries, or those who were repeatedly admitted to emergency rooms over a short space of time have been identified in the clinical literature as a high-risk group. However, Reiner et al. (1990) were the first to apply the term recidivism to clinical analysis, this term as defined by the P.E.D (2004), is a "somebody who relapses" (P.E.D 2004, 1167). Reiner et al.'s (1990) publication also defined the clinical model of an injury recidivist. Based on their data they determined the model should be a male, with a mean age of 26 years, who would experience another fracture/injury episode within a few years of their first admission (Reiner et al. 1990, 559). Their model has been supported by subsequent clinical publications such as Kaufmann et al. (1998), Goins et al. (1992), and Hedges et al. (1995). Judd (2000, 2002b, 2004) introduced this concept to palaeopathology and her research demonstrates that it can be undertaken with success upon archaeological samples. Judd (2002b) rightly states that palaeopathologists are unable to determine the number of episodes during which an individual received the fractures/injuries and therefore we can only identify the total number of fractures/injuries per individual (Judd 2002b, 93). In order to record injury recidivism in this study, the criteria outlined by Judd (2002b, 93) was followed (as detailed below), and the category of no injury was also included in order to present all data observed,

- Adult individuals are grouped by age and sex,
- Recorded as exhibiting - no injury, one injury, two injuries, more than two injuries and
- All injuries were included (e.g. skull, long bones, hands, feet and torso).

In this study, injuries also included osteochondritis dissecans, and those sustained at the time of death. Fractures were then subdivided by mechanism into, violence-related injuries, accident-related injuries, violent and/or accidental injuries, and unknown injury mechanisms (after Judd 2002b, 96). The category of violent and/or accidental injuries was devised as many individuals presented with multiple fractures produced by both mechanisms (see Judd 2004, 46-47). Therefore, many peri-mortem fractures and individuals with rib fractures caused by different mechanisms were assigned to this category.

2.6.11 Determination of interpersonal violence

It is acknowledged that the fracture and sharp-force weapon injury patterns cannot be 'read-off' a skeleton in order to provide direct information on past life-ways, "as in other aspects of behavioural interpretation from osseous involvement, healthy scepticism is always encouraged" (Jurmain 1999, 230). A traditional osseous indicator of involvement in interpersonal violence is the 'parry' fracture (a term not used in this study). The term 'parry' fracture has become synonymous with ulna fractures, and is often used to specify the fracture type and mechanism (Jurmain 1999, 215). In a clinical setting single fractures to the ulna are common and are described as resulting from direct blow/s, most frequently sustained during assaults, when the individual uses the lower portion of the arm to protect the face from injury (Resnick 2002f, 2831). Judd's (2004) review of 'parry' fractures notes that the distal and middle segments are not commonly fractured in falls, with transverse fractures to these segments produced by the element sustaining sudden contact with a narrow edge, and are therefore most likely to be caused by assault. Judd (2004) makes the important statement that, "there is no difference in the injury configuration no matter if the injury was caused by an intentional push or an accidental fall" (Judd 2004, 46-47). Therefore, the mechanism and how this may have occurred in the past should play a more important role in understanding these fractures, rather than assuming all falls were benign or accidental. This is also highlighted by Judd (2004), in her observation that an accidental mechanism is also attributed, often without consideration, to Colles' fractures and ankle trauma (Judd 2004, 47).

'Parry' fractures have also been used to infer interpersonal violence, particularly against females (e.g. Webb 1995; see also Jurmain 1999, 216-218). One of the most intensive studies of this fracture type was conducted by Smith (1996), who studied the relationship between 'parry' fractures, cranial injury and social trauma in Late Archaic (2500-1000/500

B.C.) and Mississippian Period (1200-1600 A.D.) in west Tennessee (USA) (author's terms). The study analysed the remains of 281 male and female adults from hunter-gatherer and agrarian communities. In her conclusions, Smith (1996) stated that despite the raw data indicating the female prevalence to be unusually high at one site, this pattern could be explained by within-sample sex bias and differences in subsistence strategy. Statistical tests of all data sets demonstrated that females did not have an increased risk of forearm fractures, despite the statistically significant risk due to their respective subsistence strategies (Smith 1996, 84-88). In light of these studies, the archaeological and funerary context of individuals with fractures to the forearm will be used in conjunction with the results of clinical, palaeopathological and anthropological studies in order to provide a better understanding of the injury mechanism.

Formulating a model of interpersonal aggression based upon assault clinical data is problematic, as the individuals included in the studies are victims and aggressors. For example, Wladis et al.'s (1999) study included patients who were harmed during unarmed fights, beatings, brawls, and rape (Wladis et al. 1999, 733). Clinical data is also biased by the causative mechanism, as the majority of fractures are often produced by vehicular accidents (e.g. Whitman et al. 1984; Waller et al. 1995).

Judd's (2000) discussion of the relevance of clinical literature to palaeopathology suggests that where possible clinical studies, which bear most resemblance to the archaeological sample, should be used. These are most frequently from the developing world and traditional societies. Unfortunately, only a limited dataset is available, which is affected by many biases including poor documentation, lack of access to medical resources, and the focus of many studies upon vehicular accidents (Judd 2000, 45-46).

Walker (2001) suggests that modern patterns of inter-personal violence can be used to provide a baseline for palaeotrauma studies, however he does note that injury location may be culturally determined (Walker 2001, 580, 582). For example, modern punitive beatings result in multiple limb fractures rather than cranial trauma (Crane 2000, 78). Modern indicators of non-lethal interpersonal violence, which are the most relevant to palaeopathology, have been suggested by Judd (2000) to be multiple injuries, cranial trauma and forearm fracture from a direct blow (Judd 2000, 57). However, in a modern setting the majority of injuries caused by inter-personal violence are to the soft-tissues (e.g. Wladis et al. 1999) which, unless in rare circumstances, are not preserved in archaeological contexts. Therefore, the range, severity, and number of lesions observed in the archaeological record are probably a poor reflection of the true incidence (Walker 2001, 584).

The clearest indicators of violence are sharp-force weapon injuries and by examining their location, severity and morphology (Byers 2002, 312-322; Symes et al. 2002, 404) the context of the injury can be assessed, although Jurmain (1999) states that they have "a slightly less secure interpretative basis" (Jurmain 1999, 215). Interpretation of an injury can be insecure, because a single weapon can often produce more than one type of injury (Boylston 2000a, 361) and the plastic nature of bone can mask the true dimensions of a weapon, making identification of weapon type highly problematic (Byers 2002, 319). The use of armour can influence which parts of the skeleton are vulnerable, influencing the distribution and severity of injuries (Boylston 2000a, 359). Interpreting the direction of force is also an area of bias. If the injuries are to the posterior or anterior aspects, it could be postulated that the individual was assaulted from these directions. This however, to a certain extent, assumes that the individual remained motionless and may be true of post-mortem mutilations, or injuries sustained by an unconscious individual. Typically, during assaults, the victim tries to avoid blows. For example, an attack from the anterior aspect, which may leave no skeletal trace, could result in skeletal injury to the posterior aspect, because the individual had attempted to flee, or had been forced to the ground and then attacked (Byers 2002, 320). This forensic based view is in opposition to many archaeological studies. For example, Wenham (1989) supports Inglemark's (1939) assertion that multiple blows represent disorganised fighting (Wenham 1989, 137), and Novak (2000) who states that injury to the left side indicates assault by a right-handed assailant (Novak 2000, 93).

In order to avoid an actively biased reading of the dataset only injuries and fractures produced by violent mechanisms were used, because studies have shown them to be useful indicators of aggression in past societies. These were identified from the following categories, peri- and ante-mortem sharp-force weapon injuries, peri-mortem fractures, peri- and ante- mortem fractures to the skull or limb and skull (Walker 1989; Smith 1996; Jurmain 1999, 265; Ostendorf Smith 2003).

2.6.12 Surgical intervention: amputation

The recording of surgical intervention was only employed when direct osseous evidence was present, for example cut-marks, and if the bone response did not conform to a pseudoarthrosis (see also Ortner 2003, 169). Differentiation was based upon the presence of vascular erosion of the affected and surrounding area, the presence of endosteal callus, narrowing and/or obliteration of the medullary cavity, and remodelling of the affected area (Aufderheide and Rodríguez-Martín 1998, 30). As only the method and or instrument (e.g. amputation by a sharp-force instrument) can be identified (Mays 1996), surgery was only postulated when no associated peri- or ante-mortem trauma was present, and the grave context sheet, site photographs (where available), and plan all indicated that the change had not been produced taphonomically.

2.7 Calculation of stature

An individual's attained stature provides an insight into environmental conditions and social complexities, in addition to non-adult health and nutrition (Bogin 1999, 387-397; Larsen 1999, 13-19; Humphrey 2000, 203). Many methods for calculating stature have been created using the short and long bones, as well as the cranium (Roberts 1997, 115-116), although the most reliable method is considered to be regression formulae, based upon the long bones (Roberts 1997, 115). However, Jantz et al. (1995), and Ousley (1995) have demonstrated that Trotter (1970) standards, which calculate stature based upon the tibia, or femur and tibia, are inaccurate. This is because the tibial malleolus was not included in the tibial measurement taken by Trotter (1970) (Jantz et al. 1995, 758; Ousley 1995, 768-769). It has been suggested that the average of multiple long bones, or long bones of the leg/arm should be used to determine stature (Brothwell 1994, 102; Krogman and Iscan 1986, 310-311). This does introduce subjectivity, because intra-/inter-individual variation may exist in the number of long bones available for study.

In the present study, stature was estimated on sexed individuals (probable females/males were excluded) using a complete femur, which had not been repaired or warped/distorted due to taphonomic processes (cf. Krogman and Iscan 1986, 327). The approach was undertaken as studies have shown that long bones provide a more reliable result, the standard error of the femur formulae are less than for the humerus (Krogman and Iscan 1986, 345). It removes the problems associated with the formulae based upon the tibia, and enabled the same data to be compared through time. The regression equations used are provided below

White males	**White females**
2.32 x Femoral length + 65.53	2.47 x Femoral length + 54.10

(Bass 1995, 233).

2.8 Indicators of stress: periostitis, enamel hypoplastic defects, and cribra orbitalia

Following the model of health, nutrition, and adaptation presented by Goodman and Armelagos (1989), indicators of stress were employed to investigate adaptation to environmental and cultural stressors. Goodman et al. (1988) have shown that the use of multiple skeletal indicators enables the researcher to investigate stress adaptation that may not be available from cultural and environmental data (Goodman et al. 1988, 177). An important feature of their model is the recognition that culture can act as a stressor or a buffer, often in conjunction with environmental stressors (Goodman and Armelagos 1989, 226). If both culture and environmental stressors affect an individual and they are unable to provide an adequate biological response (e.g. due to poor nutritional status), the stressors are more likely to produce indicators of stress. The ability of an individual to cope is influenced by their social-status and health-status; therefore not all members of a community are at equal risk (Goodman and Armelagos 1989, 226). Goodman et al. (1988) also note that stress (as defined by Selye 1957), is influenced by genetics, age, sex, individual resilience and the osteological hierarchy of response, where bone is affected before the dentition (Goodman et al. 1988, 177). A large-population based study by Steckel et al. (2002) integrated this model into their health index, because the indicators could be recorded quickly and at low cost (Steckel et al. 2002, 81-89).

Due to the individual and population variation that affects the Goodman and Armelagos (1989) model, the use of non-specific indicators has been questioned. This is further compounded by the results of studies indicating a wide range of causes for their formation. Stuart-Macadam (1992a) demonstrated that cribra orbitalia could be caused by dietary deficiency, ecological factors, parasite load, or an adaptive response to infectious disease (Stuart-Macadam 1992a, 261-268). For example, periostitis new bone formation has a wide variety of causes, as it is a basic inflammatory response to infection or localised trauma (Larsen 1999, 83-84). Lewis and Roberts (1997) review of indicators of stress and their interpretations concluded that the exact aetiology of enamel hypoplasias is unknown and that periostitis is a non-specific indicator (Lewis and Roberts 1997). Ribot and Roberts (1996), who examined indicators of stress in non-adults concluded that although they are the result of a combination of stressors and only have partially over-lapping aetiologies, they can be successfully studied between populations of similar chronological, ecological and pathological backgrounds (Ribot and Roberts 1996, 78). Furthermore, stress indicators have been used many times to investigate levels of health in populations with success (e.g. Lewis 2002). Inter-sample analyses are limited within this present study, because the majority of palaeopathological studies focus upon historic populations and the number of prehistoric studies is low and typically non-European.

2.9 Statistical methodologies

Statistics were employed to make full use of the data, i.e. Relethford and Hodges (1985). Chi-Square tests were used to investigate whether significance existed between archaeological periods, disease types, also age, and biological sex groups. The tests were calculated using the Georgetown University (Washington D.C. U.S.A.) linguistics X^2 test (http://www.schnoodles.com/cgi-bin/web_chi_form.cgi). Standard deviation was also applied to the stature data using the tools in Microsoft Excel Office 2004.

CHAPTER 3.0 – RESULTS

3.1 Introduction

The results of the study are described in this chapter presented by sex. The probable male and female data has been combined with sexed individuals, and the data are sub-divided by disease type. Appendix 3 presents the results of the intra-observer error tests.

3.1.1 Presentation of data

The data is presented by true prevalence rate (i.e. number of elements affected) and by segment, and where appropriate the crude prevalence rate is provided e.g. for rarely occurring diseases such as tuberculosis and metastatic neoplasms, the number of individuals affected by sex and/or at the regional level is given. The prevalence rate is also expressed as a percentage. Calculation of the total number (N) of elements is summarised in Table 1. In the text and tables the segment location has been abbreviated to the following. The proximal articular surface by pe, the proximal third by p1/3, the middle third by m1/3, the distal third by d1/3 and distal articular surface by de.

As stated in section 2.4.8.2, in order to succinctly present the fracture and sharp-force weapon injury data, elements other than long bones have also been displayed by segment affected (N= total number of elements observed), Table 1 summarises the percentage of an element used to calculate N. With the purpose of presenting the recorded data in a standardised manner, this approach was applied (where appropriate) to the display of data recorded for fractures, sharp-force weapon injuries, specific infection, benign neoplasms, surgical intervention, and hypertrophic osteoarthropathy. By displaying the information in this way, data upon which the diagnosis was made (e.g. hypertrophic osteoarthropathy and benign neoplasms) could also be presented.

Table 1 Calculation of the total number of elements present.

Element	Presence used to calculate N
Skull	25-75% of the element (Buikstra and Ubelaker 1994, 6)
Carpals, metacarpals, tarsals, metatarsals and phalanges	25-75% of the element (Buikstra and Ubelaker 1994, 7).
Ribs	Number of heads observed.
Vertebrae	Centrum and spinous process.
Long bones	Presence of one diaphyseal segment
Ilium, ischium and pubis	25-75% of each (Buikstra and Ubelaker 1994, 8).
Scapula	Presence of the glenoid cavity and body.

3.2 Total number of males and females included in the sample

Table 2 Number of individuals included in the study from each period.

Period	Male	Female	Total
Iron Age	64	51	115
Romano-British period	96	59	155
Total	160	110	270

Table 2 shows that 270 individuals were recorded from the region. Appendix 1 details the number of individuals by age and sex from each site included in the sample. The number of individuals in the Romano-British period is higher, due to the greater archaeological visibility of cemeteries from this period, but this result was not statistically significant (Table 3).

3.2.1 Demography of the total sample

Figure 5 A graph displaying the demographic results of the total sample.

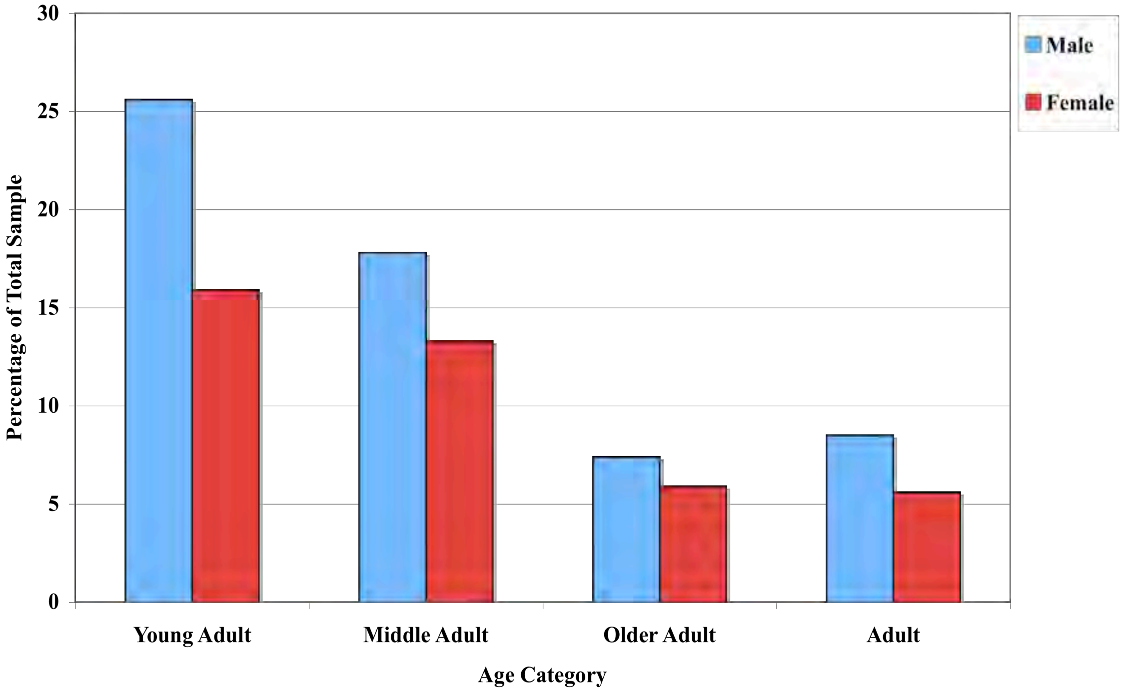


Figure 5 presents the percentage of individuals in each age group. The majority of individuals were dying during young adulthood, however male mortality is greatest in all age groups. The graph demonstrates that the sample data is weighted towards young and middle adults.

3.2.2 Iron Age demography

Figure 6 A graph displaying the Iron Age demographic results.

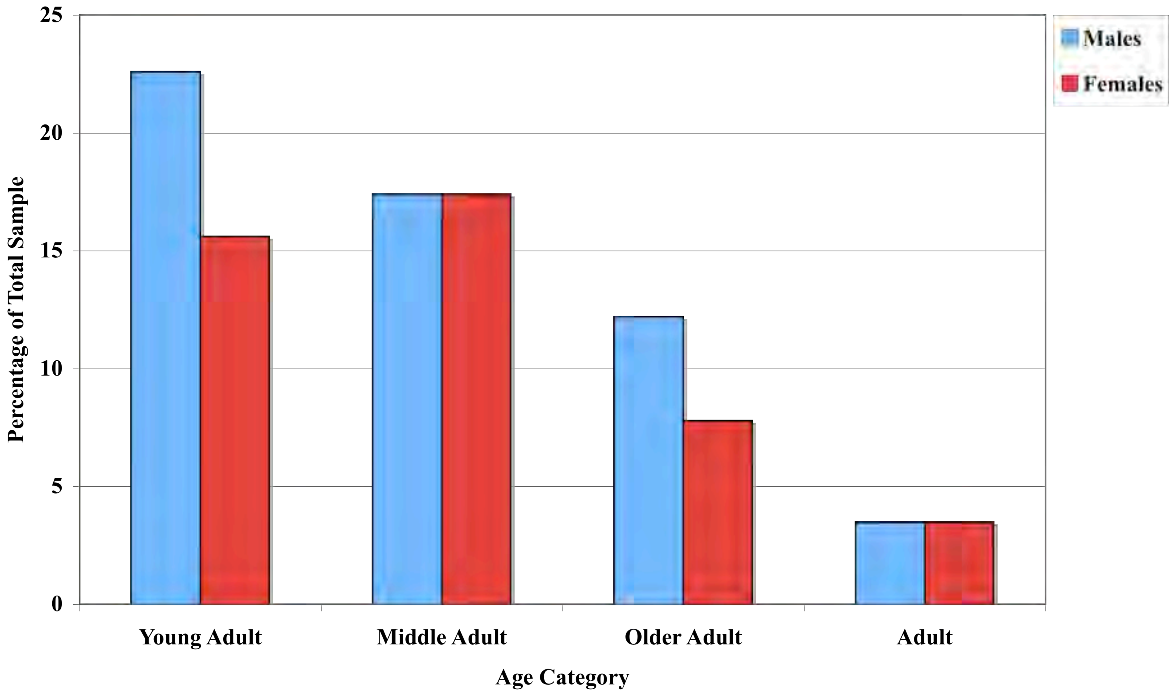


Figure 6 shows that in the Iron Age, males have the highest number of individuals in the young adult and older adult age groups. It is only in the middle adult group that both sexes show equal age-at-death percentages. The lowest percentages were observed in both sexes for older adult age groups.

3.2.3 Romano-British period demography

Figure 7 A graph displaying the Romano-British period demographic results.

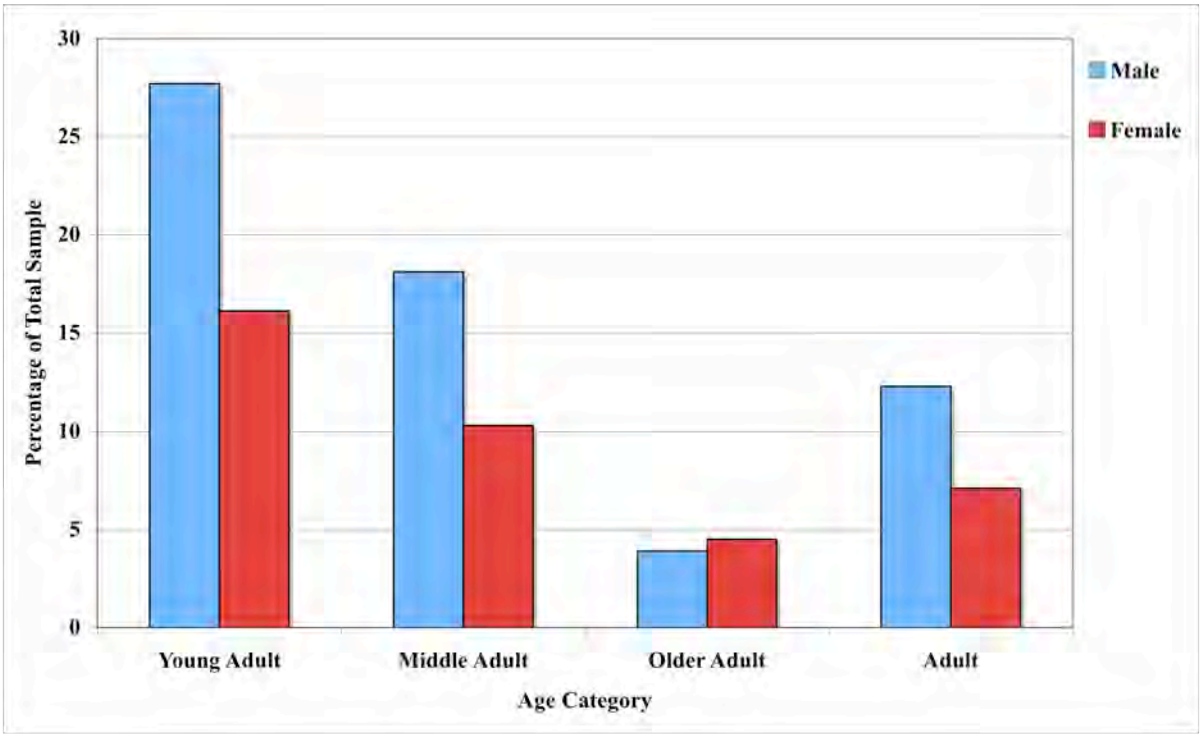


Figure 7 shows that in the Romano-British period sample, the majority of the sample died before reaching older adulthood, with the highest percentage of males in the young adult group. Unlike the Iron Age, male mortality exceeds that of females and was observed in all age groups, with the greatest disparities observed in the young to older adult groups. The female pattern also changes from the Iron Age, with the highest percentage of Romano-British females dying in middle adulthood.

3.2.4 Chi-Square test: comparison of the number of males and females in the sample

Table 3 A chi-square testing comparing the number of males and females included in the total sample.

	Males	**Females**	**Total**
Iron Age	64	51	115
Romano-British period	96	59	155
Total	160	110	270

Degrees of freedom = 1
Chi-square = 1.079
For significance at the 0.05 level, chi-square should be greater than or equal to 3.84
p is less than or equal to 1
<u>The distribution is not significant</u>

Table 3 shows that there is no statistical significance in the numbers of males and females in the sample and therefore, there is no significant difference between archaeological periods.

3.3 Stature

Stature could be calculated (see 2.7) for 194 individuals and results are presented by archaeological period.

3.3.1 Iron Age stature

Figure 8 A graph displaying male and female stature in the Iron Age.

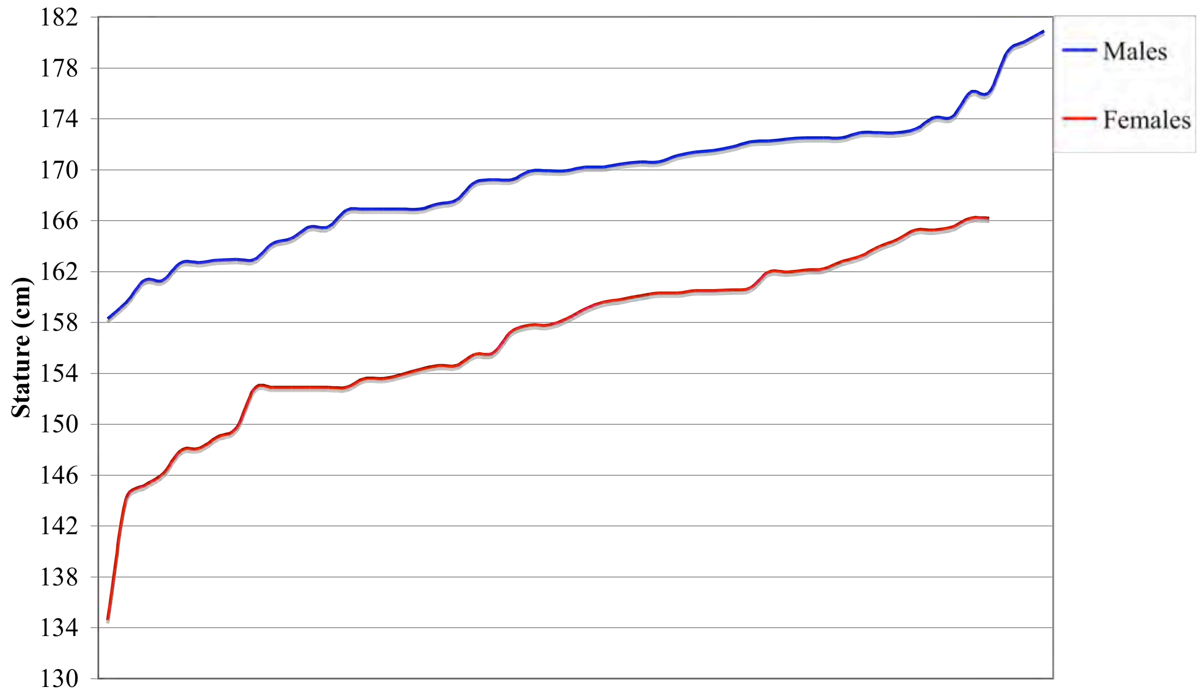


Figure 8 shows the spread of male and female stature during the Iron Age. The mean male (N=49) stature is 169.2 cm and female (N=42) stature is 156.2 cm. The standard deviation from the mean in males was 5.03 and in females 6.64. The graph shows that the majority of females were of shorter stature compared to males, which is supported by their mean stature, which is 13 cm shorter than the male sample.

3.3.2 Romano-British period stature

Figure 9 A graph displaying male and female stature in the Romano-British period.

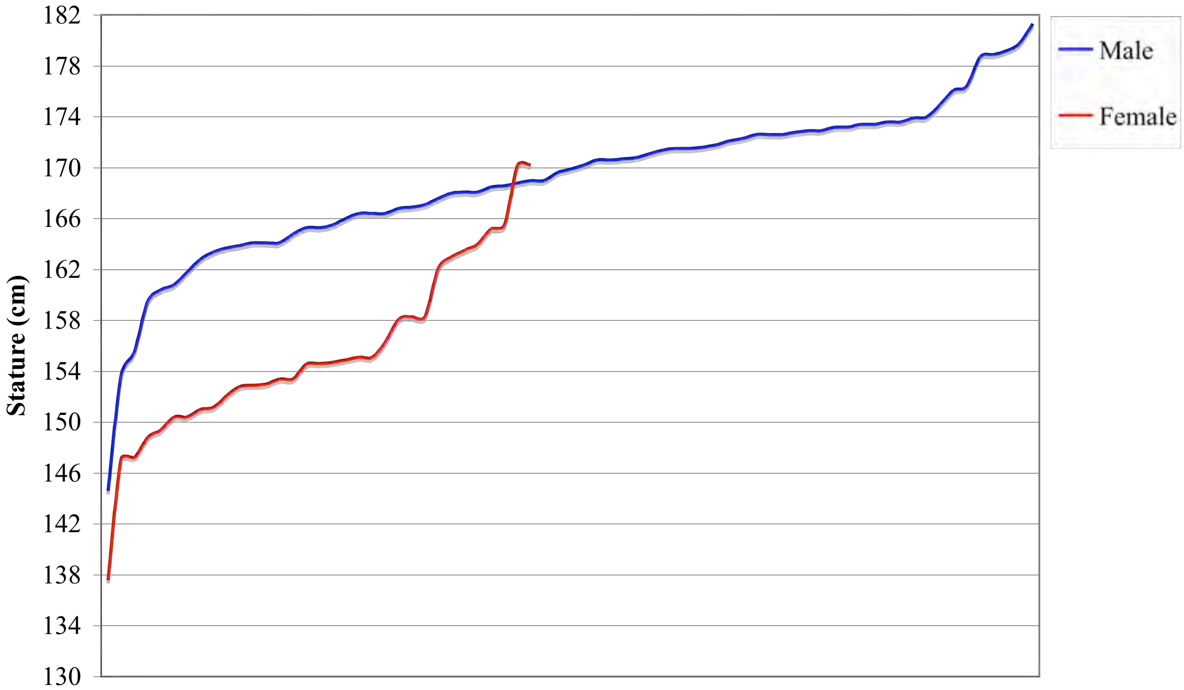


Figure 9 shows the spread of male and female stature from the Romano-British period. The average male (N=71) stature was 169 cm and the average female (N=32) stature was 153 cm. The standard deviation from the mean in males was 6.11 and in females 6.98. The majority of females, as in the Iron Age are shorter than the males, by an average of 16 cm. However, unlike the earlier period, the male data includes individuals under 158 cm.

3.4 Male health

Section 3.4 presents the data at the regional level by disease type through time.

3.4.1 Indicators of stress

Tables 4 and 5 present the number of elements present in the sample by archaeological period with evidence of indicators of stress. The data has been aggregated by side and in the case of the lower limb, by element affected.

3.4.1.1 Iron Age

Table 4 Iron Age male indicators of stress.

Bone and Enamel Response	Cribra Orbitalia (N = 1 orbit)	Periosteal New Bone Formation (N= all lower limb elements)	Maxilla	Mandible
Barely Discernible	18/93	-	-	-
	19.4%	-	-	-
Porosity Only	10/93	-	-	-
	10.8%	-	-	-
Porosity with Coalescence of the Foramina with no Thickening	19/93	-	-	-
	20.4%	-	-	-
Lamellar	-	169/330	-	-
	-	51.2%	-	-
Sclerotic	-	64/330	-	-
	-	19.4%	-	-
Mixed	-	5/330	-	-
	-	1.5%	-	-
Woven	-	2/330	-	-
	-	0.6%	-	-

Enamel Hypoplastic Defects	-	-	39/548	56/548
	-	-	7.1%	10.2%

Table 4 shows that the majority of cribra orbitalia was barely discernible, and porosity only and the greatest number of orbits displayed porosity with coalescence of the foramina with no thickening. The number of lower limb elements with active periosteal new bone formation lesions was very low and the majority displayed lamellar bone formation. The maxillary dentition had more teeth presenting enamel hypoplastic defects.

3.4.1.2 Romano-British period

Table 5 Romano-British male indicators of stress.

Bone and Enamel Response	**Cribra Orbitalia (N = 1 orbit)**	**Periosteal New Bone Formation (N=all lower limb elements)**	**Maxilla**	**Mandible**
Barely Discernible	26/159	-	-	-
	16.4%	-	-	-
Porosity Only	20/159	-	-	-
	12.6%	-	-	-
Porosity with Coalescence of Foramina, no Thickening	12/159	-	-	-
	7.5%	-	-	-
Lamellar	-	119/495	-	-
	-	24%	-	-
Sclerotic	-	46/495	-	-
	-	9.3%	-	-
Woven	-	4/495	-	-
	-	0.8%	-	-
Enamel Hypoplastic Defects	-	-	41/917	71/766
	-	-	4.5%	9.3%

Table 5 shows that the majority of orbits displayed barely discernible, and porosity only changes, and barely discernible had the highest prevalence rate. The minority of lower limb elements displayed an active periosteal new bone formation reaction and the highest number of elements presented with a lamellar bone formation. The mandibular dentition has more teeth with an observable enamel hypoplastic defect. The statistical tests presented in Tables 10, 15 and 25 demonstrate that the number of elements affected was statistically significant between the two periods.

3.5 Enamel hypoplastic defects and age formation

Tables 6 to 8 present the number of individuals with enamel hypoplastic defects and the age at which they were formed. The data from the mandible and maxilla have been combined.

3.5.1 Iron Age

Table 6 Age at which the enamel hypoplastic defect formed in Iron Age male dentitions, displayed by number of individuals observed with a defect at each dental location (Buikstra and Ubelaker 1994, attachment 14a).

	Age in Years (N = individuals)							
Location	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1st Incisors (Maxillary and mandibular)	9	-	1	4	-	-	-	-
2nd Incisors (Maxillary and mandibular)	1	2	1	-	2	-	-	-
Canines (Maxillary and mandibular)	2	2	3	4	-	2	1	1
1st Premolars (Maxillary and mandibular)	1	1	-	1	-	1	2	-
2nd Premolars (Maxillary and mandibular)	-	1	-	-	-	-	-	2
2nd Molars (Maxillary and mandibular)	-	-	1	-	-	-	-	-
Total	13	6	6	9	2	3	3	3

Table 6 shows that the greatest number of observable defects formed before the first and third years of life, with defects at the canines and 1st incisors observed in the majority of males.

3.5.1.1 Chi-Square test (Iron Age): comparison of enamel hypoplastic defects between the sexes

Table 7 Chi-square test comparing the number of Iron Age male and female teeth displaying an observable enamel hypoplastic defect.

	Present	**Absent**	**Total**
Males	95	1001	1096
Females	51	862	913
Total	146	1863	2009

Degrees of freedom = 1
Chi-square = 7.019
p is less than or equal to 0.01
The distribution is significant

Table 7 shows that the difference in the number of Iron Age males and female teeth with an observable enamel hypoplastic defect is statistically significant.

3.5.2 Romano-British period

Table 8 Age at which the enamel hypoplastic defect formed in Romano-British male dentitions, displayed by number of individuals observed with a defect at each dental location (Buikstra and Ubelaker 1994, attachment 14a).

	Age in Years (N= individuals)						
Location	**0**	**1**	**2**	**3**	**4**	**5**	**6**
1st Incisors (Maxillary and mandibular)	4	1	1	1	1	-	-
2nd Incisors (Maxillary and mandibular)	5	1	-	-	-	1	1
Canines (Maxillary and mandibular)	4	1	4	4	1	2	3
1st Premolar (Maxillary and mandibular)	-	1	1	-	-	1	1
2nd Premolar (Maxillary and mandibular)	-	-	1	1	-	-	1
Total	13	4	7	6	2	4	6

Table 8 shows that the majority of enamel hypoplastic defects were formed before the first and second years of life, with most individuals displaying observable defects on the first incisors and canines. No observable enamel hypoplastic defects were recorded on molar teeth.

3.5.2.1 Chi-Square test (Romano-British period): comparison of enamel hypoplastic defects between the sexes

Table 9 Chi-square test comparing the number of Romano-British male and female teeth displaying an observable enamel hypoplastic defect.

	Present	**Absent**	**Total**
Males	112	1571	1683
Females	102	767	869
Total	214	2338	2552

Degrees of freedom = 1
Chi-square = 19.272
p is less than or equal to 0.001
The distribution is significant

Table 9 demonstrates that the difference in the number of observable enamel hypoplastic defects between the sexes is statistically significant in the Romano-British period.

3.5.2.2 Chi-Square test: comparison of male enamel hypoplastic defects

Table 10 Chi-square test comparing the number of Iron Age and Romano-British male teeth displaying an observable enamel hypoplastic defect.

	Present	**Absent**	**Total**
Iron Age	95	1001	1096
Romano-British period	112	1571	1683
Total	207	2572	2779

Degrees of freedom = 1
Chi-square = 3.901
p is less than or equal to 0.05
The distribution is significant

Table 10 demonstrates that the difference in the number of observable enamel hypoplastic defects is statistically significant for males between the two periods.

3.6 Metabolic disease

The only metabolic diseases observed in the region for both periods were cribra orbitalia and porotic hyperostosis. Tables (11 to 20) present the number of bones affected and the range of changes observed.

3.6.1 Iron Age: cribra orbitalia

Table 11 The evidence for cribra orbitalia in Iron Age males, displayed by side, change and activity level.

Change	Side	Active	Mixed	Healed
Barely Discernible	Right	-	-	9/46
		-	-	19.6%
	Left	-	1/47	10/47
		-	2.1%	21.3%
Porosity Only	Right	-	2/46	2/46
		-	4.3%	4.3%
	Left	-	2/47	2/47
		-	4.3%	4.3%
Porosity with Coalescence of the Foramina, no Thickening	Right	2/46	-	7/46
		4.3%	-	15.2%
	Left	3/47	-	5/47
		6.4%	-	10.6%

Table 11 shows that the majority of cribra orbitalia observed was healed and this is also reflected in the majority of changes observed being less severe. There does not appear to be a side predilection in the male sample.

3.6.1.1 Chi-Square test (Iron Age): comparison of cribra orbitalia between the sexes

Table 12 Chi-square test comparing the number of Iron Age male and female orbits displaying cribra orbitalia.

	Present	Absent	Total
Males	47	46	93
Females	53	40	93
Total	100	86	186

Degrees of freedom = 1
Chi-square = 0.778
For significance at the 0.05 level, chi-square should be greater than or equal to 3.84
p is less than or equal to 1
The distribution is not significant

Table 12 shows that there is no statistical difference in the number of Iron Age male and female orbits displaying cribra orbitalia.

3.6.2 Romano-British period: cribra orbitalia

Table 13 The evidence for cribra orbitalia in Romano-British males, displayed by side, change and activity level.

Change	Side	Mixed	Healed
Barely Discernible	Right	-	11/80
		-	13.8%
	Left	-	13/79
		-	16.5%
Porosity Only	Right	1/80	8/80
		1.3%	10%
	Left	2/79	7/79
		2.5%	8.9%
Porosity with Coalescence of	Right	2/80	5/80
		2.5%	6.3%

Foramina, no Thickening	Left	3/79	4/79
		3.8%	5.1%

Table 13 demonstrates that no active lesions were observed in the Romano-British period sample. The majority of observable changes were not severe and were healed. The left orbit was more affected compared to the right.

3.6.2.1 Chi-Square test (Romano-British period): comparison of cribra orbitalia between the sexes

Table 14 Chi-square test comparing the number of Romano-British male and female orbits displaying cribra orbitalia.

	Present	**Absent**	**Total**
Males	58	101	159
Females	17	73	90
Total	75	174	249

Degrees of freedom = 1
Chi-square = 8.447
p is less than or equal to 0.01
<u>The distribution is significant</u>

Table 14 indicates that there is a statistically significant difference in the number of orbits displaying cribra orbitalia between the sexes in the Romano-British period.

3.6.2.2 Chi-Square test: comparison of male cribra orbitalia

Table 15 Chi-square test comparing the number of Iron Age and Romano-British male orbits displaying cribra orbitalia.

	Present	**Absent**	**Total**
Iron Age	47	46	93
Romano-British period	58	101	159
Total	105	147	252

Degrees of freedom = 1
Chi-square = 4.772
p is less than or equal to 0.05
<u>The distribution is significant</u>

Table 15 shows that the difference in the number of male orbits displaying cribra orbitalia between the two periods is statistically significant.

3.6.3 Iron Age: porotic hyperostosis

Table 16 The evidence for porotic hyperostosis in Iron Age male crania, displayed by bone, side, change and activity level.

Change	Element	Active	Mixed	Healed
Barely Discernible	Frontal bone	-	-	5/47
		-	-	10.6%
	Parietal bones (right and left)	-	-	14/96
		-	-	14.6%
	Occipital bone	-	-	6/47
		-	-	12.8%
Porosity Only	Frontal bone	-	4/47	7/47
		-	8.5%	14.9%
	Parietal bones (right and left)	2/96	7/96	12/96
		2.1%	7.3%	12.5%
	Occipital bone	1/47	6/47	6/47
		2.1%	12.8%	12.8%
Coalescing Foramina with increased Thickness	Frontal bone	-	1/47	1/47
		-	2.1%	2.1%
	Parietal bones (right and left)	-	2/96	2/96
		-	2.1%	2.1%
	Occipital bone	-	1/47	1/47
		-	2.1%	2.1%

Table 16 shows that the parietal bones were most frequently affected by porotic hyperostosis, although the majority of observable changes to all elements were mixed or healed. The most common change was porosity only, which showed the widest range of response.

3.6.3.1 Chi-Square test (Iron Age): comparison of porotic hyperostosis between the sexes

Table 17 Chi-Square test comparing the number of Iron Age male and female frontal, parietal and occipital bones, displaying evidence for porotic hyperostosis.

	Present	**Absent**	**Total**
Males	68	122	190
Females	44	146	190
Total	112	268	380

Degrees of freedom = 1
Chi-square = 7.291
p is less than or equal to 0.01
<u>The distribution is significant</u>

Table 17 shows that the difference in number male and female cranial bones displaying porotic hyperostosis is statistically significant for the Iron Age.

3.6.4 Romano-British period: porotic hyperostosis

Table 18 The evidence for porotic hyperostosis in Romano-British male crania, displayed by bone, side, change and activity level.

<table>
<tr><th>Change</th><th>Element</th><th>Mixed</th><th>Healed</th></tr>
<tr><td rowspan="6">Barely Discernible</td><td rowspan="2">Frontal bone</td><td>-</td><td>1/80</td></tr>
<tr><td>-</td><td>1.3%</td></tr>
<tr><td rowspan="2">Parietal bones (right and left)</td><td>-</td><td>6/155</td></tr>
<tr><td>-</td><td>3.9%</td></tr>
<tr><td rowspan="2">Occipital bone</td><td>-</td><td>2/76</td></tr>
<tr><td>-</td><td>2.6%</td></tr>
<tr><td rowspan="2">Porosity Only</td><td rowspan="2">Frontal bone</td><td>2/80</td><td>5/80</td></tr>
<tr><td>2.5%</td><td>6.3%</td></tr>
</table>

	Parietal bones (right and left)	6/155	14/155
		3.9%	9%
	Occipital bone	4/76	7/76
		5.3%	9.2%
Coalescing Foramina with increased Thickness	Occipital bone	1/76	-
		1.3%	-

Table 18 shows that the majority of the Romano-British sample displayed healed lesions. The occipital bone displayed the most variability in observable changes. As in the Iron Age, the parietal bones were the most frequently affected element.

3.6.4.1 Chi-Square test (Romano-British period): comparison of porotic hyperostosis between the sexes

Table 19 Chi-Square test comparing the number of Romano-British male and female frontal, parietal and occipital bones, displaying evidence for porotic hyperostosis.

	Present	Absent	Total
Males	48	263	311
Females	20	152	172
Total	68	415	483

Degrees of freedom = 1
Chi-square = 1.326
For significance at the 0.05 level, chi-square should be greater than or equal to 3.84
p is less than or equal to 1
<u>The distribution is not significant</u>

Table 19 demonstrates that there is no statistically significant difference in the number of female and male cranial bones displaying porotic hyperostosis in the Romano-British period.

3.6.4.2 Chi-Square test: comparison of male porotic hyperostosis

Table 20 Chi-Square test comparing the number of Iron Age and Romano-British male frontal, parietal and occipital bones, displaying evidence for porotic hyperostosis.

	Present	Absent	Total
Iron Age	68	122	190
Romano-British period	48	263	311
Total	116	385	501

Degrees of freedom = 1
Chi-square = 27.465
p is less than or equal to 0.001
The distribution is significant

Table 20 demonstrates that the number of cranial bones displaying porotic hyperostosis was statistically significant between males over time.

3.7 Non-specific infectious disease

The following Tables (21 to 25) present the number of leg elements displaying a periosteal new bone response and the state of remodelling observed. The pooled femora, tibiae and fibulae data is presented in indicators of stress (Tables 4 and 5), as described in section 2.8.

3.7.1 Iron Age

Table 21 Periosteal new bone formation observed to the femora, tibiae and fibulae of Iron Age males, displayed by osseous change observed and side affected.

Type of New Bone Formation Observed	Femur		Tibia		Fibula	
	Right	Left	Right	Left	Right	Left
Lamellar	33/54	33/59	31/55	31/54	21/55	20/53
	61.1%	55.9%	56.4%	57.4%	38.2%	37.7%
Sclerotic	9/54	9/59	15/55	15/54	8/55	8/53
	16.7%	15.3%	27.3%	27.8%	14.5%	15.1%
Mixed	1/54	1/59	2/55	1/54	-	-
	1.9%	1.7%	3.6%	1.9%	-	-
Woven	-	-	1/55	1/54	-	-
	-	-	1.8%	1.9%	-	-

Table 21 shows that the tibia is most frequently affected element, with the widest range of observable lesions. The majority of lesions to the lower limb were healed or healing, with only two elements displaying woven new bone formation. No side predilection was observed for any element.

3.7.1.1 Chi-Square test (Iron Age): comparison of lower limb periosteal new bone formation lesions between the sexes

Table 22 Chi-Square test comparing the number of Iron Age male and female femora, tibiae and fibulae displaying periosteal new bone formation.

	Present	**Absent**	**Total**
Males	240	90	330
Females	209	71	280
Total	449	161	610

Degrees of freedom = 1
Chi-square = 0.286
For significance at the 0.05 level, chi-square should be greater than or equal to 3.84
p is less than or equal to 1
<u>The distribution is not significant</u>

Table 22 demonstrates that the number of lower limbs with periosteal new bone formation was not statistically significant between the sexes during the Iron Age.

3.7.2 Romano-British period

Table 23 Periosteal new bone formation observed to the femora, tibiae and fibulae of Romano-British males, displayed by osseous change observed and side affected.

Type of New Bone Formation Observed	**Femur**		**Tibia**		**Fibula**	
	Right	**Left**	**Right**	**Left**	**Right**	**Left**
Lamellar	23/83	23/83	26/85	25/85	11/80	11/78
	27.7%	27.7%	30.6%	29.4%	13.8%	14.1%
Sclerotic	9/83	9/84	9/85	9/85	9/80	9/78

	10.8%	10.7%	10.6%	10.6%	11.3%	11.5%
Woven	-	-	1/85	1/85	-	-
	-	-	1.2%	1.2%	-	-

Table 23 shows that the tibia is the most frequently affected element and also has the only evidence for a woven bone response. No side predilection was observed in any element and the most frequently observed change was a remodelled response.

3.7.2.1 Chi-Square test (Romano-British period): comparison of periosteal new bone formation to the lower limb between the sexes

Table 24 Chi-Square test comparing the number of Romano-British male and female femora, tibiae and fibulae displaying periosteal new bone formation.

	Present	**Absent**	**Total**
Males	169	326	495
Females	95	188	283
Total	264	514	778

Degrees of freedom = 1
Chi-square = 0.283
For significance at the 0.05 level, chi-square should be greater than or equal to 3.84
p is less than or equal to 1
<u>The distribution is not significant</u>

Table 24 demonstrates that the number of elements displaying periosteal new bone formation is not statistically significant between the sexes during the Romano-British period.

3.7.2.2 Chi-Square test: comparison of male periosteal new bone formation

Table 25 Chi-Square test comparing the number of Iron Age and Romano-British male femora, tibiae and fibulae displaying periosteal new bone formation.

	Present	**Absent**	**Total**
Iron Age	240	90	330
Romano-British period	169	326	495
Total	409	416	825

Degrees of freedom = 1
Chi-square = 117.926
p is less than or equal to 0.001
The distribution is significant

Table 25 demonstrates that the number of male lower limb elements displaying a periosteal bone formation is statistically significant in males between the two periods.

3.8 Specific infectious disease

Specific infectious diseases were observed in both periods, however only in the Iron Age could the cause be determined, namely tuberculosis. A Roman case of tuberculosis [Individual 1088] has been reported at Alington Avenue, affecting the lower cervical and thoracic spine and had resulted in kyphosis (Waldron 2002, 153). Unfortunately, the affected elements were missing and could not be located. Consequentially this individual was not included, because the diagnosis could not be confirmed.

Tuberculosis has been observed in a male dating from the late to post-Roman period at Tolpuddle Ball (McKinley 1999,167-168). However, the burials from this phase of the cemetery were deemed too late to be included in the sample examined for the present study.

3.8.1 Iron Age: tuberculosis

Table 26 Summary table of the changes observed in an Iron Age male displaying a healed tubercular infection.

Element	Anterior Aspect Affected	Posterior Aspect Affected	Superior Aspect Affected	Inferior Aspect Affected	Remodelling Sclerotic Bone Present
1st Lumbar vertebra	1/234	1/234	-	1/234	1/234
	0.4%	0.4%	-	0.4%	0.4%
2nd Lumbar vertebra	1/234	1/234	1/234	1/234	1/234
	0.4%	0.4%	0.4%	0.4%	0.4%
3rd Lumbar	1/234	1/234	1/234	1/234	1/234

vertebra	0.4%	0.4%	0.4%	0.4%	0.4%

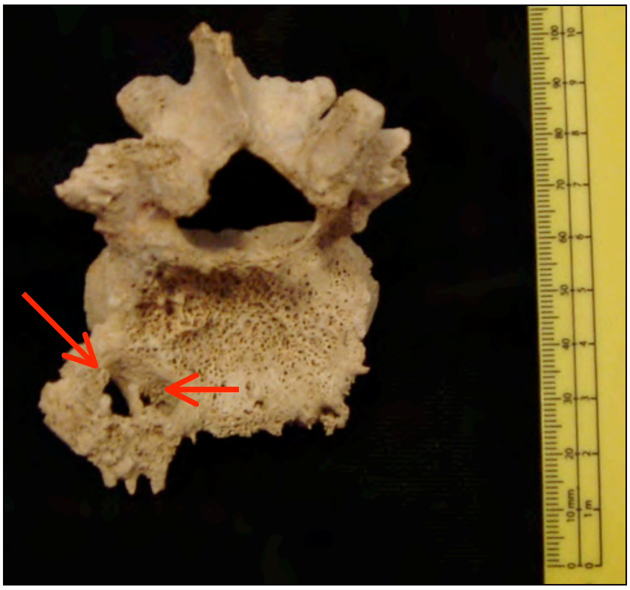
Healed tubercular changes were observed in three lumbar vertebrae from one middle adult male [AB 2 Tarrant Hinton], the disease affected 1.6% of male individuals and 0.9% of the regional sample (Figure 10). Extensive destruction had occurred to the inferior aspect of the 1st and 2nd lumbar vertebrae, causing an estimated 45° of anterior kyphosis (Figure 10b). Remodelling of the infection resulted in kyphosis, which had caused the development of large bony osteophytes on the superior and inferior margins of the centrums, which in the case of the 3rd were 32.9 mm in height (Figure 10c).

In all three affected vertebrae, the infection had extended through the posterior wall of the centra (Figure 10d) and had caused destruction of the posterior aspect, particularly around the venous foramen. The 3rd lumbar vertebra also had a small circular area of destruction, revealing dense smoothed trabecular bone on the superior aspect of the left pedicle.

Figure 10: Evidence for tuberculosis in the Iron Age [AB 2 Tarrant Hinton]

10a Superior view of the lumbar vertebrae, with the healed tubercular changes clearly seen in the 1st, 2nd and 3rd centra.

10b Right lateral view of the 1st to 3rd lumbar vertebrae. The figure demonstrates the considerable anterior kyphosis, due to the extensive ante-mortem destruction of the 3rd lumbar vertebra.



10c Superior view of the 3rd lumbar vertebra. The extensive destruction can be observed to the superior and posterior aspects of the centrum and the left pedicle. The large superiorly projecting spur of dense sclerotic bone (32.9 mm) has two perforations (arrowed), which could be associated with the exit of infected material during the active stage of the osseous response.

10d Inferior view of the 1st lumbar vertebra. The ante-mortem destruction is confined to the posterior margin of the centrum. There is an oval area of destruction, which has disrupted the annulus fibrosus (arrowed) and the posterior aspect of the centrum has remodelling smooth trabeculae present, indicating that the posterior cortex had been destroyed.

3.8.1.1 Iron Age: specific infection

Table 27 Iron Age male elements displaying periosteal bone formation to a specific localised infection.

Element	Side	Aspect/Segment	Sclerotic	Woven
Maxilla	Right	Supero-lateral	-	1/45
			-	2.2%
Ilium	Left	Medial	1/57	-
			1.8%	-
Cervical vertebrae	Un-sided	Anterior	5/180	-
			2.8%	-
Thoracic vertebrae	Un-sided	Anterior	12/523	-
			2.3%	-
Lumbar vertebrae	Un-sided	Anterior	5/234	-
			2.1%	-
1st Sacral vertebra	Un-sided	Anterior	1/49	-
			2%	-
2nd Sacral vertebra	Un-sided	Anterior	1/42	-
			2.4%	-
3rd Sacral vertebra	Un-sided	Anterior	1/44	-
			2.3%	-
4th Sacral vertebra	Un-sided	Anterior	1/39	-
			2.6%	-
5th Sacral vertebra	Un-sided	Anterior	1/38	-
			2.6%	-
Ulna	Left	d1/3	1/57	-
			1.8%	-

Table 27 shows that a small number of elements from three individuals had evidence of a specific localised response to an infection but it was not possible to suggest a specific disease that may have caused these changes, apart from in one older adult male [204 8 Gussage All Saints] described below. No evidence of osteitis or osteomyelitis was observed in the sample.

The evidence of an active infection in the right maxilla, resulting from dental abscesses, was observed in an older adult male [204 8] from Gussage All Saints. Remodelling woven bone was present from the alveolar bone to the superior portion of the right maxilla (Figure 11).

Figure 11: Right lateral view of the active infection observed to the maxilla in an older adult male [204 8 Gussage All Saints].

The sclerotic reaction to the vertebrae and ilium was observed in one middle adult male [P29 Maiden Castle]. A new layer of bone was recorded on the anterior aspect of the vertebrae. The inner surface of the ilium also has a remodelling layer of sclerotic bone present, extending from the posterior margin to the pubic symphysis. No specific disease processes were diagnostic of these changes, but they could be (amongst others) a response to a neoplastic condition (Ragsdale and Ortner 2005).

The localised infection to the posteromedial aspect of the distal third of a left ulna, from a middle adult male [823 Alington Avenue], consisted of an oval area of destruction (9.38 mm long and 5.13 mm wide), surrounded by striated and porotic lamellar bone formation. The destruction may relate to infection of the over-lying soft-tissue.

3.8.2 Romano-British period: specific infectious disease

Table 28 Romano-British male elements displaying periosteal new bone formation in response to a specific disease.

Element	Side	Aspect/Segment	Woven new bone formation	Sclerotic bone formation	Lamellar bone formation
Ribs	Un-sided	Visceral aspect p1/3-m1/3	7/901	-	-
			0.8%	-	-
Metatarsals	Un-sided	Circumferentially p1/3-d1/3	-	4/696	6/696
			-	0.6%	0.9%
Phalanges	Un-sided	Circumferentially p1/3-d1/3	-	3/848	-
			-	0.4%	-

The reactions were observed in two individuals, both from Poundbury Camp. An older adult male [249] has new woven formation present on the visceral surface of both right and left ribs, with the thickest deposit at the proximal third. The new bone formation indicates a response to a pulmonary infection (Roberts et al. 1994). The second male (middle adult) from Poundbury [467] has thick deposits of sclerotic and lamellar bone formation circumferentially to the metatarsals. The proximal and intermediate pedal phalanges also have isolated patches of sclerotic bone present, and the right pedal elements are more affected than the left. Unfortunately, the affected elements have been glued together, making observation difficult (Figure 12). The bone formation may represent a response to an overlying soft tissue infection, but the individual does not conform to the palaeopathological criteria for leprosy (Roberts et al. 2002a).

Figure 12: Bone formation to the foot elements of a middle adult male [467 Poundbury Camp].

12a Superior view of foot elements. The right 1st and 2nd metatarsals (arrowed) display the most proliferative changes.

12b Inferior view of the right foot. The 1st right metatarsal has the most marked osseous changes present. On the diaphyses of the metatarsals, a lamellar reaction can be observed (arrowed).

The elements have been glued together and the distal articular surfaces have been damaged post-mortem.

No evidence for osteitis or osteomyelitis was observed in the Romano-British period, however one case of a remodelled non-adult osteomyelitic infection to the right femur was recorded in a male from Poundbury Camp (Molleson 1993, 195), but the individual was not included in the random sample strategy applied to that site.

3.9 Dental Health

In both periods (Tables 29 to 48), evidence for poor dental health is dominated by the evidence for occlusal wear, calculus, and ante-mortem tooth loss; the enamel hypoplastic defect data is provided in Tables 6 to 8.

3.9.1 Iron Age

Table 29 The dental health of Iron Age males; displayed by the number of teeth, dental position or number of maxillae and mandibles affected. The results are separated into maxillary, mandibular or loose teeth.

	Maxilla	Mandible	Loose
Post-mortem loss	100/638	74/623	-
	15.7%	11.9%	-
Ante-mortem loss	169/638	175/623	-
	26.5%	28.1%	-
Congenitally Absent/Not Present	5/638	6/631	-
	0.8%	1%	-
Wear	366/554	419/548	6/15
	66.1%	76.5%	40.0%
Calculus	261/554	290/554	6/15
	47.1%	52.3%	40.0%
Caries	30/554	41/554	4/15
	5.4%	7.4%	26.7%
Deciduous Retention	-	1/554	-
	-	0.2%	-
Abscesses	49/638	49/631	-
	7.7%	7.8%	-
Periodontal Disease (N= number of maxillae and mandibles)	44/86	44/94	-
	51.2%	46.8%	-
Total Number of Observable Teeth	554/638	553/623	15/15
	86.8%	88.8%	100%
Total Number of Observable Dental Positions	638	623	-

Table 29 shows that the highest percentages were observed for occlusal wear, calculus and ante-mortem tooth loss. Deciduous retention was observed in one young adult male [P23 Maiden Castle], who had probable congenital absence (radiography could not be employed) of the left 2nd mandibular pre-molar (20) and retention of the 2nd deciduous molar (70).

3.9.1.1 Chi-Square test (Iron Age): comparison of ante-mortem tooth loss between the sexes

Table 30 Chi-Square test comparing the number of Iron Age male and female dental positions with evidence for ante-mortem tooth loss.

	Present	**Absent**	**Total**
Males	344	917	1261
Females	500	568	1068
Total	844	1485	2329

Degrees of freedom = 1
Chi-square = 95.517
p is less than or equal to 0.001
The distribution is significant

Table 30 demonstrates the number of dental positions displaying ante-mortem tooth loss was statistically significant between the sexes during the Iron Age.

3.9.1.2 Chi-Square test (Iron Age): comparison of dental wear between the sexes

Table 31 Chi-Square test comparing the number of Iron Age male and female teeth with evidence for wear.

	Present	**Absent**	**Total**
Males	791	326	1117
Females	700	213	913
Total	1491	539	2030

Degrees of freedom = 1
Chi-square = 8.832
p is less than or equal to 0.01
The distribution is significant

Table 31 demonstrates that the number of teeth with evidence of wear is statistically significant between the sexes during the Iron Age.

3.9.1.3 Chi-Square test (Iron Age): comparison of calculus between the sexes

Table 32 Chi-Square test comparing the number of Iron Age male and female teeth with evidence for calculus.

	Present	**Absent**	**Total**
Males	557	566	1123
Females	702	211	913
Total	1259	777	2036

Degrees of freedom = 1
Chi-square = 158.924
p is less than or equal to 0.001
<u>The distribution is significant</u>

Table 32 demonstrates that the number of teeth with calculus is statistically significant between the sexes during the Iron Age.

3.9.1.4 Chi-Square test (Iron Age): comparison of caries between the sexes

Table 33 Chi-Square test comparing the number of Iron Age male and female teeth with evidence for carious lesions.

	Present	**Absent**	**Total**
Males	75	1048	1123
Females	58	855	913
Total	133	1903	2036

Degrees of freedom = 1
Chi-square = 0.087
For significance at the 0.05 level, chi-square should be greater than or equal to 3.84
p is less than or equal to 1
<u>The distribution is significant</u>

Table 33 demonstrates that the number of teeth with a carious lesion is statistically significant between the sexes during the Iron Age.

3.9.1.5 Chi-Square test (Iron Age): comparison of abscesses between the sexes

Table 34 Chi-Square test comparing the number of Iron Age male and female dental positions with evidence for an abscess.

	Present	Absent	Total
Males	98	1171	1269
Females	62	1006	1068
Total	160	2177	2337

Degrees of freedom = 1
Chi-square = 3.342
For significance at the 0.05 level, chi-square should be greater than or equal to 3.84
p is less than or equal to 0.10
The distribution is not significant

Table 34 demonstrates that the number of dental positions with evidence for an abscess was not statistically significant between the sexes during the Iron Age.

3.9.1.6 Chi-Square test (Iron Age): comparison of periodontal disease between the sexes

Table 35 Chi-Square test comparing the number of Iron Age male and female maxillae and mandibles with evidence for periodontal disease.

	Present	Absent	Total
Males	88	92	180
Females	88	23	111
Total	176	115	291

Degrees of freedom = 1
Chi-square = 26.530
p is less than or equal to 0.001
The distribution is significant

Table 35 demonstrates that the number of maxillae and mandibles displaying evidence of periodontal disease during the Iron Age was statistically significant between the sexes.

3.9.2 Romano-British period

Table 36 The dental health of Romano-British males; displayed by the number of teeth, dental position or number of maxillae and mandibles affected. The results are separated into maxillary, mandibular or loose teeth.

	Maxilla	**Mandible**	**Loose**
Post-mortem loss	314/917	185/766	-
	34.2%	24.2%	-
Ante-mortem loss	195/917	147/766	-
	21.3%	19.2%	-
Congenitally Absent/Not Present	20/917	14/1044	-
	2.2%	1.3%	-
Wear	530/917	646/766	63/81
	57.8%	84.3%	77.8%
Calculus	399/917	608/766	21/81
	43.5%	79.4%	25.9%
Caries	48/917	62/766	5/81
	5.2%	8.1%	6.2%
Abscess	40/917	29/1044	-
	4.4%	2.8%	-
Periodontal Disease (N= number of maxillae and mandibles)	65/121	71/134	-
	53.7%	53.1%	-
Total Number of Observable Teeth	588/917	766/1044	81/81
	64.1%	73.4%	100%
Total Number of Observable Dental Positions	995	1044	**-**

During the Romano-British period (Table 36), there are a higher number of teeth displaying carious lesions compared to the Iron Age, but the highest percentages were observed for dental wear, calculus, and ante-mortem tooth loss. The percentage of congenital absence/non-eruption increases in the Romano-British period.

3.9.2.1 Chi-Square test (Romano-British period): comparison of ante-mortem tooth loss between the sexes

Table 37 Chi-Square test comparing the number of Romano-British male and female dental positions with evidence for ante-mortem tooth loss.

	Present	**Absent**	**Total**
Males	342	1341	1683
Females	241	1065	1306
Total	583	2406	2989

Degrees of freedom = 1
Chi-square = 1.633
For significance at the 0.05 level, chi-square should be greater than or equal to 3.84
p is less than or equal to 0.05
<u>The distribution is not significant</u>

Table 37 shows that the number of dental positions displaying ante-mortem tooth loss was not statistically significant between the sexes during the Romano-British period.

3.9.2.2 Chi-Square test (Romano-British period): comparison of dental wear between the sexes

Table 38 Chi-Square test comparing the number of Romano-British male and female teeth with evidence for wear.

	Present	**Absent**	**Total**
Males	1239	525	1764
Females	654	905	1559
Total	1893	1430	3323

Degrees of freedom = 1
Chi-square = 270.144
p is less than or equal to 0.001
<u>The distribution is significant</u>

Table 38 demonstrates that the number of teeth with evidence for wear is statistically significant between the sexes for the Romano-British period.

3.9.2.3 Chi-Square test (Romano-British period): comparison of calculus between the sexes

Table 39 Chi-Square test comparing the number of Romano-British male and female teeth with evidence for calculus.

	Present	Absent	Total
Male	1028	736	1764
Female	359	546	905
Total	1387	1282	2669

Degrees of freedom = 1
Chi-square = 82.973
p is less than or equal to 0.001
The distribution is significant

Table 39 demonstrates that the number of teeth present with calculus is statistically significant between the sexes during the Romano-British period.

3.9.2.4 Chi-Square test (Romano-British period): comparison of caries between the sexes

Table 40 Chi-Square test comparing the number of Romano-British male and female teeth with evidence for carious lesions.

	Present	Absent	Total
Male	115	1649	1764
Female	396	509	905
Total	511	2158	2669

Degrees of freedom = 1
Chi-square = 535.781
p is less than or equal to 0.001
The distribution is significant

Table 40 demonstrates that the number of teeth displaying a carious lesion is statistically significant between the sexes during the Romano-British period.

3.9.2.5 Chi-Square test (Romano-British period): comparison of abscess between the sexes

Table 41 Chi-Square test comparing the number of Romano-British male and female dental positions with evidence for an abscess.

	Present	Absent	Total
Male	69	1892	1961
Female	27	1279	1306
Total	96	3171	3267

Degrees of freedom = 1
Chi-square = 5.788
p is less than or equal to 0.025
<u>The distribution is significant</u>

Table 41 demonstrates that the difference between male and female dental positions with evidence for an abscess is statistically significant during the Romano-British period.

3.9.2.6 Chi-Square test (Romano-British period): comparison of periodontal disease between the sexes

Table 42 Chi-Square test comparing the number of Iron Age male and female maxillae and mandibles with evidence for periodontal disease.

	Present	Absent	Total
Males	136	119	255
Females	67	165	232
Total	203	284	487

Degrees of freedom = 1
Chi-square = 29.884
p is less than or equal to 0.001
<u>The distribution is significant</u>

Table 42 demonstrates that the number of maxillae and mandibles displaying evidence for periodontal disease is statistically significant between the sexes during the Romano-British period.

3.9.2.7 Chi-Square test: comparison of male dental wear

Table 43 Chi-Square test comparing the number of Iron Age and Romano-British male teeth with evidence for wear.

	Present	**Absent**	**Total**
Iron Age	791	326	1117
Romano-British period	1239	525	1764
Total	2030	851	2881

Degrees of freedom = 1
Chi-square = 0.109
For significance at the 0.05 level, chi-square should be greater than or equal to 3.84
p is less than or equal to 1
<u>The distribution is not significant</u>

Table 43 shows that the number of teeth displaying wear is not statistically significant between males through time.

3.9.2.8 Chi-Square test: comparison of male ante-mortem tooth loss

Table 44 Chi-Square test comparing the number of Iron Age and Romano-British male dental positions with evidence for ante-mortem tooth loss.

	Present	**Absent**	**Total**
Iron Age	344	917	1261
Romano-British period	342	1341	1683
Total	686	2258	2944

Degrees of freedom = 1
Chi-square = 19.534
p is less than or equal to 0.001
<u>The distribution is significant</u>

Table 44 demonstrates that the number of dental positions with evidence for ante-mortem tooth loss is statistically significant between the two periods.

3.9.2.9 Chi-Square test: comparison of male calculus

Table 45 Chi-Square test comparing the number of Iron Age and Romano-British male teeth with evidence for calculus.

	Present	**Absent**	**Total**
Iron Age	557	566	1123
Romano-British period	1028	736	1764
Total	1585	1302	2887

Degrees of freedom = 1
Chi-square = 20.866
p is less than or equal to 0.001
<u>The distribution is significant</u>

Table 45 demonstrates that the number of male teeth with calculus is statistically significant between the two periods.

3.9.2.10 Chi-Square test: comparison of male caries

Table 46 Chi-Square test comparing the number of Iron Age and Romano-British male teeth with evidence for carious lesions.

	Present	**Absent**	**Total**
Iron Age	75	1048	1123
Romano-British period	115	1649	1764
Total	190	2697	2887

Degrees of freedom = 1
Chi-square = 0.028
For significance at the 0.05 level, chi-square should be greater than or equal to 3.84
p is less than or equal to 1
<u>The distribution is not significant</u>

Table 46 shows that the number of male teeth displaying a carious lesion is not statistically significant between the two periods.

3.9.2.11 Chi-Square test: comparison of male abscesses

Table 47 Chi Square test comparing the number of Iron Age and Romano-British male dental positions with evidence for abscesses.

	Present	Absent	Total
Iron Age	98	1171	1269
Romano-British period	69	1892	1961
Total	167	3063	3230

Degrees of freedom = 1
Chi-square = 27.771
p is less than or equal to 0.001
The distribution is significant

Table 47 demonstrates that the number of male dental positions with evidence for an abscess is statistically significant between the two periods.

3.9.2.12 Chi-Square test: comparison of male periodontal disease

Table 48 Chi-Square test comparing the number of Iron Age and Romano-British male maxillae and mandibles with evidence for periodontal disease.

	Present	Absent	Total
Iron Age	88	92	180
Romano-British period	136	119	255
Total	224	211	435

Degrees of freedom = 1
Chi-square = 0.834
For significance at the 0.05 level, chi-square should be greater than or equal to 3.84
p is less than or equal to 1
The distribution is not significant

Table 48 shows that the difference in the number of male maxillae and mandibles with evidence for periodontal disease was not statistically significant between the two periods.

3.10 Fractures

The fracture tables are divided into peri-mortem and ante-mortem fracture data (Tables 49 to 76). The data is presented by number of elements affected, then number of segments affected and by location for vertebra. The fracture location and type are presented in separate tables.

A clear difference in fracture distribution, prevalence and presence of peri-mortem trauma is observed between the two periods. For example, peri-mortem fractures to the appendicular skeleton were only observed in the Iron Age. Differences in the elements with ante-mortem fractures were also observed. For example in the Romano-British period, fractures to the patella, frontal bone and mandible occur for the first time, and differences in the number of fractured elements between the two periods is statistically significant (Tables 67 and 116).

3.10.1 Iron Age: location of peri-mortem fractures to skull elements

Table 49 Location of peri-mortem fractures to the skull elements of Iron Age males, displayed by side, number and segment affected.

Element	Side	N	p1/3	m1/3
Frontal bone	Right	11/46	-	-
		23.9%	-	-
	Left	13/47	-	-
		27.7%	-	-
Parietal bones	Right	15/47	-	-
		31.9%	-	-
	Left	13/47	-	-
		27.7%	-	-
Temporo-Sphenoid bones	Right	8/45	-	-
		17.8%	-	-
	Left	9/43	-	-
		20.9%	-	-
Occipital bone	Un-sided	9/95	-	-
		9.5%	-	-
Maxilla	Right	1/45	-	-
		2.2%	-	-
	Left	1/41	-	-
		2.4%	-	-
Mandible	Right	3/47	-	3/47
		6.4%	-	6.4%
	Left	2/47	1/47	1/47
		4.3%	2.1%	2.1%

Table 49 shows that all the large cranial bones sustained fractures, with the left side having the highest prevalence for all skull elements, apart from the parietals bones and mandible. Peri-mortem fracturing to the cranium was produced by blunt-force trauma and sharp-force weapon injuries. The most frequently fractured elements were right parietal bone, followed by the left frontal bone, left parietal bone, right frontal bone, and left temporo-sphenoid bones, however only males have evidence for maxillary bone fractures. The anterior and side portions of the cranium have the highest fracture prevalence, which can be explained by examining the direction of force (see below).

The male sample has the highest prevalence of observable mandibular fractures in the region (Table 49) (combined N= 5/94, 5.3%). The majority of fractures affected the mandibular body, and one fracture was observed to the anterior aspect, adjacent to the mental eminence. One middle adult male [P24 Maiden Castle] has a fracture present to each side of the body. Four individuals [N1, P24, P2 and P22 Maiden Castle] were affected by mandibular fractures, and all apart from P22 had sharp-force weapon injuries to the cranium.

3.10.1.1 Iron Age: direction of peri-mortem skull blunt-force trauma

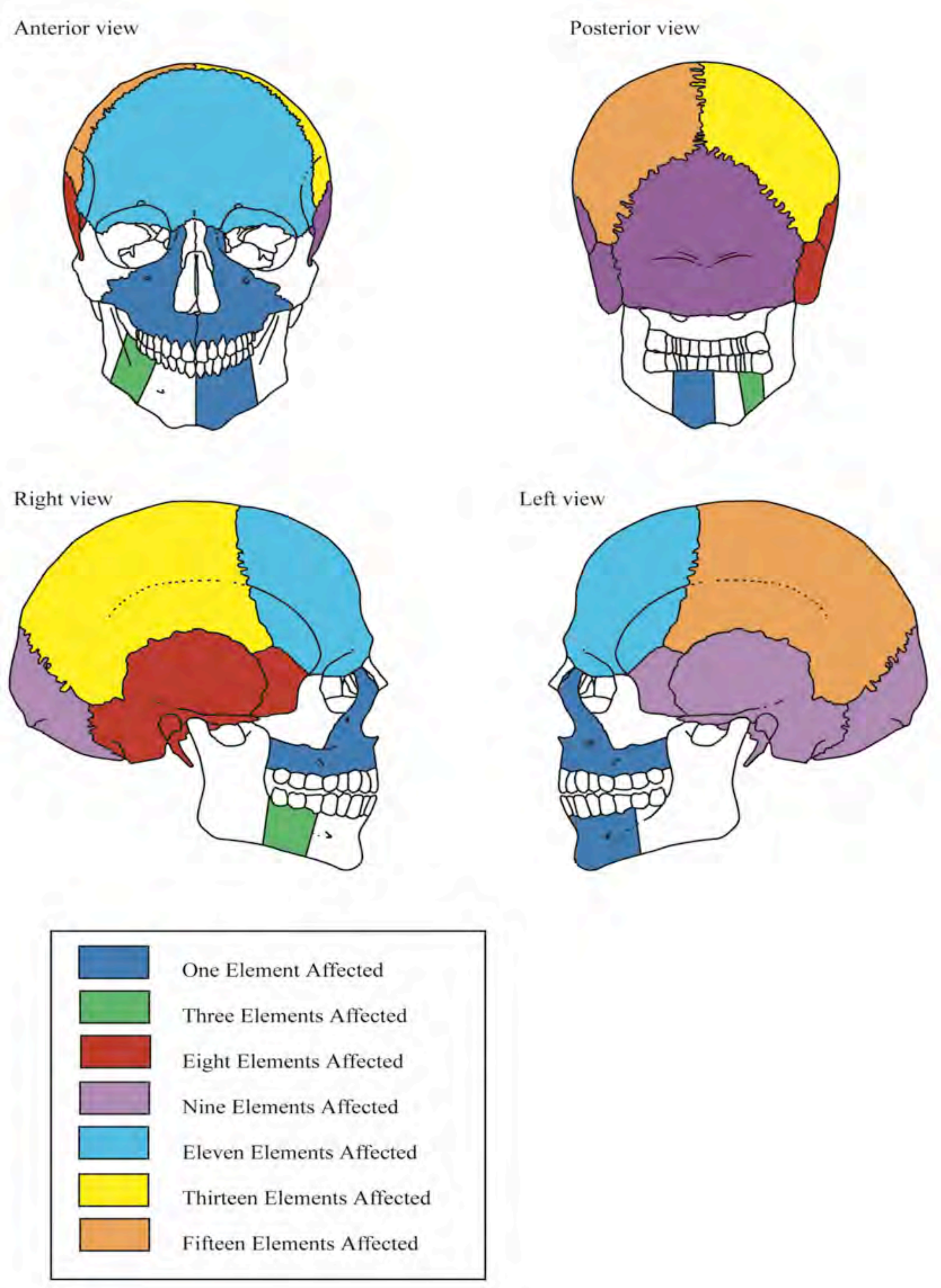
Table 50 Direction of Iron Age male peri-mortem skull blunt-force trauma, following Gurdjian et al. (1950a, b).

	Direction of blunt force trauma and areas affected					
	Mid Frontal Nasion **Supra-orbital notch Lateral frontal Parieto-temporal**	**Anterior Interparietal** **Lateral Parietal-temporal Bilateral Parietal-temporal**	**Mid occipital** **Foramen magnum Lateral Parietal-occipital Bi-Parietal**	**Lateral-Frontal** **Orbital roof Lateral supra-orbital notch Frontal Zygomatic-sphenoid Bi-Frontal Lateral Frontal**	**Posterior-Parietal** **Tempero-frontal Temporal Supra-parietal Mastoid-parietal Frontal-temporal junction**	**Lateral Parietol-occipital** **Foramen magnum Mastoid-zygomatic Occipital-parietal**
No Sharp-force	1/66	1/66	3/66	6/66	5/66	2/66
	1.5%	1.5%	4.5%	9.1%	7.6%	3%
Sharp-Force	1/66	1/66	2/66	3/66	1/66	2/66
	1.5%	1.5%	3%	4.5%	1.5%	3%

Many individuals had sustained multiple blows and therefore will be counted more than once. Table 50 shows that the greatest number of individuals without evidence of sharp-force injuries to the cranium, had trauma directed to the lateral-frontal and posterior-parietal regions, causing fracturing to the observed portions. Other blunt force trauma directions observed included, the mid frontal, mid occipital and lateral parietal regions. No trauma was restricted to the anterior interparietal region, as the majority of observed fractures affected both the endo- and ecto-cranial surfaces of the cranium, and individuals had received multiple blows (Figure 13). In some instances (e.g. P11 Maiden Castle), large areas of the cranium were missing post-mortem, but these may have been cranial bones displaying depressed fractures and/or linear radiating fractures. Unfortunately, due to taphonomy, poor recovery, and the reconstruction of some crania, these changes were either lost or disguised, making observation and interpretation frequently impossible. For example, a middle adult male [T4 Maiden Castle] has the majority of the left parietal bones, the facial bones, and left portion of the mandible absent.

Individuals with sharp-force weapon injuries had linear fractures present to all aspects of the crania, with the most frequently affected areas being the mid occipital and lateral-frontal, which corresponds to the distribution of sharp-force weapon injuries to these or adjacent areas. The linear fractures frequently affected multiple elements, as well as the endo- and ecto- cranial tables of the cranium. For example a young adult male [P34 Maiden Castle] has a roundel removed from the right frontal bone and on the right superior parietal aspect, there is an absent circular area from which, five linear fractures run towards the coronal and sagittal sutures. The ‘Whitcombe Warrior’ [Burial 9 Whitcombe] also had an absent circular area missing from the mid occipital area, from which multiple radiating fractures issued, some of which terminated at the foramen magnum and nasion.

Figure 13: Diagrams showing the distribution of peri-mortem cranial fractures in Iron Age males. Due to the presence of numerous fracture lines on each cranial element, the distribution of peri-mortem fractures to the skull are shown by number of element affected.



(after Buikstra and Ubelaker 1994, attachments 6a -7b)

3.10.1.2 Chi-Square test (Iron Age): comparison of males and females with peri-mortem fractures to the skull

Table 51 Chi-Square test comparing the number of Iron Age males and females with peri-mortem fractures to the skull.

	Present	Absent	Total
Male	12	52	64
Female	15	36	51
Total	27	88	115

Degrees of freedom = 1
Chi-square = 1.795
For significance at the 0.05 level, chi-square should be greater than or equal to 3.84
p is less than or equal to 0.20
<u>The distribution is not significant</u>

Table 51 shows that despite males having more evidence for peri-mortem blunt-force cranial trauma, no statistical significance.

3.10.2 Romano-British period: location of peri-mortem fractures to cranial elements

Table 52 Location of Romano-British male peri-mortem fractures to the cranium, displayed by side and number affected.

<table>
<tr><th>Element</th><th>Side</th><th>N</th></tr>
<tr><td rowspan="4">Frontal bone</td><td rowspan="2">Right</td><td>1/80</td></tr>
<tr><td>1.3%</td></tr>
<tr><td rowspan="2">Left</td><td>1/79</td></tr>
<tr><td>1.3%</td></tr>
<tr><td rowspan="4">Parietal bone</td><td rowspan="2">Right</td><td>1/77</td></tr>
<tr><td>1.3%</td></tr>
<tr><td rowspan="2">Left</td><td>1/78</td></tr>
<tr><td>1.3%</td></tr>
<tr><td rowspan="4">Temporo-Sphenoid bones</td><td rowspan="2">Right</td><td>1/71</td></tr>
<tr><td>1.4%</td></tr>
<tr><td rowspan="2">Left</td><td>1/73</td></tr>
<tr><td>1.4%</td></tr>
<tr><td rowspan="2">Occipital bone</td><td rowspan="2">Un-sided</td><td>1/76</td></tr>
<tr><td>1.3%</td></tr>
</table>

3.10.2.1 Romano-British period: direction of peri-mortem cranial blunt-force trauma

Table 53 Direction of Romano-British male peri-mortem blunt-force trauma to the cranium, following Gurdjian et al. (1950a, b).

	Direction of blunt force trauma and areas affected	
	Mid occipital **Foramen magnum** **Lateral Parietal-occipital** **Bi-Parietal**	**Lateral-Frontal** **Orbital roof** **Lateral supra-orbital notch** **Frontal** **Zygomatic-sphenoid** **Bi-Frontal** **Lateral Frontal**
No Sharp-force	1/90	1/90
	1.1%	1.1%

Peri-mortem cranial fracturing was only observed in one middle adult male [EU 1.3.216 Hod Hill]. This individual had sustained blunt-force trauma from two directions, both cranial tables were fractured and multiple elements were also affected. Unfortunately, due to taphonomy, poor recovery and reconstruction of the crania, the fracture margins have been disguised, making observation and determination of peri-mortem fractures difficult.

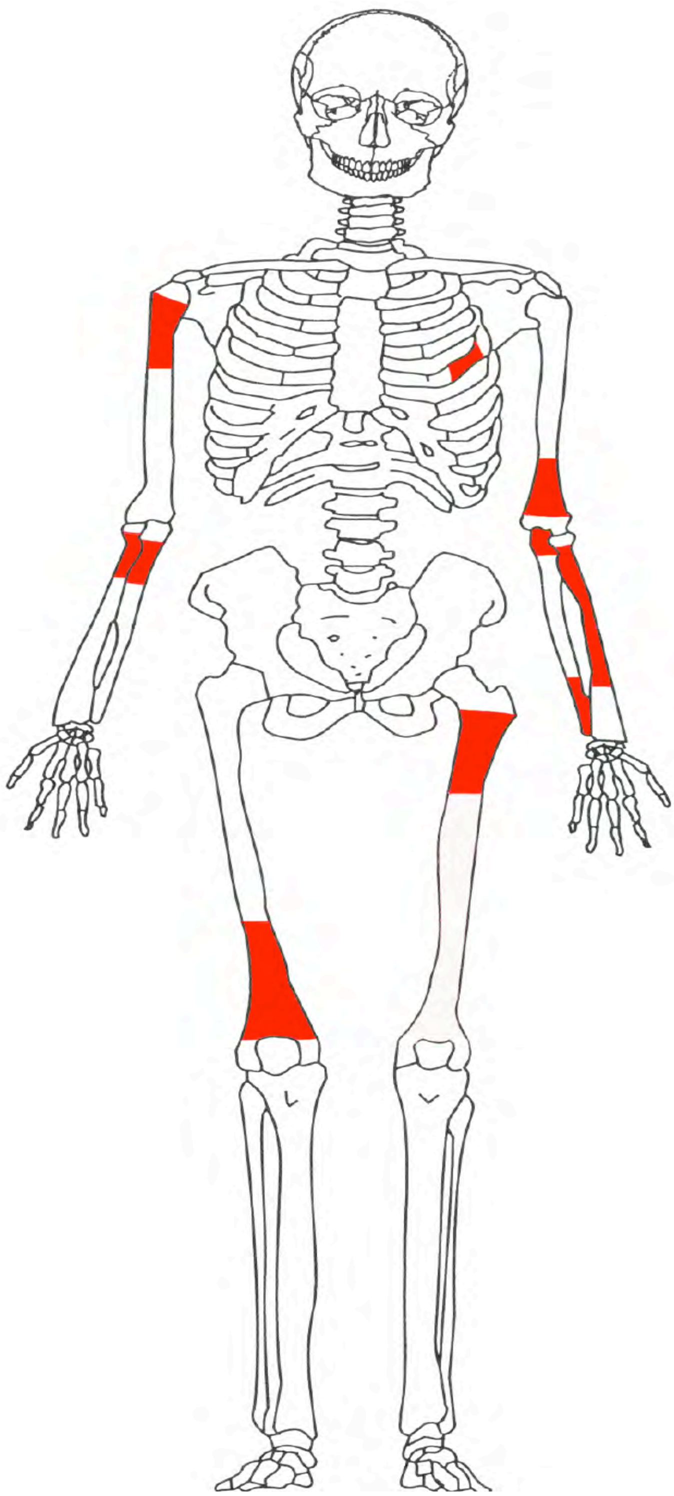
3.10.3 Iron Age: location of peri-mortem fractures to post-cranial elements

Table 54 Location of Iron Age male peri-mortem fractures to post-cranial elements, displayed by side, number and segment affected.

Element	Side	N	pe	p1/3	m1/3	d1/3
Ribs	Un-sided	69/703	-	-	14/703	-
		9.8%	-	-	2%	-
Humerus	Left	2/53	-	-	1/53	1/53
		3.8%	-	-	1.9%	1.9%
Radius	Right	1/57	-	1/57	-	-
		1.8%	-	1.8%	-	-
	Left	1/54	-	1/52	1/54	-
		1.9%	-	1.9%	1.9%	-
Ulna	Right	1/63	-	1/57	-	-
		1.6%	-	1.8%	-	-
	Left	3/57	1/55	-	2/55	-
		5.3%	1.8%	-	3.6%	-
Femur	Right	1/54	-	-	-	1/53
		1.8%	-	-	-	1.9%
	Left	2/59	-	1/59	-	1/53
		3.4%	-	1.7%	-	1.9%

Table 54 shows that the most fractured element was the rib and left ulna. The most fractured segment was the middle third and the side distribution was practically even (Figure 14).

Figure 14: Location of post-cranial peri-mortem fractures in Iron Age males.
Red shading = segment with evidence for fracture



(after Buikstra and Ubelaker 1994, attachment 3a)

3.10.3.1 Iron Age: type of peri-mortem fractures to post-cranial elements

Table 55 Peri-mortem fracture type observed in the post-cranial elements of Iron Age males, displayed by side and number affected.

Element	Side	N	Complete	Transverse	Oblique	Spiral with Butterfly fragment
Ribs	Un-sided	69/703	34/703	1/703	34/709	-
		9.8%	4.8%	0.1%	4.8%	-
Humerus	Left	1/53	-	-	1/53	-
		1.9%	-	-	1.9%	-
Radius	Right	1/57	-	-	1/57	-
		1.8%	-	-	1.8%	-
	Left	1/54	-	1/54	1/54	-
		1.9%	-	1.9%	1.9%	-
Ulna	Right	1/63	-	-	1/63	-
		1.6%	-	-	1.6%	-
	Left	3/57	1/57	2/57	-	-
		5.3%	1.8%	3.5%	-	-
Femur	Right	2/54	-	-	-	2/54
		3.7%	-	-	-	3.7%
	Left	2/59	-	1/59	-	1/59
		3.4%	-	1.7%	-	1.7%

Table 55 indicates that the most common fracture types were oblique and complete. Spiral fractures with a butterfly fragment were only observed to the femora. The ribs are the only element to present with three different fracture types.

The prevalence of post-cranial fractures in males is far higher than in females and there are some similarities in elements affected, such as fractures to the radius, ulna and ribs. However, other elements are also fractured, such as the femora and metacarpals. Unfortunately, for the majority of fractured ribs, the segment could not be identified, however where it was observable the middle third was affected. Where the fracture type could be identified, the majority were oblique in type and one transverse type was identified.

The upper limb sustained more peri-mortem fractures compared to the lower limb and left elements were affected. A middle adult male [T10 Maiden Castle] has an oblique peri-mortem fracture to the distal third of the left humerus, extending from the medial supra-trochlear margin to lateral border, superior to the lateral epicondyle (Figure 15).

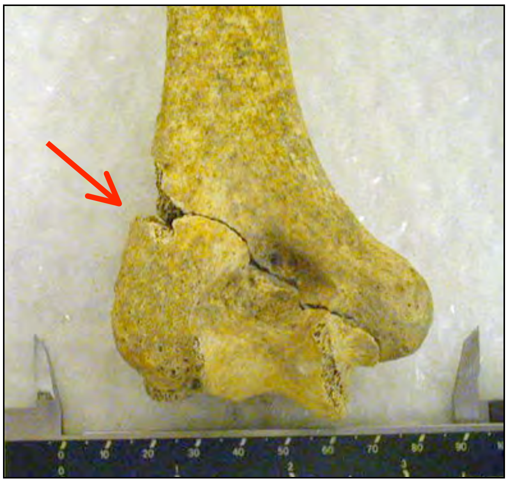
The femoral fractures were observed in two individuals (Figure 15). P24 also a middle adult male [Maiden Castle] has a butterfly fracture to the distal third of the right femur and a transverse fracture to the middle third of the left femur. Also present are peri-mortem sharp-force weapon injuries, blunt-force trauma, and fractures to the ribs and mandible. N1 a middle adult male [Maiden Castle] has a butterfly fracture to the distal third of a right femur and a butterfly fracture to the proximal third of the left femur. This male also has peri-mortem sharp-force weapon injuries, blunt-force cranial trauma, and fractures to the mandible.

Figure 15: Examples of post-cranial peri-mortem fractures in Iron Age males

15a Anterior view of the right radius and ulna with oblique fractures to the proximal third [P12 Maiden Castle].

15b Anterior view of the right femur with a butterfly fracture to the distal-third of the diaphysis [P24 Maiden Castle].

15c Anterior view of an oblique the distal third of the left humerus [T10 Maiden Castle].



15d Posterior view of an oblique fracture to fracture to the distal third of the left humerus [T10 Maiden Castle].

3.10.3.2 Iron Age peri-mortem: details of radial-ulna fractures

Table 56 Details of Iron Age male peri-mortem radial-ulna fractures, displayed by the affected side, segment and the number of arms and individuals.

Element	Side	pe	p1/3	m1/3
Ulna	Right	-	1/57	-
		-	1.8%	-
	Left	1/55	-	2/55
		1.8%	-	3.6%
Radius	Right	-	1/57	-
		-	1.8%	-
	Left	-	1/52	1/54
		-	1.9%	1.9%
Total Number of Arms Affected				N=3
Total Number of Individuals Affected				N= 2

Fractures to the radius and ulna were observed in two individuals and three limbs were affected. P12 [Maiden Castle] an adult male has oblique fractures to the proximal third of the right radius and ulna, and a complete fracture to the middle third of the left ulna. Also present are a transverse rib fracture and multiple blunt-force trauma and sharp-force injuries to the cranium. The other individual affected was a young adult male [P11 Maiden Castle], who has four fractures present to the left radius and ulna, also multiple sharp-force injuries and blunt-force traumas to the torso and cranium. The radius has fractures present to the proximal third and middle third of the diaphysis, and the ulna has a fracture to the olecranon process, and to the middle third of the diaphysis.

3.10.3.3 Chi-Square test (Iron Age): comparison of males and females with peri-mortem fractures

Table 57 Chi-Square test comparing the number of Iron Age males and females with peri-mortem fractures.

	Present	Absent	Total
Male	14	50	64
Female	14	36	50
Total	28	86	114

Degrees of freedom = 1
Chi-square = 0.568
For significance at the 0.05 level, chi-square should be greater than or equal to 3.84
p is less than or equal to 1
<u>The distribution is not significant</u>

Table 57 shows that there is no statistical difference in the number of males and females with peri-mortem fractures during the Iron Age.

3.10.4 Iron Age: ante-mortem fracture location

Table 58 The location of Iron Age male ante-mortem fractures, displayed by side, number, segment or aspect affected.

Element	Side	N affected	Segment					Vertebral Aspect		
			pe	p1/3	m1/3	d1/3	de	Neural Arch	Superior (centrum)	Inferior (centrum)
Zygomatic bone	Right	1/37	-	-	-	1/37	-	-	-	-
		2.7%	-	-	-	2.7%	-	-	-	-
Thoracic vertebrae	Un-sided	2/523	-	-	-	-	-	1/523	-	1/523
		0.4%	-	-	-	-	-	0.2%	-	0.2%
Lumbar vertebrae	Un-sided	5/234	-	-	-	-	-	-	4/234	1/234
		2.6%	-	-	-	-	-	-	2.1%	0.4%
Ribs	Un-sided	7/703	-	3/703	3/703	1/703	-	-	-	-
		1.0%	-	0.4%	0.4%	0.1%	-	-	-	-
Clavicle	Right	1/46	-	1/46	-	-	-	-	-	-
		2.2%	-	2.2%	-	-	-	-	-	-
	Left	2/47	-	1/47	-	1/46	-	-	-	-
		4.2%	-	2.1%	-	2.2%	-	-	-	-
Humerus	Right	2/59	-	-	1/55	-	1/59	-	-	-
		3.4%	-	-	1.8%	-	1.7%	-	-	-
	Left	1/53	-	-	1/53	-	-	-	-	-
		1.9%	-	-	1.9%	-	-	-	-	-
Radius	Left	1/54	-	-	-	1/54	-	-	-	-
		1.9%	-	-	-	1.9%	-	-	-	-
Ulna	Right	2/63	1/58	1/57	-	-	-	-	-	-
		3.2%	1.7%	1.7%	-	-	-	-	-	-
Femur	Right	1/54	-	-	-	-	1/54	-	-	-
		1.9%	-	-	-	-	1.9%	-	-	-
Tibia	Right	1/55	1/50	-	-	-	-	-	-	-
		1.8%	2%	-	-	-	-	-	-	-
	Left	1/54	-	-	-	-	1/53	-	-	-
		1.9%	-	-	-	-	1.9%	-	-	-
Fibula	Right	1/55	-	-	-	-	1/49	-	-	-
		1.8%	-	-	-	-	2%	-	-	-
	Left	2/53	-	1/49	-	1/54	-	-	-	-
		3.8%	-	2%	-	1.9%	-	-	-	-

Table 58 shows that the most fractured elements were the lumbar vertebrae, ribs, and left clavicle. The proximal third was the most fractured segment, the middle and distal thirds were equally affected, and the proximal epiphysis sustained the least fractures.

3.10.4.1 Iron Age: ante-mortem fracture type

Table 59 The ante-mortem fracture type observed in Iron Age males, displayed by number of elements and side affected.

Element	Side	Complete	Colles'	Oblique	Spiral	Transverse	Osteo-chondritis dissecans	Compression	Avulsion
Nasal bones	Right	-	-	-	-	1/29	-	-	-
		-	-	-	-	3.4%	-	-	-
	Left	-	-	-	-	1/30	-	-	-
		-	-	-	-	3.3%	-	-	-
Zygomatic bone	Right	1/37	-	-	-	-	-	-	-
		2.7%	-	-	-	-	-	-	-
Ribs	Un-sided	7/703	-	-	-	-	-	-	-
		1%	-	-	-	-	-	-	-
Thoracic vertebrae	Un-sided	-	-	-	-	-	-	1/523	1/523
		-	-	-	-	-	-	0.2%	0.2%
Lumbar vertebrae	Un-sided	-	-	-	-	-	-	3/234	2/234
		-	-	-	-	-	-	1.7%	0.9%
Clavicle	Right	1/46	-	-	-	-	-	-	-
		2.2%	-	-	-	-	-	-	-
	Left	2/47	-	-	-	-	-	-	-
		4.3%	-	-	-	-	-	-	-
Humerus	Right	-	-	-	1/59	-	1/59	-	-
		-	-	-	1.7%	-	1.7%	-	-
	Left	-	-	-	-	1/53	-	-	-
		-	-	-	-	1.9%	-	-	-
Radius	Left	-	1/54	-	-	-	-	-	-
		-	1.9%	-	-	-	-	-	-
Ulna	Right	1/63	-	1/63	-	-	-	-	-
		1.6%	-	1.6%	-	-	-	-	-
Femur	Right	-	-	-	-	-	1/54	-	-
		-	-	-	-	-	1.9%	-	-
Tibia	Right	-	-	-	-	-	2/55	-	-
		-	-	-	-	-	3.6%	-	-
	Left	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-
Fibula	Right	-	-	1/55	-	-	-	-	-
		-	-	1.8%	-	-	-	-	-
	Left	-	-	-	-	2/53	-	-	-
		-	-	-	-	3.8%	-	-	-

The most commonly occurring fracture types were complete, and osteochondritis dissecans. Importantly, the location and type of peri-mortem fractures were not observed in the ante-mortem results e.g. to the distal third of the humerus and ulna.

However, fractures that may have been produced by violent mechanisms were present in four males from Maiden Castle [P30, P20, P28 and T5] and a male from Gussage All Saints [285 3], three males have peri-mortem sharp-force weapon injuries [P30, P23 and 285 3]. Two males had healed middle third fractures to the right humerus (Figure 16). P30 has a well-healed oblique fracture, and 285 3 has a spiral fracture, which has healed with evidence of tissue involvement.

Figure 16: Examples of ante-mortem humeral fractures in Iron Age males

16a Anterior view of the humerii showing the healed fracture to the middle third (marked) [P30 Maiden Castle].

16b Posterior view of the left humerus showing the healed fracture to the middle third (marked) [P30 Maiden Castle].

16c Lateral right view of a middle third spiral fracture to the right humerus of a young adult [285 3 Gussage All Saints]. The remnants of the callus are still visible on the anterior and lateral aspects of the diaphysis.

P20 [Maiden Castle] has the only example of a healed, un-united fracture to the temporal process of the right zygomatic bone. A unique example of a healing distal ulna fracture was observed in a young adult male [P23 Maiden Castle]. The callus in this case consists of dense remodelling mixed reaction bone (Resnick and Goergen 2002, 2770-2771), and there was no evidence of rotation, angulation, over-lap, and radial involvement (Figure 17).

Figure 17: Anterior view of the distal third, showing the remodelling fracture callus to the right ulna of an Iron Age young adult male [P23 Maiden Castle]

3.10.4.2 Iron Age: details of ante-mortem radial-ulna fractures

Table 60 Details of Iron Age male ante-mortem radial-ulna fractures, displayed by the affected side, segment and the number of arms and individuals.

Element	Side	pe	p1/3	d1/3
Ulna	Right	1/58	-	-
		1.7%	-	-
Radius	Left	-	-	1/54
		-	-	1.9%
Total Number of Arms Affected				N=1
Total Number of Individuals Affected				N=1

An older adult male [T5 Maiden Castle] has a well healed fracture to the olecranon process of the right ulna that has resulted in secondary osteoarthritis to the radial head and distal humeral articulation, no evidence of radial dislocation was present (Figure 18). Also present are a fracture to the distal third of the left radius, and a fracture to the distal third of the left fibula, which has ankylosed to the tibia. The fracture affecting the olecranon process is transverse in form and is un-united. It is not known whether the olecranon was present as a fragment during life, as it may have been lost during excavation.

Figure 18: Ante-mortem fractures (marked) to the upper limbs of a middle adult male [T5 Maiden Castle]

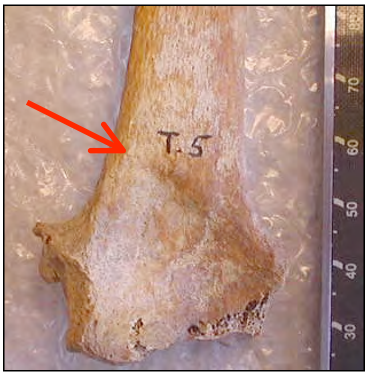
18a Anterior view of the right elbow joint.

18b Posterior view of the right elbow joint.

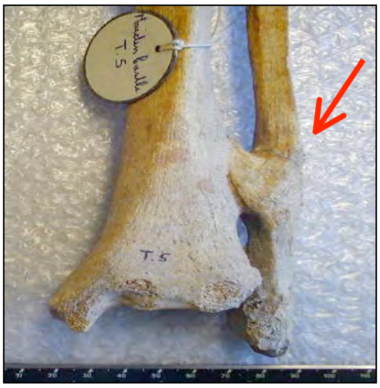
18c Superior view of the right ulna.

18d. Posterior view of the olecranon process.

18e. Anterior view of the Colles' fracture to the left radius.



18f Anterior view of the left tibia and fibula.



3.10.4.3 Chi-Square test (Iron Age): comparison of males and females with ante-mortem fractures

Table 61 Chi-Square test comparing the number of Iron Age males and females with ante-mortem fractures.

	Present	Absent	Total
Males	34	30	64
Females	28	23	51
Total	62	53	115

Degrees of freedom = 1
Chi-square = 0.036
For significance at the 0.05 level, chi-square should be greater than or equal to 3.84
p is less than or equal to 1
<u>The distribution is not significant</u>

Table 61 shows that despite a greater number of males presenting with ante-mortem fractures, the result is not statistically significant.

3.10.4.4 Iron Age: unknown cranial trauma

Table 62 Location of cranial trauma caused by an unknown mechanism observed in an Iron Age male, displayed by element, side and number affected.

Element	Side	N	Lamellar bone formation present
Frontal bone	Left	1/4	1/4
		25%	25%

The osseous response was observed in a middle adult male [04 Maiden Castle] and consisted of a large raised oval area of dense lamellar bone formation (16.8 mm in length and 15.1 mm width), located 75.2 mm from the coronal suture. The posterior margin has obliterated the coronal suture. This individual also has peri-mortem blunt-force trauma to the cranium.

3.10.5 Romano-British period: ante-mortem fracture location

Table 63 The location of Romano-British male ante-mortem fractures, displayed by side, number, segment or aspect affected.

Element	Side	N	Segment					Aspect
			pe	p1/3	m1/3	d1/3	de	Posterior
Frontal bone	Right	4/80	-	-	-	-	-	-
		5%	-	-	-	-	-	-
	Left	1/79	-	-	-	-	-	-
		1.3%	-	-	-	-	-	-
Parietal bone	Right	3/77	-	-	-	-	-	-
		3.9%	-	-	-	-	-	-
	Left	4/78	-	-	-	-	-	-
		5.1%	-	-	-	-	-	-
Zygomatic bone	Right	2/65	-	1/65		1/65	-	-
		3.1%	-	1.5%		1.5%	-	-
Nasal bones	Right	2/63	-	-	2/63	-	-	-
		3.2%	-	-	3.2%	-	-	-
	Left	1/61	-		1/61	-	-	-
		1.6%	-	-	1.6%	-	-	-
Mandible	Right	1/69	1/69	-	-	-	-	-
		1.4%	1.4%	-	-	-	-	-
Ribs	Un-sided	11/901	-	3/901	8/901	-	-	-
		1.2%	-	0.3%	0.9%	-	-	-
Sternum	Un-sided	1/39	-	-	-	-	-	-
		2.6%	-	-	-	-	-	-
Scapula	Right	2/69	-	1/69	1/69	-	-	-
		2.9%	-	1.4%	1.4%	-	-	-
Humerus	Left	2/84	-	-	-	2/85	-	-
		2.4%	-	-	-	2.3%	-	-
Ulna	Right	3/83	-	-	-	3/82	-	-
		3.6%	-	-	-	3.7%	-	-
Femur	Right	2/83	1/80	1/82	-	-	-	-
		2.4%	1.2%	1.3%	-	-	-	-
Tibia	Left	4/85	1/79	-	2/84	1/83	-	-
		4.7%	1.3%	-	2.4%	1.2%	-	-
Fibula	Right	3/80	-	1/78	-	1/79	1/66	-
		3.7%	-	1.3%	-	1.3%	1.5%	-
	Left	3/78	-	2/68	-	1/78	-	-
		3.8%	-	2.9%	-	1.3%	-	-
Patella	Un-sided	1/119	-	-	-	-	-	1/119
		0.8%	-	-	-	-	-	0.8%
Metacarpals	Un-sided	3/633	-	1/633	-	2/633	-	-
		0.5%	-	0.2%	-	0.3%	-	-
Phalanges	Un-sided	2/848	1/848	-	1/848	-	-	-
		0.2%	0.1%	-	0.1%	-	-	-

The most commonly fractured elements were the rib and left tibia. Healed fractures were also observed to affect the large cranial elements (e.g. occipital bone) and facial elements (e.g. nasal bones and right zygomatic bone). The middle and distal thirds were the most fractured segments, particularly in rib shafts. In this period, the first evidence for fractures to the patella, hand elements, sternum, mandible, and cranium are observed (Figure 19), in addition to the first humeral epicondylar fracture, observed in a young adult male [577 Alington Avenue], in which the left medial epicondyle has been superiorly displaced and is malformed.

A young adult male [1137] from Alington Avenue is reported to have a healed fracture at the neck of the right humerus (Waldron 2002, 152). Unfortunately, the humerus, right scapula and clavicle were missing from the archive and the fracture could not be included in the study.

Figure 19: Anterior view of a healed fracture to the medial epicondyle of the left humerus in a young Romano-British adult male [577 Alington Avenue].

3.10.5.1 Romano-British period: details of ante-mortem tibial-fibula fractures

Table 64 Details of Romano-British male ante-mortem tibial-fibula fractures, displayed by the affected side, segment and the number of legs and individuals.

Element	Side	p1/3	m1/3
Tibia	Left	-	2/84
		-	2.4%
Fibula	Left	2/68	-
		33.3%	-
Total Number of Legs Affected			N= 2
Total Number of Individuals Affected			N= 2

Table 64 shows that the minority of fractures to the tibia and fibula affected both elements. Only two individuals [847 and 6 Poundbury Camp] presented with healed lower limb fractures, often known as contra-coup fractures. Both individuals have less than 50% apposition for the oblique fractures and also displayed angulation and slight rotation (recorded as deformity 3.10.12).

3.10.5.2 Romano-British period: ante-mortem fracture type

Table 65 The fracture type observed in Romano-British male ante-mortem fractures, displayed by number of elements and side affected.

Element	Side	Comminuted	Complete	Oblique	Transverse	Osteo-chondritis Dissecans	Depressed
Frontal bone	Right	-	1/80	-	-	-	2/80
		-	1.3%	-	-	-	2.5%
	Left	-	-	-	-	-	1/79
		-	-	-	-	-	1.3%
Parietal bone	Right	-	-	-	-	-	1/77
		-	-	-	-	-	1.3%
	Left	-	-	-	-	-	1/78
		-	-	-	-	-	1.3%
Zygomatic bone	Right	-	1/65	-	1/65	-	-
		-	1.5%	-	1.5%	-	-
Nasal bones	Right	-	1/63	1/63	-	-	-
		-	1.6%	1.6%	-	-	-
	Left	-	-	1/63	-	-	-
		-	-	1.6%	-	-	-
Mandible	Left	-	-	-	1/69	-	-
		-	-	-	1.4%	-	-
Ribs	Un-sided	-	5/901	3/901	3/901	-	-
		-	0.6%	0.3%	0.3%	-	-
Sternum	Un-sided	-	-	1/39	-	-	-
		-	-	2.6%	-	-	-
Scapula	Right	-	-	2/69	-	-	-
		-	-	2.9%	-	-	-
Humerus	Left	-	1/84	-	-	1/84	-
		-	1.2%	-	-	1.2%	-
Ulna	Right	-	-	2/83	1/83	-	-
		-	-	2.4%	1.2%	-	-
Femur	Right	-	1/83	-	-	1/83	-
		-	1.2%	-	-	1.2%	-
Tibia	Left	-	-	2/85	1/85	-	1/85
		-	-	2.4%	1.2%	-	1.2%
Fibula	Right	-	-	2/80	-	-	-
		-	-	2.5%	-	-	-
	Left	-	-	4/78	-	-	-
		-	-	5.1%	-	-	-
Patella	Un-sided	1/119	-	-	-	-	-
		0.8%	-	-	-	-	-
Metacarpals	Un-sided	-	2/633	1/633	-	-	-
		-	0.3%	0.2%	-	-	-
Phalanges	Un-sided	-	1/848	-	-	1/848	-
		-	0.1%	-	-	0.1%	-

The most commonly occurring fracture types were oblique and complete, and only one element (patella) presented with a comminuted fracture. The Romano-British male sample has the first regional examples of healed male skull trauma. For example, an older adult male [4042 Western Link] has a remodelled blunt-force depressed fracture that affects both cranial tables. It is oval (11.6 mm in length by 8.8 mm wide) and located on the supra-orbital margin, 36.4 mm from the coronal suture, adjacent to the temporal line. A middle adult male [1400] from Maiden Castle Road has a healed depressed fracture on the lateral condyle of the left tibial plateau, which is well healed with slight depression of the lateral margin.

3.10.6 Chi-Square test (Romano-British period): comparison of males and females with ante-mortem fractures

Table 66 Chi-Square test comparing the number of Romano-British males and females with ante-mortem fractures.

	Present	**Absent**	**Total**
Males	34	62	96
Females	16	43	59
Total	50	105	155

Degrees of freedom = 1
Chi-square = 1.151
For significance at the 0.05 level, chi-square should be greater than or equal to 3.84
p is less than or equal to 1
<u>The distribution is not significant</u>

Table 66 shows that despite more male elements having healed fractures, this result was not statistically significant.

3.10.7 Chi-Square test: comparison of males with ante-mortem fractures

Table 67 Chi-Square test comparing Iron Age and Romano-British males with ante-mortem fractures.

	Present	**Absent**	**Total**
Iron Age	34	30	64
Romano-British	34	62	96
Total	68	92	160

Degrees of freedom = 1
Chi-square = 4.927
p is less than or equal to 0.05
<u>The distribution is significant</u>

Table 67 demonstrates that the number of males with healed fractures is statistically significant between the two periods.

3.10.8 Iron Age: secondary changes associated with fracture

Table 68 Secondary changes associated with ante-mortem fractures (N), observed in Iron Age males. Deformity includes angulation, rotation, shortening, poor alignment and apposition (section 2.4.8.1).

Element	Osteo-arthritis	Deformity	Overlap	Tissue Involvement	Active Callus	Fusion to another element	Un-united
Nasal bones	-	2/2	-	-	-	-	-
	-	100%	-	-	-	-	-
Zygomatic bone	-	-	-	-	-	-	1/1
	-	-	-	-	-	-	100%
Ribs	-	-	-	-	1/7	-	2/7
	-	-	-	-	14.3%	-	28.6%
Clavicle	-	2/4	-	-	-	-	-
	-	50%	-	-	-	-	-
Radius	1/1	1/1	-	-	-	-	-
	100%	100%	-	-	-	-	-
Ulna	1/2	1/2	-	-	1/2	-	1/2
	50%	50%	-	-	50%	-	50%
Fibula	-	-	-	-	-	1/2	-
	-	-	-	-	-	50%	-
Thoracic vertebrae	-	-	-	-	-	-	1/2
	-	-	-	-	-	-	50%
Lumbar vertebrae	2/6	1/6	-	-	-	-	-
	33.3%	16.7%	-	-	-	-	-
Humerus	-	-	1/3	2/3	-	-	-
	-	-	33.3%	66.7%	-	-	-

The most affected elements were the ulna, clavicle, and lumbar vertebrae. The changes observed were directly related to fracture location and type. For example, a Colles' fracture to the distal radius resulted in deformity.

3.10.8.1 Assessment of fracture treatment

Table 69 Detail of Iron Age male ante-mortem fractures that may indicate treatment (Grauer and Roberts 1996).

Skeletal Number	Age	Element	Side	Segment	Fracture Type	Amount of Shortening	Apposition	Rotation and/or Angulation
285 3 Gussage All Saints	Young Adult	Humerus	Right	m1/3	Spiral	0.5 mm	100%	None
P30 Maiden Castle	Older Adult	Humerus	Left	m1/3	Transverse	0.2 mm	100%	Slight medial angulation

Table 69 summarises the information from two Iron Age males, with ante-mortem humeral fractures who may show evidence of treatment, such as reduction. The young adult male [285 3 Gussage All Saints] has a healed middle third spiral fracture to the right humerus, which does not display any rotation or angulation. A small amount of shortening and good apposition was also observed. There are no macroscopic indications of a healed infection at the fracture site, or elsewhere on the element, as the callus consists of smooth dense lamellar bone formation. In the original report, Keepax (1979) describes the element as "poorly healed … [with] considerable proliferation of new bone … X-ray examination indicated that … there was evidence of a long-standing infection" (Keepax 1979, 164). Neither the radiograph or the criteria upon which this assessment was based is included in the site archive. It is accepted that the radiograph may show evidence for infection, but no new bone was observed, and there is no evidence of non-union, which can result from middle third fractures (Apley and Solomon 2000, 276).

The left humeral fracture observed in the older adult male [P30 Maiden Castle], displays 100% apposition, a small amount of shortening, and no rotation but it does have slight medial angulation of the distal segment, however this within successful modern clinical standards for acceptable reduction (30º) (Kelenerman 1969).

3.10.9 Romano-British period: secondary changes associated with fracture

Table 70 Secondary changes associated with ante-mortem fractures (N), observed in Romano-British males. Deformity includes angulation, rotation, shortening, poor alignment and apposition (section 2.4.8.1).

Element	Deformity	Overlap	Tissue Involvement	Active Callus	Un-united
Nasal bones	-	1/3	-	-	-
	-	33.3%	-	-	-
Zygomatic bones	-	2/2	1/2	-	-
	-	100%	50%	-	-
Mandible	1/1	-	-	-	-
	100%	-	-	-	-
Sternum	-	1/1	-	-	-
	-	100%	-	-	-
Ribs	2/11	2/11	2/11	-	-
	18.2%	18.2%	18.2%	-	-
Scapula	2/2	1/2	1/2	1/2	1/2
	100%	50%	50%	50%	50%
Ulna	2/3	-	-	-	-
	66.7%	-	-	-	-
Femur	1/2	-	-	-	-
	50%	-	-	-	-
Tibia	3/4	2/4		-	-
	75%	50%		-	-
Fibula	-	5/6	2/6	-	-
	-	83.3%	33.3%	-	-
Patella	1/1	-	-	-	-
	100%	-	-	-	-
Metacarpals	2/3	2/3	1/3	-	-
	66.7%	66.7%	33.3%	-	-
Phalanges	1/1	1/1	1/1	-	-
	100%	100%	100%	-	-

In this period, no secondary osteoarthritis was observed to have affected any element subsequent to being fractured and the number of un-united fractures was far lower than the Iron Age. For the majority of fractured elements, the secondary changes were caused by the fracture type and or location e.g. patella and sacrum. However, the tibia fractures had more evidence of overlap compared to the Iron Age.

3.10.9.1 Assessment of fracture treatment

Table 71 Detail of Romano-British male ante-mortem fractures that may indicate treatment (Grauer and Roberts 1996).

Skeletal Number	Age	Element	Side	Segment	Fracture Type	Amount of Shortening	Apposition	Rotation and/or Angulation
6 Poundbury Camp	Middle adult	Tibia	Left	m1/3	Oblique	3 mm	Less than 50%	20° Angulation
		Fibula	Left	p1/3	Oblique	0.3 mm	Less than 50%	22° Angulation
847 Poundbury Camp	Adult	Tibia	Left	m1/3	Oblique	9.6 mm	Less than 50%	More than 15° anterior angulation and 5° of Rotation
		Fibula	Left	p1/3	Oblique	-	50%	15° of Rotation
1137 Alington Avenue	Young Adult	Tibia	Left	d1/3	Transverse	0.1 mm	100%	None
1.114b Fordington Old Vicarage	Middle Adult	Fibula	Left	p1/3	Oblique	-	50-75%	None
1032 Alington Avenue	Middle Adult	Metacarpal	Right	d1/3	Complete	-	100%	None
210 Alington Avenue	Middle Adult	Metacarpal	Right	m1/3	Complete	2 mm	50-75%	c. 15-20° Angulation and Slight medial rotation.
Frampton	Adult	Metacarpal	Un-sided	p1/3	Complete	-	c.50%	None

The number of elements that could be assessed for treatment is greater than the Iron Age male and Romano-British female samples. A middle adult male [6 Poundbury Camp] has fractures to the middle third of the left tibia and proximal third of the fibula, and it was possible to assess the elements macroscopically and radiographically. The amount of shortening to both elements falls within successful modern clinical standards (10 to 15 mm), but is greater than that observed in the Iron Age. The amount of deformity observed radiographically for both elements, exceeds successful modern clinical standards (5° to 10°).

Both elements display less than 50% apposition, as 28 to 30 mm of overlap is observable, which is less than modern successful clinical standards of more than 50% apposition (http://www.wheelessonline.com/ortho/cast_treatment_of_tibial_fractures).

Adult male 847 [Poundbury Camp] has healed fractures to the left tibia and fibula. The shortening observed to the tibia is within successful modern clinical standards (10 to 15 mm). The degree of rotation for the tibia is also within successful modern clinical standards (see above), but the fibula exceeds these (5°to 7°). In several respects, the elements do not conform to clinical guidelines. Both elements display less than 50% apposition, which falls below successful clinical standards. The tibia also displays anterior angulation greater than 15° in the distal segment, and reduction of the fractures appears to be poorer compared to male 6 [Poundbury Camp] (http://www.wheelessonline.com/ortho/cast_treatment_of_tibial_fractures).

The middle adult male [1.114b] from Fordington Old Vicarage with a healed fracture to the left fibula, displays reasonable alignment (apposition), with 54.3 mm of overlap, and no evidence for rotation or angulation. Unfortunately, shortening could not be determined as the right element had been taphonomically damaged post-mortem.

Metacarpal fractures were observed in three males, and a range of deformity was noted. Shortening was observed in all three males, but could only be measured in one middle adult [210 Alington Avenue], and poor apposition (overlap) was observed in two males and estimated to be between 50 to 75% [210 Alington Avenue and Frampton].

3.10.10 Iron Age: fracture injury recidivism (N=1 individual)

Table 72 The number of Iron Age males with zero to more than two ante- and peri-mortem injuries. The data is shown by the number of males affected at the regional level and in their age group.

Age Group in Years		No Injuries	One Injury	Two Injuries	More than Two Injuries
Young Adult	**N of Regional sample**	14/64	5/64	4/64	3/64
		21.9%	7.8%	6.3%	4.7%
	N of Age group	15/26	5/26	4/26	3/26
		57.7%	19.2%	15.4%	11.5%
Middle Adult	**N of Regional sample**	13/64	2/64	1/64	4/64
		20.3%	3.1%	1.6%	6.3%
	N of Age group	13/20	2/20	1/20	4/20
		65%	10%	5%	20%
Older Adult	**N of Regional sample**	4/64	9/64	-	1/64
		6.3%	14.1%	-	1.6%
	N of Age group	4/14	9/14	-	1/14
		28.6%	64.3%	-	7.1%
Adult	**N of Regional sample**	1/64	1/64	1/64	1/64
		1.6%	1.6%	1.6%	1.6%
	N of Age group	1/4	1/4	1/4	1/4
		25%	25%	25%	25%

The male sample has a higher overall prevalence of fractures compared to females. As with the female sample, the majority of the sample did not have any fractures present, and the highest prevalence rate was observed at the regional level in young to older adults. Unlike the female sample, the majority of age groups had individuals with injury rates ranging from one injury, to more than two injuries. The exception is the older adults, who did not have any individuals with two injuries. The majority of individuals in the sample sustained one or two injuries, and the young adult age group had the highest prevalence rates at both the regional and age group level. Middle adults have the highest prevalence rate at both the regional (N= 4/64, 6.3%) and age group (N= 4/20, 20%) level for more than two injuries, suggesting that these males had the greatest risk from episodes of trauma during young and middle adulthood. This hazard may have been related to a high mortality risk during these years, as only one older adult has more than two injuries.

3.10.11 Iron Age: fracture injury recidivism mechanism

Table 73 The fracture injury mechanism observed in Iron Age males with one or multiple injuries (over two) (N= 1 injured individual).

Injury Mechanism	One Injury	Multiple Injuries
Violence	4/35	11/35
	11.4%	31.4%
Accident	1/35	-
	2.9%	-
Violent and/or Accident	7/35	7/35
	20%	20%
Unknown	4/35	-
	11.4%	-

The majority of multiple injuries were produced by violence (11/35, 31.4%), and violence or accident (N= 7/35, 20%). No individual was present with multiple injuries caused by accidental or unknown mechanisms. The majority of single injuries were produced by violent or accident mechanisms (N= 7/35, 20%), followed by violence, and unknown (N= 4/35, 11.4% respectively), with those produced by accidental mechanism having the lowest prevalence rate (N= 1/35, 2.9%).

The dominance of the recidivism data by violent mechanisms is related to the high frequency of peri-mortem fractures in the male sample, the majority of which were produced by violence, and violent and/or accidental mechanisms, again reflecting the bias introduced by the Maiden Castle sample.

3.10.12 Romano-British period: fracture injury recidivism

Table 74 The number of Romano-British males with zero to more than two ante- and peri-mortem injuries. The data is shown by the number of males affected at the regional level and in their age group.

Age Group in Years		No Injuries	One Injury	Two Injuries	More than Two Injuries
Young Adult	**N of Regional sample**	31/96	4/96	5/96	3/96
		32.3%	4.2%	5.2%	3.1%
	N of Age group	31/43	4/43	5/43	3/43
		72.1%	9.3%	11.6%	7%
Middle Adult	**N of Regional sample**	19/96	7/96	1/96	1/96
		19.8%	7.3%	1%	1%
	N of Age group	19/28	7/28	1/28	1/28
		67.9%	25%	3.6%	3.6%
Older Adult	**N of Regional sample**	2/96	4/96	-	-
		2.1%	4.2%	-	-
	N of Age group	2/6	4/6	-	-
		33.3%	66.7%	-	-
Adults	**N of Regional sample**	14/96	1/96	1/96	3/96
		14.6%	1%	1%	3.1%
	N of Age group	14/19	1/19	1/19	3/19
		73.7%	5.3%	5.3%	15.8%

The majority of males in the region during the Romano-British period did not have evidence for injury/ies, particularly the young adult category (N= 31/96, 32.3%). For those with injuries, the majority had sustained just one injury, especially in middle adults (N= 7/96, 7.3%). The highest numbers of males with two or more injuries were observed in young adult category (N= 3/96, 3.1% and N= 3/43, 7% respectively). This is in direct contrast to older adult males, who did not have two or more injuries. A result supported by the age-group prevalence rates, for example in young adults, the majority of the age group (N= 31/43, 72.1%), did not have evidence of injury.

3.10.13 Romano-British period: fracture injury recidivism mechanism

Table 75 The fracture injury mechanism observed in Romano-British males with one or multiple injuries (over two) (N= 1 injured individual).

Injury Mechanism	One Injury	Multiple Injuries
Violence	5/30	2/30
	16.7%	6.7%
Accident	4/30	2/30
	13.3%	6.7%
Violent and/or Accident	6/30	5/30
	20%	16.7%
Unknown	9/30	1/30
	30%	3.3%

The highest prevalence rate, as before, was violent and/or accidental mechanisms (N= 6/30, 20% for one injury, and N= 5/30, 16.7% for multiple injuries), and unknown (N= 9/30, 30% for one injury). The majority of single injuries were produced by unknown mechanisms (N= 9/30, 30%), and multiple injuries were caused by violent and/or accident (N= 6/30, 20%) and for multiple injuries equal results were found for both violent and accidental mechanisms (N= 2/30, 6.7%).

The number of injury recidivists in the region is far lower than the Iron Age, and no individuals had ante- and peri-mortem fractures present. However, as in the Iron Age, older adults did not have two or more fractures present, and only two middle adult individuals in both periods had evidence for two or more fractures. The most injured male in the region was a middle adult [210 Alington Avenue] who had healed fractures of the distal articular surface of the right fibula, right distal third of the ulna, metacarpal, nasal bones, right mandibular condyle, and one depressed fracture to the cranium.

3.14 Sharp-force weapon injuries

No sharp-force weapon injuries were observed for the Romano-British period.

3.14.1 Iron Age: location of cranial peri-mortem sharp-force weapon injuries

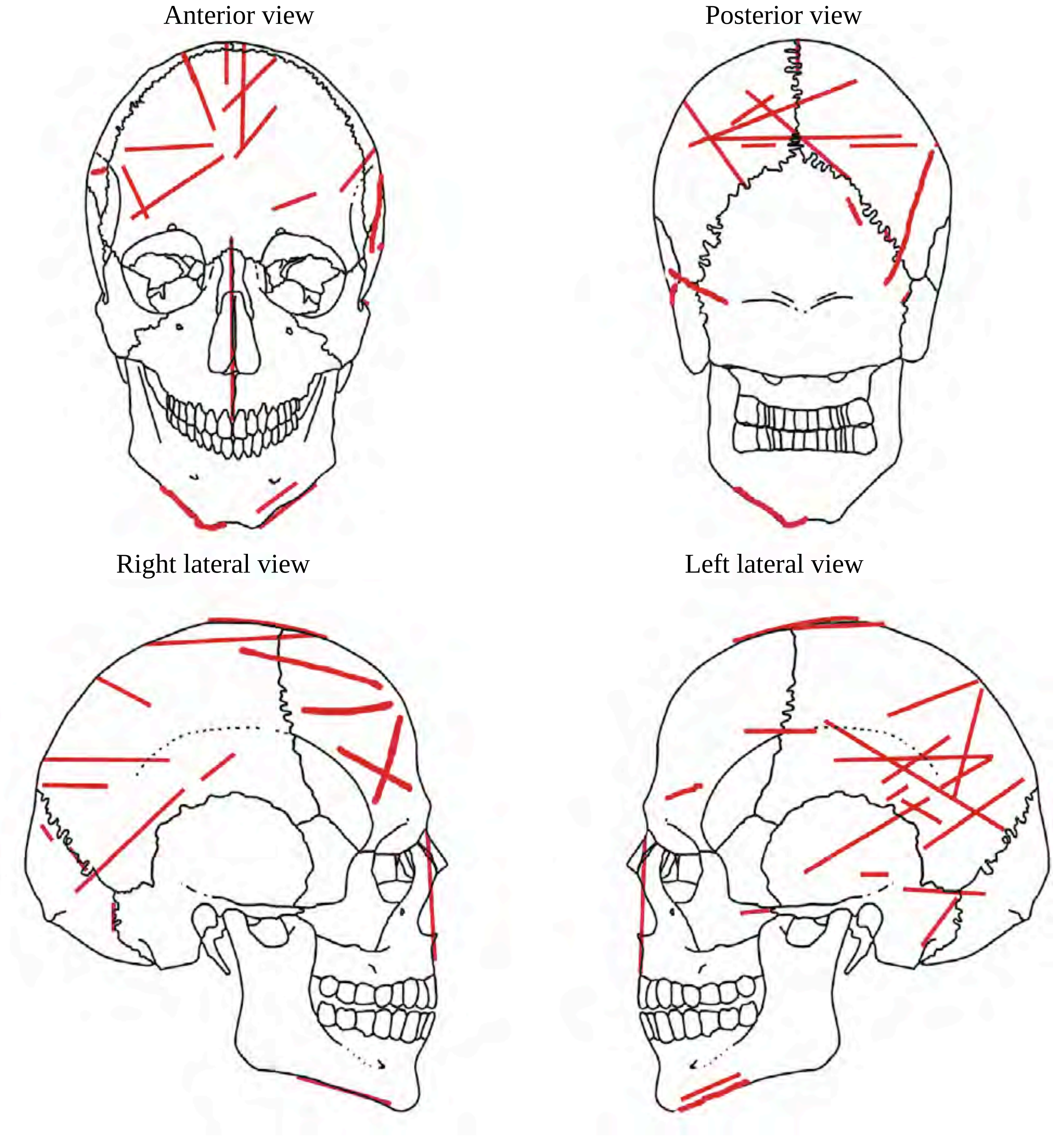
Table 76 Location of peri-mortem sharp-force weapon injuries to the skull in Iron Age males, displayed by element, side, number and aspect affected.

Element	Side	N	Anterior	Posterior	Superior	Inferior
Frontal bone	Right	6/46	5/46	-	1/46	-
		13.0%	10.9%	-	2.2%	-
	Left	4/47	4/47	-	-	-
		8.5%	8.5%	-	-	-
Parietal bone	Right	6/47	-	5/47	1/47	-
		12.8%	-	10.6%	2.1%	-
	Left	10/47	-	9/47	-	1/47
		21.3%	-	19.1%	-	2.1%
Temporal bone	Left	2/43	-	-	-	-
		4.7%	-	-	-	-
Zygomatic bone	Left	3/38	1/38	2/38	-	-
		7.9%	2.6%	5.3%	-	-
Nasal bones	Right	1/29	1/29	-	-	-
		3.4%	3.4%	-	-	-
	Left	1/30	1/30	-	-	-
		3.3%	3.3%	-	-	-
Occipital bone	Un-sided	4/95	-	-	1/95	3/95
		4.2%	-	-	1.1%	3.2%
Maxilla	Right	1/45	1/45	-	-	-
		2.2%	2.2%	-	-	-
	Left	1/41	1/41	-	-	-
		2.4%	2.4%	-	-	-
Mandible	Right	1/47	-	-	-	1/47
		2.1%	-	-	-	2.1%
	Left	1/48	1/48	-	-	-
		2.1%	2.1%	-	-	-

A range of cranial sharp-force weapon injuries were observed, which varied from small isolated, square or oval punctures to multiple linear injuries, with some individuals having a combination of injuries. One middle adult male [T16] from Maiden Castle has two linear (e.g. 61.9 mm) sharp-force weapon injuries to the posterior aspect of the left parietal bone, which have produced wastage fragments (no longer present). On the left middle and distal portions of the lambdoidal suture, two narrow diamond shaped defects are present (the edges of each are bevelled), located 25.6 mm apart, the first being 10 mm and the other 14 mm in length. A similar but larger defect (31 mm in length and 13 mm in width) was observed in another male from Maiden Castle [01], located in the distal portion of the right lambdoidal suture. An un-paralleled defect was also observed at Maiden Castle, in a younger adult male [P7] to the left temporal bone. This consists of a square aperture (10.2 mm in length and 11.3 mm in width), the margins of which are sharply defined, with slight bevelling on all sides. P7 also had a defect comparable to males 01 and T16, which consists of a narrow diamond shape (15.7 mm in length) aperture in the distal portion of the right lambdoidal suture. P12, an adult male from Maiden Castle, may also have sustained a penetrating injury inferior to the superior portion of the right lambdoidal suture; it is rectangular in shape (30 mm in length and 8 mm in width), with the superior portion created by the formation of a wastage fragment. The injury has a triangular aperture in the inferior right corner, and probable bevelling on the right margin.

Many individuals have more than three instances of linear sharp-force weapon injuries to the skull. The majority of injuries were to the anterior aspect, particularly affecting the facial and frontal bones (Figure 20). Injuries to the posterior and inferior aspects were also quite frequent, with the lowest prevalence rate occurring to the superior aspect of the cranium. The left side has a higher rate of involvement compared to the right (e.g. no right temporal or zygomatic bones were affected) and the left parietal bone has the highest prevalence rate. Some individuals demonstrate injury clustering for example, a middle adult male [P9] from Maiden Castle has four intersecting injuries extending from bregma to mid portion of the frontal bone, which penetrated both tables and produced radiating fractures.

Figure 20: Diagrams showing the location of peri-mortem sharp-force weapon injuries to the skull of Iron Age males.



(after Buikstra and Ubelaker 1994, attachments 6a to 7b)

The male also has a sharp-force weapon injury to the inferio-posterior portion of the left parietal bone, which has produced a wastage flake (no longer present). Another adult male [P12] from Maiden Castle also displays this injury pattern. The posterior aspect of both parietals bones, the anterior and inferior portions of the left parietal bone, the occipital bone and posterior aspect of the left mastoid process, has a minimum of ten injuries (this cranium was fragmentary, with portions missing or glued together, and had to be reconstructed). The possible penetrating double-edged instrument injuries observed to P12’s cranium are described above, and the remainder of the injuries only display bevelling to one margin. Two injuries are particularly severe. The first is an injury that extends from the mid superior portion of the right parietal bone to the left supra-orbital area, and the second extends from the mid portion of the left lambdoidal suture to the left supra-orbital area. These are bisected by smaller injuries, which have created wastage flakes, and the force of these blows also produced multiple linear radiating fractures.

P28 a middle adult male [Maiden Castle] had a unique example of a peri-mortem sharp-force weapon injury. A linear injury bisected the face from the nasal cavity to the anterior nasal spine, and created fractures that ran through the maxillae and terminated at the maxillary-sphenoid suture. The male did not have any other observable ante- or peri-mortem trauma to the skeleton.

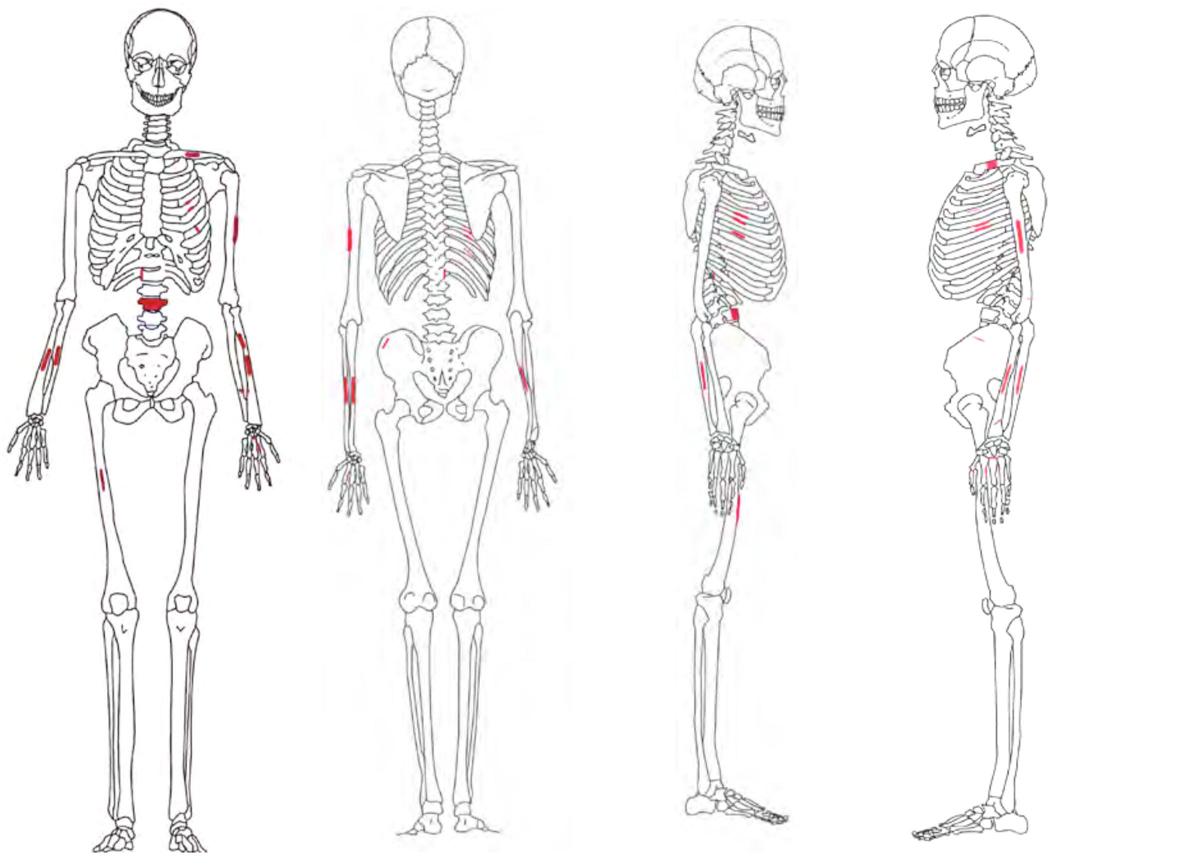
3.14.2 Iron Age: location of post-cranial peri-mortem sharp-force weapon injuries

Table 77 Location of peri-mortem sharp-force weapon injuries to the post-cranial skeleton in Iron Age males, displayed by element, side, number, segment and aspect affected.

Element	Side	N	Segment	Anterior	Posterior	Medial	Lateral	Superior	Inferior
Clavicle	Left	1/47	m1/3	1/46	-	-	-	-	-
		2.1%		2.2%	-	-	-	-	-
Humerus	Right	1/59	d1/3	-	-	1/58	-	-	-
		1.7%		-	-	1.7%	-	-	-
	Left	1/53	m1/3	-	-	-	1/53	-	-
		1.9%		-	-	-	1.9%	-	-
Radius	Right	1/57	m1/3	1/57	-	-	-	-	-
		1.8%		1.8%	-	-	-	-	-
	Left	1/54	p1/3	-	-	1/52	-	-	-
		1.9%		-	-	1.9%	-	-	-
	Left	3/54	d1/3	1/54	2/54	-	-	-	-
		5.6%		1.9%	3.7%	-	-	-	-
Ulna	Right	1/63	m1/3	1/52	1/52	-	-	-	-
		1.6%		1.9%	1.9%	-	-	-	-
	Left	2/57	m1/3	-	1/55	-	-	-	-
		3.5%		-	1.8%	-	-	-	-
	Left	1/56	d1/3	1/51	-	-	-	-	-
		1.8%		2.1%	-	-	-	-	-
Metacarpals	Un-sided	1/461	pe	-	-	-	-	-	1/461
		0.2%		-	-	-	-	-	0.2%
	Un-sided	1/461	m1/3	-	-	-	1/461	-	-
		0.2%		-	-	-	0.2%	-	-
Ribs	Un-sided	11/703	m1/3	6/703	3/703	-	-	1/703	1/703
		1.6%		0.9%	0.4%	-	-	0.1%	0.1%
Thoracic vertebrae	Un-sided	1/523		1/523	-	-	-	-	-
		0.2%	-	0.2%	-	-	-	-	-
Lumbar vertebrae	Un-sided	6/234		5/234	-	-	1/234	-	-
		2.6%	-	2.1%	-	-	0.4%	-	-
Femur	Right	1/54	m1/3	1/54	-	-	-	-	-
		1.9%		1.9%	-	-	-	-	-
Ilium	Left	1/57	-	-	-	-	-	1/57	-
		1.8%		-	-	-	-	1.8%	-

Peri-mortem sharp-force weapon injuries appear to be focused upon the ribs, lower vertebrae, and arms, particularly the left side (Figure 21).

Figure 21: A schematic drawing of the post-cranial location of peri-mortem sharp-force weapon injuries in Iron Age males



21a Anterior view. 21b Posterior view. 21c Right lateral view. 21d Left lateral view.

(after Buikstra and Ubelaker 1994, attachments 3a to 4b)

3.14.3 Iron Age: radial-ulna peri-mortem sharp-force weapon injuries

Table 78 Details of Iron Age male peri-mortem sharp-force weapon injuries to the radius and ulna, displayed by the affected side, segment and the number of arms and individuals.

Element	Side	m1/3
Ulna	Right	1
	Left	2
Radius	Right	1
	Left	2
Total Number of Arms Affected		N=3
Total Number of Individuals Affected		N=2

Multiple small double-edged sharp-force injuries (between 3 and 8 mm in length) were observed on ribs of three males [P18, 02 and T16 Maiden Castle], and two males [P25 and P23 Maiden Castle] have sharp-force weapon injuries to the lumbar vertebrae. The male from Gussage All Saints [285 3] has the only evidence of sharp-force weapon injury to the clavicle, located on the anterior aspect of the middle third.

P25 an older adult male [Maiden Castle] has peri-mortem blunt-force trauma to the cranium, and a single oblique line (27 mm in length) caused by sharp-force weapon injury to the third lumbar vertebra. It enters the centrum from the left at the middle, and extends to the mid portion of superior aspect. The anterior surface of the femoral middle third also has a deep linear incision (17.5 mm in length), which has produced a wastage flake superiorly. Also present is a single deep incision to the medial border at the proximal third of the left radius that created a wastage flake. P23 a young adult male [Maiden Castle] has three sharp-force linear weapon injuries to the antero-superior aspect and left portion of a lumbar vertebra. These are oblique in form and penetrate the trabeculae. This individual also has peri-mortem sharp-force weapon injuries to the left parietal bone, and a healing fracture to the distal right ulna.

A middle adult male 02 [Maiden Castle] has the only example of sharp-force weapon injury to the left ilium. This consists of an oblique linear defect (20 mm in length) inferior to the superior border of the element, extending posteriorly, penetrating the outer cortex and trabeculae. P7A a young adult male [Maiden Castle] has the only regional example of an embedded implement. This consists of a projectile (possibly a spear or arrow head), one side of which is embedded in an oblique position, in the right outer cortex and trabeculae of the twelfth thoracic vertebra. This male also has peri-mortem sharp-force weapon injury to the inferior aspect of the right mandibular body and mental eminence.

3.14.4 Iron Age: location of cranial ante-mortem sharp-force weapon injuries

Table 79 Location of ante-mortem sharp-force weapon injuries to the cranium observed in Iron Age males, displayed by side, number and aspect affected.

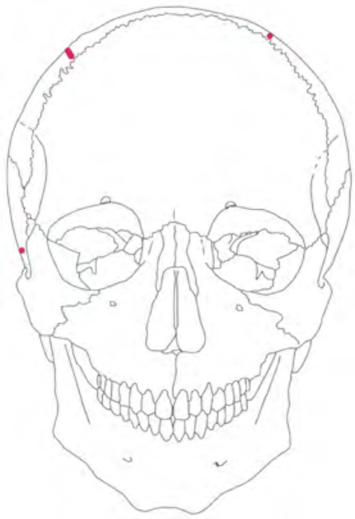
Element	Side	N	Anterior	Superior	Inferior
Parietal bone	Right	1/47	1/47	-	-
		2.1%	2.1%	-	-
	Left	1/47	-	1/47	-
		2.1%	-	2.1%	-
Temporal bone	Right	1/45	-	-	1/45
		2.2%	-	-	2.2%

Ante-mortem evidence for sharp-force weapon injuries in comparison to the peri-mortem evidence was very low (Figure 22). It was only observed in two males from Maiden Castle [01 and N1] and one male [285 3] at Gussage All Saints. All ante-mortem sharp-force weapon injuries were only observed on the cranium, and the affected elements were the parietal bones (N= 2) and temporal bone (N= 1). None of the individuals had more than one injury present, and there were no indications of infection or surgical treatment, but all had peri-mortem sharp-force weapon injuries to cranial and or post-cranial elements.

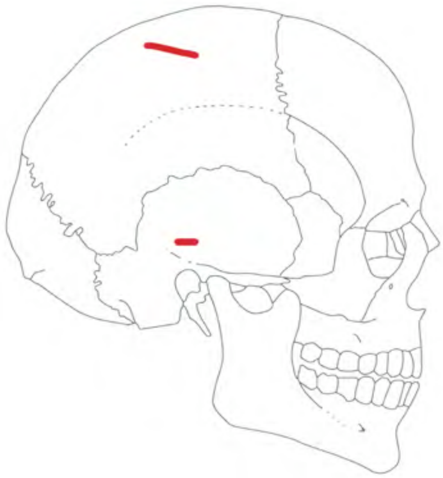
One younger adult male [285 3 Gussage All Saints] had a remodelled linear injury to the left parietal bone, which only affected the outer table and a portion of the diplöe. The other cranial injuries may have been caused by a penetrating instrument. Male 01 has a remodelled lesion on the right temporal bone, which had penetrated both tables; and N1 has a long and deep depression (28 mm in length and 12 mm in width), in a lozenge shape on the right parietal bone. It appears to have channelled out the outer table, and created a lacuna at its terminus into the diploë, it is without parallel in the region.

Figure 22: Location of ante-mortem sharp-force weapon injuries in Iron Age males. The healed injuries observed in N1 and 01 [Maiden Castle] and 285 3 [Gussage All Saints] are shown in 22a., 22b illustrates those observed in N1 and 01 and 22c shows the healed injury in 285 3 [Gussage All Saints].

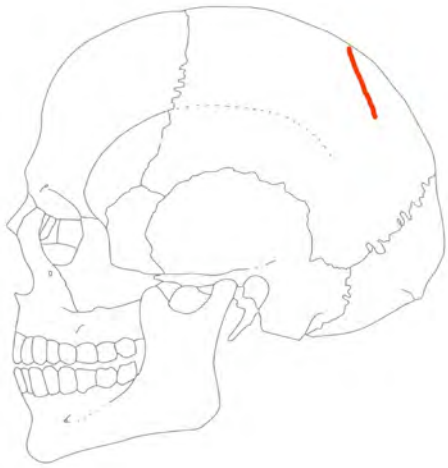
22a Anterior view.



22b Right lateral view.



22c Left lateral view.



(after Buikstra and Ubelaker 1994, attachments 6a, 6b and 7a)

3.14.5 Iron Age: sharp-force weapon injury recidivism

Table 80 The number of Iron Age males with zero to more than two ante- and peri-mortem sharp-force weapon injuries. The data is shown by the number of males affected at the regional level and in their age group.

Age Group in Years		No Injuries	One Injury	Two Injuries	More than Two Injuries
Young Adult	**N of Regional sample**	16/64	1/64	5/64	3/64
		25%	1.5%	7.8%	4.6%
	N of Age group	16/26	1/26	5/26	3/26
		61.5%	3.8%	19.2%	11.5%
Middle Adult	**N of Regional sample**	15/64	1/64	1/64	3/64
		23.4%	1.5%	1.5%	1.5%
	N of Age group	15/20	1/20	1/20	3/20
		75%	5%	5%	15%
Older Adult	**N of Regional sample**	11/64	1/64	1/64	1/64
		17.2%	1.5%	1.5%	1.5%
	N of Age group	11/14	1/14	1/14	1/14
		78.6%	7.1%	7.1%	7.1%
Adults	**N of Regional sample**	4/64	-	-	-
		6.2%	-	-	-
	N of Age group	4/4	-	-	-
		100%	-	-	-

The evidence for injury recidivism displays clear age differences in the number of injuries sustained by individuals, and it is worth noting that the majority of injuries were peri-mortem (Tables 76, 77 and 79). The majority of individuals in the sample do not have evidence of sharp-force weapon injuries. The highest prevalence rate for those without injuries were observed in young adult males the regional level (N= 16/64, 25%), and in older adult males at the age group level (N= 11/14, 78.6%). The young adult males had the highest prevalence at the regional and age group levels. The majority of young adult males with evidence for sharp-force weapon injury had two injuries (N= 5/64, 19.2% at the regional level) present. Both young and middle adult males had the same number of individuals displaying more than two injuries, with middle adults having more individuals affected in their age group (N= 3/20, 15%), compared to young adults (N= 3/26, 11.5%). In older adults, the minority of individuals have sharp-force weapon injuries at the regional level (N= 3/64, 4.7%) and age group level (N= 3/14, 21.4%).

3.15 Neoplasms

No neoplasms were observed in the male Iron Age sample.

3.15.1 Romano-British period: benign osteochondroma

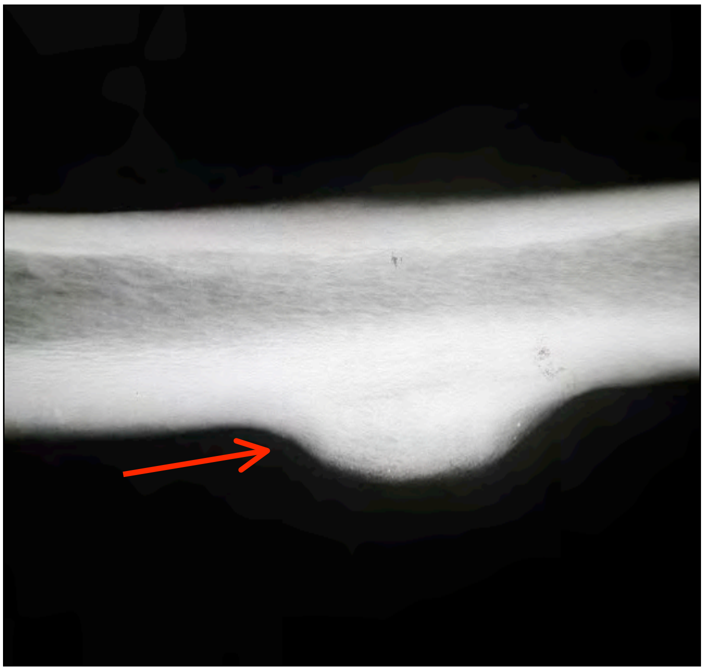
Table 81 Romano-British male elements with benign osteochondromas present. Displayed by element, side and segment affected.

<table>
<tr><th>Element</th><th>Side</th><th>N of element</th><th>Segment</th><th>N of segment</th></tr>
<tr><td rowspan="2">Humerus</td><td rowspan="2">Left</td><td>1/85</td><td rowspan="2">p1/3</td><td>1/81</td></tr>
<tr><td>1.2%</td><td>1.2%</td></tr>
<tr><td rowspan="2">Tibia</td><td rowspan="2">Left</td><td>1/85</td><td rowspan="2">m1/3</td><td>1/84</td></tr>
<tr><td>1.2%</td><td>1.2%</td></tr>
<tr><td rowspan="2">Fibula</td><td rowspan="2">Right</td><td>1/78</td><td rowspan="2">pe</td><td>1/41</td></tr>
<tr><td>1.3%</td><td>2.4%</td></tr>
</table>

Only three elements had evidence of benign neoplastic change in the region, and two were observed in the same individual. A middle adult male [791 Alington Avenue] had a medially projecting osteochondroma (10.2 mm in length) at the proximal third of a left humerus, and another inferiorly projecting osteochondroma at the proximal third of a right fibula, which has been damaged post-mortem (Figure 23). The tibial osteochondroma was observed in an older adult male [Crown Building], it was 42.2 mm in length and 25.6 mm wide (Figure 23).

Figure 23: Benign osteochondromas observed in Romano-British males.

23a Anterior view showing the proximal third of the fibulae, illustrating the benign osteochondroma extending from the inferior-medial aspect of the articular surface, observed in a middle adult male [791 Alington Avenue].



23b A medio-lateral radiograph of the middle third of a left tibia, showing the benign osteochondroma on the anterior aspect (arrowed), observed in an older adult male [Crown Building].

3.15.2 Romano-British period: malignant neoplasm

Table 82 The distribution of axial and appendicular elements with osteolytic metastatic changes observed in a middle adult male [955 Poundbury Camp], displayed by number and side affected.
(continues onto the next page)

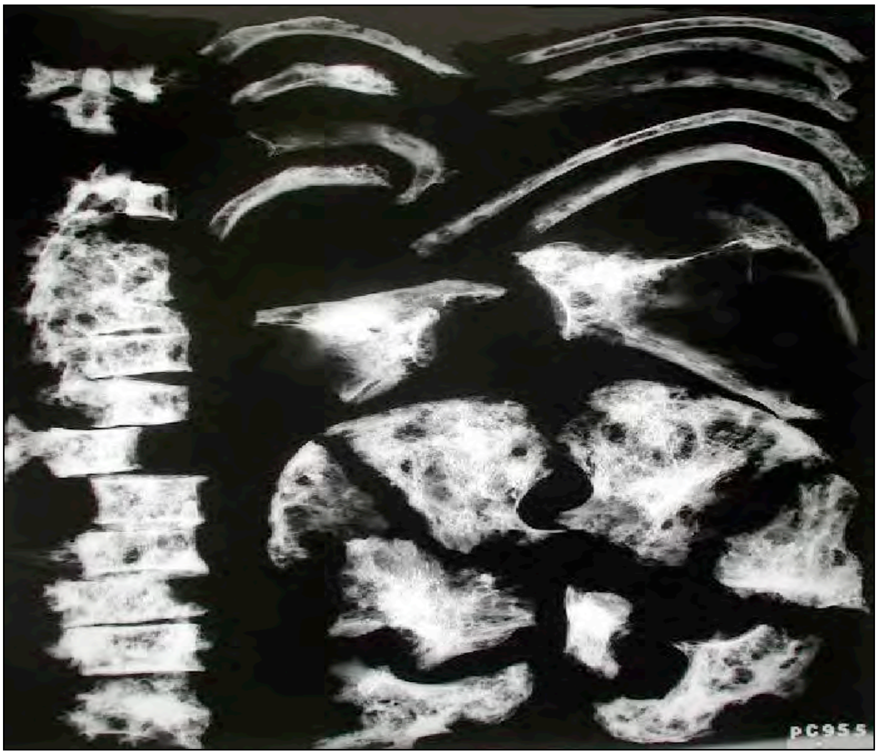
Element	N	Right	Left
Frontal bone	-	1/80	1/79
	-	1.3%	1.3%
Parietal bone	-	1/77	1/78
	-	1.3%	1.3%
Occipital bone	1/76	-	-
	1.3%	-	-
Temporal bone	-	1/71	1/73
	-	1.4%	1.4%
Zygomatic bone	-	1/65	1/62
	-	1.5%	1.6%
Maxilla	-	1/62	1/61
	-	1.6%	1.6%
Mandible	-	1/69	1/69
	-	1.4%	1.4%
Atlas vertebra	1/52	-	-
	1.9%	-	-
Axis vertebra	1/49	-	-
	2.0%	-	-
Cervical Vertebrae	4/230	-	-
	1.7%	-	-
Thoracic Vertebrae	10/666	-	-
	1.5%	-	-
Lumbar Vertebrae	5/299	-	-
	1.7%	-	-
1st Sacral vertebra	1/73	-	-
	1.4%	-	-
2nd Sacral vertebra	1/58	-	-
	1.7%	-	-
3rd Sacral vertebra	1/54	-	-
	1.9%	-	-
4th Sacral vertebra	1/50	-	-
	2.0%	-	-
5th Sacral vertebra	1/50	-	-
	2.0%	-	-

Element	N	Right	Left
Manubrium	1/34	-	-
	2.9%	-	-
Sternum	1/39	-	-
	2.6%	-	-
Ribs	20/901	-	-
	2.2%	-	-
Clavicle	-	1/59	1/61
	-	1.7%	1.6%
Scapula	-	1/69	1/67
	-	1.4%	1.5%
Humerus	-	1/79	1/85
	-	1.3%	1.2%
Radius	-	1/80	1/82
	-	1.3%	1.2%
Ulna	-	1/83	1/86
	-	1.2%	1.2%
Carpals	8/605	-	-
	1.3%	-	-
Metacarpals	5/633	-	-
	0.8%	-	-
Ilium	-	1/74	1/75
	-	1.4%	1.3%
Ischium	-	1/60	1/59
	-	1.7%	1.7%
Pubis	-	1/51	1/48
	-	2.0%	2.1%
Femur	-	1/83	1/84
	-	1.2%	1.2%
Tibia	-	1/85	1/85
	-	1.2%	1.2%
Fibula	-	1/80	1/78
	-	1.3%	1.3%
Metatarsals	10/696	-	-
	1.4%	-	-
Tarsals	14/800	-	-
	1.8%	-	-
Phalanges	27/848	-	-
	3.2%	-	-

Only one middle adult male [955 Poundbury Camp] had evidence of a malignant neoplasm (Figure 24). Macroscopically, it was most evident in the axial skeleton, particularly the cranium, where lesions had penetrated both tables. Radiographic analysis demonstrated that numerous lesions were present in the appendicular skeleton. The destructive lesions conform to the palaeopathological diagnosis of osteolytic metastatic changes (Ortner 2003, 532-535). The elements are incredibly fragile, and in the thoracic vertebrae, extensive bone destruction has resulted in ankylosis and slight anterior kyphosis, which are typical secondary consequences of this disease (Ortner 2003, 535). Molleson (1993) originally reported that this individual, was a "relatively young male" and that the changes were most probably caused by "adenocarcinoma … bladder cancer is possible" (Molleson 1993, 196). Molleson's (1993) diagnosis is rejected in light of extensive macroscopic and radiographic examination of the skeleton, and comparison to clinical and palaeopathological literature. The determination of a particular type of cancer is also questioned, as a specific diagnosis is often impossible in palaeopathology (Ortner 2003, 532-533; Ragsdale and Ortner 2005).

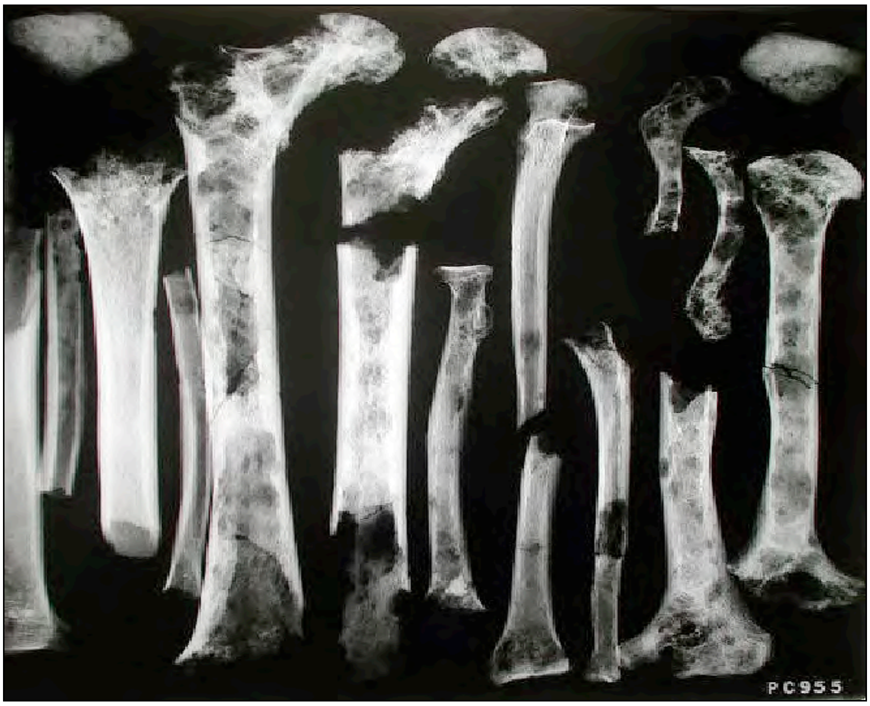
A middle adult male from Alington Avenue [789] had destructive changes suggestive of meningioma to the left parietal bone (Waldron 2002, 153). Unfortunately, the cranium was missing from the archive, and no destructive lesions could be macroscopically observed in the remaining elements. Consequentially, this neoplasm could not be included in the present study.

Figure 24: Osteolytic metastatic changes observed in middle adult male [955 Poundbury Camp]



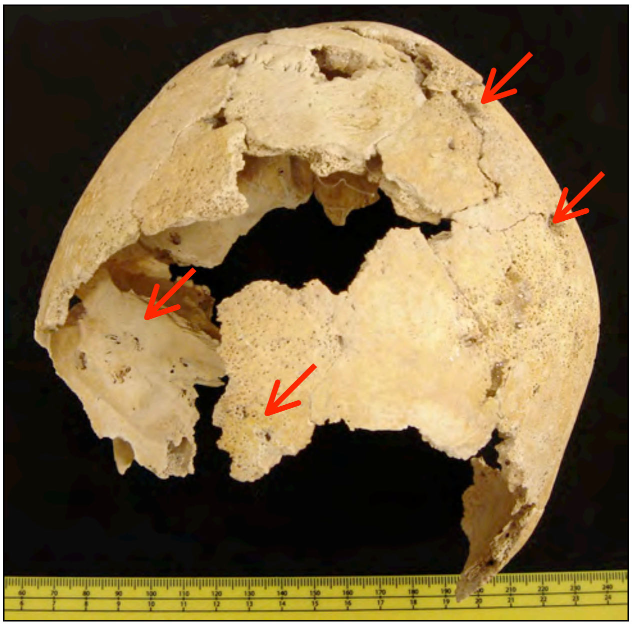
24a Medio-lateral radiograph of selected cervical, thoracic and lumbar vertebrae.

Supero-inferior radiograph of ribs, scapulae, and the os coxae.



24b Supero-inferior radiograph of the patellae and long bones.

24c Supero-inferior radiograph of the cranium, the maxillae, left temporal bone and mastoid are placed separately on the plate.



24d Superior view of the cranium. The osteolytic lesions can be observed to affect both cranial tables and are dispersed throughout the cranium (examples are arrowed).

The element has been glued post-mortem

24e Endocranial view. The numerous osteolytic lesions (arrowed) are clearly observable on the inner cranial table. The element has been glued post-mortem.

24f Right lateral view of the fused 10^{th} to 12^{th} thoracic vertebrae. The extensive osteolytic destruction to the vertebral column is typified by this example.

24g Anterior view of the right femur and portions of the right ilium and ischium, showing the presence of osteolytic lesions.

24h Anterior view of the scapulae and clavicles, showing the numerous and dispersed osteolytic lesions.

3.16 Romano-British period: surgical intervention

Table 83 Evidence for surgical intervention in a Romano-British male, displayed by element, side, segment and number affected.

Element	**Side**	**Segment**	**N**
Humerus	Right	d1/3	1/73
			1.4%

This was observed in a young adult male [852 Alington Avenue], unfortunately, taphonomic processes have removed the majority of the cortical bone, and the cut/sawn/chopped end had been partially abraded. Nevertheless, it conforms to two of the criteria for identifying sharp-force weapon injury (2.6.9), evidence for linearity and the presence of a well-defined clean edge (Boylston 2000a, 361). The right distal third of the humerus, right radius and ulna were not present at the time of excavation. It is suggested that the humeral segment and forearm are absent due to amputation (Ham and Cotton 1991; Mays 1996; Aufderheide and Rodríquez-Martín 1998, 30). As the lateral aspect of the right humeral distal third has a triangular shaped ‘step’, indicating a hinge; there is no macroscopic evidence for remodelling prior to death, and the affected area does not conform to the criteria for dry-fracturing (Knüsel 2005, 51) (Figure 25).

Figure 25: Lateral aspect of the right humerus. The figure illustrates the amputation observed at the distal third of the right humerus, in a young adult male [852 Alington Avenue]. The triangular 'step' and the regularity of the inferior margin can be observed, despite extensive post-mortem taphonomic change.

3.17 Female Health

This section presents the data derived from female and probable females from the region by disease type through time.

3.17.1 Indicators of Stress

The following tables (84 to 87) present the number of elements in the sample by archaeological period displaying an indicator of stress. The data have been aggregated by side, and in the case of the lower limb by element affected.

3.17.1.1 Iron Age

Table 84 Iron Age female indicators of stress.

Bone and Enamel Response	Cribra Orbitalia (N = 1 orbit)	Periosteal new bone formation (N=femora, tibiae and fibulae)	Maxilla	Mandible
Barely Discernible	10/93	-	-	-
	10.8%	-	-	-
Porosity Only	17/93	-	-	-
	18.3%	-	-	-
Porosity with Coalescence of the Foramina with no Thickening	26/93	-	-	-
	28.0%	-	-	-
Lamellar	-	164/280	-	-
	-	58.6%	-	-
Sclerotic	-	28/280	-	-
	-	10.0%	-	-
Mixed	-	14/280	-	-
	-	5.0%	-	-
Woven	-	3/280	-	-
	-	1.1%	-	-

Enamel Hypoplastic Defects	-	-	15/403	36/510
	-	-	3.7%	7.1%

Table 84 shows that the most observed orbital change was porosity with coalescence of the foramina with no thickening. Lamellar bone formation was the most commonly observed periosteal new bone response on the lower limb. The mandible has a higher percentage of teeth displaying enamel hypoplastic defects compared to the maxilla. Chi-square statistical tests of male and female indicators of stress demonstrate that there are statistically significant differences between the sexes during the Iron Age (Tables 7, 12 and 22).

3.17.1.2 Romano-British period

Table 85 Romano-British female indicators of stress.

Bone and Enamel Response	**Cribra Orbitalia (N = 1 orbit)**	**Periosteal new bone formation (N=femora, tibiae and fibulae)**	**Maxilla**	**Mandible**
Barely Discernible	5/90	-	-	-
	5.6%	-	-	-
Porosity Only	8/90	-	-	-
	8.9%	-	-	-
Porosity with Coalescence of Foramina, no Thickening	2/90	-	-	-
	2.2%	-	-	-
Coalescence Foramina with Thickening	2/90	-	-	-
	2.2%	-	-	-
Lamellar	-	76/283	-	-
	-	26.9%	-	-
Sclerotic	-	18/283	-	-
	-	6.4%	-	-
Woven	-	1/283	-	-

	-	0.4%	-	-
Enamel Hypoplastic Defects	-	-	49/410	53/459
	-	-	12.0%	11.5%

Tables 84 and 85 show that the numbers of elements with indicators of stress were higher in the Iron Age, particularly for cribra orbitalia and enamel hypoplastic defects. Statistical tests (Tables 86 to 88) show that differences in the number of elements affected between females in the two periods were statistically significant.

3.18 Enamel hypoplastic defects and age formation

The following Tables (86 and 87) present the number of individuals with enamel hypoplastic defects and the age at which they were formed. The data from the mandible and maxilla have been combined.

3.18.1 Iron Age

Table 86 Age at which the enamel hypoplastic defect formed in Iron Age female dentitions, displayed by number of individuals observed with a defect at each dental location (Buikstra and Ubelaker 1994, attachment 14a).

	Age in Years (N= individuals)						
Location	**0**	**1**	**2**	**3**	**4**	**5**	**6**
1st Incisors (Maxillary and mandibular)	4	2	1	3	-	2	-
2nd Incisors (Maxillary and mandibular	2	3	1	1	-	2	1
Canines (Maxillary and mandibular)	1	4	-	1	-	2	1
1st Premolars (Maxillary and mandibular)	-	1	2	-	-	1	1
2nd Premolars (Maxillary and Mandibular) and 2nd Molar (Mandibular)	-	-	1	-	-	2	-
Total	7	10	5	5	0	9	3

The formation of defects occurred from birth to three years and five to six years. The majority occurred before the age of four. The majority of individuals had defects on the first incisors.

3.18.2 Romano-British period

Table 87 Age at which the enamel hypoplastic defect formed in Romano-British female dentitions, displayed by number of individuals observed with a defect at each dental location (Buikstra and Ubelaker 1994, attachment 14a).

	Age in Years (N= individuals)							
Location	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1st Incisors (Maxillary and mandibular)	8	4	4	4	-	1	-	-
2nd Incisors (Maxillary and mandibular)	3	2	2	1	-	1	-	-
Canines (Maxillary and mandibular)	2	-	3	5	4	4	3	1
1st Premolars (Maxillary and mandibular)	1	1	2	-	1	3	-	-
2nd Premolars (Maxillary and mandibular)	-	-	-	-	-	-	1	-
2, 15, 31 and 18	-	-	1	1	-	-	-	-
Total	14	7	12	11	5	9	4	1

The formation of defects has a wider range of development in the Romano-British period, extending from birth to ten years. As in the Iron Age, the majority of defects were observed on the canine and incisors. The majority of defects were produced before the first year, and during the second year of life.

3.18.3 Chi-Square test: comparison of female enamel hypoplastic defects

Table 88 Chi-square test comparing the number of Iron Age and Romano-British female teeth displaying an observable enamel hypoplastic defect.

	Present	**Absent**	**Total**
Iron Age	51	862	913
Romano-British period	102	767	869
Total	153	1629	1782

Degrees of freedom = 1
Chi-square = 21.466
p is less than or equal to 0.001
<u>The distribution is significant</u>

Table 88 demonstrates that the difference in the number of Iron Age and Romano-British female teeth with an observable enamel hypoplastic defect is statistically significant.

3.19 Metabolic disease

The only metabolic diseases observed in the region for both periods were cribra orbitalia and porotic hyperostosis. The following Tables (89 to 94) present the number of bones affected, and the range of changes observed.

3.19.1 Iron Age: cribra orbitalia

Table 89 The evidence for cribra orbitalia in Iron Age females, displayed by side, change and activity level.

Change	Side	Active	Mixed	Healed
Barely Discernible	Right	-	-	6/47
		-	-	12.8%
	Left	-	-	6/46
		-	-	13.0%
Porosity Only	Right	1/47	2/47	6/47
		2.1%	4.2%	12.8%
	Left	1/46	1/46	6/46
		2.2%	2.2%	13.0%
Porosity with Coalescence of the Foramina	Right	2/47	-	9/47
		4.2%	-	19.1%
	Left	2/46	2/46	7/46
		4.3%	4.3%	15.2%

The majority of lesions defined as cribra orbitalia observed were healed, and this is reflected by the majority of changes being less severe. The right orbit is more affected by cribra orbitalia than the left.

3.19.2 Romano-British period: cribra orbitalia

Table 90 The evidence for cribra orbitalia in Romano-British females, displayed by side, change and activity level.

Change	Side	Mixed	Healed
Barely Discernible	Right	-	2/44
		-	4.5%
	Left	-	4/46
		-	8.7%
Porosity Only	Right	2/44	6/44
		4.5%	13.6%
	Left	2/46	4/46
		4.3%	8.7%
Porosity with Coalescence of the Foramina	Right	2/44	4/44
		4.5%	9.1%
	Left	2/46	4/46
		4.3%	8.7%

The majority of cribra orbitalia was healed, and this is reflected by the most changes being less severe (i.e. porosity only). Unlike the Iron Age sample, no active lesions were observed and there is no side predilection.

3.19.2.2 Chi-Square test: comparison of female cribra orbitalia

Table 91 Chi-Square comparing the number of Iron Age and Romano-British female orbits displaying cribra orbitalia.

	Present	Absent	Total
Iron Age	53	40	93
Romano-British period	17	73	90
Total	70	113	183

Degrees of freedom = 1
Chi-square = 28.109

p is less than or equal to 0.001
<u>The distribution is significant</u>

Table 91 shows that differences in the number of orbits with cribra orbitalia between the two periods were statistically significant.

3.19.3 Iron Age: porotic hyperostosis

Table 92 The evidence for porotic hyperostosis in Iron Age female crania, displayed by bone, side, change and activity level.

Change	Element	Active	Mixed	Healed
Barely Discernible	Frontal bone	-	-	3/47
		-	-	6.4%
	Parietal bones (right and left)	-	-	6/95
		-	-	6.3%
	Occipital bone	-	-	3/48
		-	-	6.3%
Porosity Only	Frontal bone	1/47	-	5/47
		2.1%	-	10.6%
	Parietal bone	2/95	2/95	13/95
		2.1%	2.1%	13.7%
	Occipital bone	1/48	-	8/48
		2.1%	-	16.7%

The parietal bones were the most frequently affected by porotic hyperostosis, and the majority of lesions observed were healed. The most frequently observed change was porosity only.

3.19.4 Romano-British period: porotic hyperostosis

Table 93 The evidence for porotic hyperostosis in Romano-British female crania, displayed by bone, side, change and activity level.

Change	Element	Mixed	Healed
Barely Discernible	Parietal bones (right and left)	-	2/84
		-	2.4%
	Occipital bone	-	2/42
		-	4.8%
Porosity Only	Frontal bone	1/46	1/46
		2.2%	2.2%
	Parietal bones (right and left)	2/84	8/84
		2.4%	9.5%
	Occipital bone	1/42	3/42
		2.4%	7.1%

The parietal bones were the most frequently affected and the majority of lesions observed were healed. The most frequently observed change was porosity only, and unlike the Iron Age, no active lesions were noted.

3.19.5 Chi-Square test: comparison of female porotic hyperostosis

Table 94 Chi-Square test comparing the number of Iron Age and Romano-British female frontal, parietal and occipital bones, displaying evidence for porotic hyperostosis.

	Present	Absent	Total
Iron Age	44	146	190
Romano-British period	20	152	172
Total	64	298	362

Degrees of freedom = 1
Chi-square = 8.246
p is less than or equal to 0.01
The distribution is significant

Table 94 demonstrates that the difference in the number of cranial bones affected by porotic hyperostosis was statistically significant between the two periods.

3.20 Non-specific infectious disease

The following Tables (95 to 97) present the number of elements affected and the range of changes observed. The pooled femora, tibiae and fibulae data is presented in indicators of stress (Tables 4 and 5), as described in section 2.8.

3.20.1 Iron Age

Table 95 Periosteal new bone formation observed to the femora, tibiae and fibulae of Iron Age females, displayed by osseous change observed and side affected.

Type of new bone formation observed	Femur		Tibia		Fibula	
	Right	Left	Right	Left	Right	Left
Lamellar	30/50	30/45	30/49	28/48	23/46	23/42
	60.0%	66.7%	61.2%	58.3%	50.0%	54.8%
Sclerotic	5/50	5/45	5/49	5/48	4/46	4/42
	10.0%	11.1%	10.2%	10.4%	8.7%	9.5%
Mixed	3/50	3/45	3/49	3/48	1/46	1/42
	6%	6.7%	6.1%	6.3%	2.2%	2.4%
Woven	-	-	-	1/48	1/46	1/42
	-	-	-	2.1%	2.2%	2.4%

The tibia is most commonly affected element, as observed in the male sample. Both the tibia and fibula have the widest variety of observable changes. The majority of lesions to the lower limbs were healed or healing, with only three elements displaying woven bone formation. The left side is marginally more affected than the right. The most frequently observed response was remodelling/ed.

3.20.2 Romano-British period

Table 96 Periosteal new bone formation observed to the femora, tibiae and fibulae of Romano-British females, displayed by osseous change observed and side affected.

Type of new bone formation observed	**Femur**		**Tibia**		**Fibula**	
	Right	**Left**	**Right**	**Left**	**Right**	**Left**
Lamellar	16/46	16/48	15/47	15/46	7/48	7/48
	34.8%	33.3%	31.9%	32.6%	14.6%	14.6%
Sclerotic	1/46	1/48	6/47	6/46	2/48	2/48
	2.2%	2.1%	12.8%	13.0%	4.2%	4.2%
Woven	-	-	-	-	1/48	-
	-	-	-	-	2.1%	-

The tibia is the most frequently affected element, and unlike the male sample does not display woven bone formation. The widest variety in periosteal new bone formation was observed in the right fibula. No side predilection was observed in the sample. The majority of the sample displayed remodelling/ed lesions.

3.20.3 Chi-Square test: comparison of female periosteal new bone formation lesions

Table 97 Chi-Square test comparing the number of Iron Age and Romano-British female femora, tibiae and fibulae displaying periosteal new bone formation lesions.

	Present	**Absent**	**Total**
Iron Age	209	71	280
Romano-British period	95	188	283
Total	304	259	563

Degrees of freedom = 1
Chi-square = 95.590
p is less than or equal to 0.001
<u>The distribution is significant</u>

Table 97 demonstrates that the number of female elements with periosteal new bone formation was statistically significant between the two periods.

3.21 Specific infectious disease

Evidence of a specific infectious disease, namely tuberculosis, was only observed in two individuals in the Romano-British period, representing 2/59 or 3.4% of the regional female population. Unfortunately, an additional case from Alington Avenue [Female 960], which affected the lower lumbar vertebrae and left clavicle (Waldron 2002, 153), could not be included in the sample, as the elements were missing and diagnosis could not be confirmed. Osteitis and osteomyelitis were not observed in the female sample.

3.21.1 Tuberculosis to the axial skeleton

Table 98 Summary table of the changes observed in a Romano-British female [1128 Poundbury Camp] displaying a healed tubercular infection to the axial skeleton.

Element	**Inferior Affected**	**Anterior Affected**	**Anterior Destruction**	**Remodelling Sclerotic Bone**
4th Lumbar vertebra	1/160	-	1/160	1/160
	0.6%	-	0.6%	0.6%
5th Lumbar: right pedicle	-	-	-	1/160
	-	-	-	0.6%
5th Lumbar vertebra: Superior and Posterior aspects of the Centrum	-	-	1/160	1/160
	-	-	0.6%	0.6%
1st Sacral vertebra	-	1/36	-	1/36
	-	2.8%	-	2.8%
2nd Sacral vertebra	-	1/33	-	1/33
	-	3.0%	-	3.0%
3rd Sacral vertebra	-	1/28	-	1/28
	-	3.6%	-	3.6%
	-	1/29	-	1/29

4th Sacral vertebra	-	1/29	-	1/29

4th Sacral vertebra

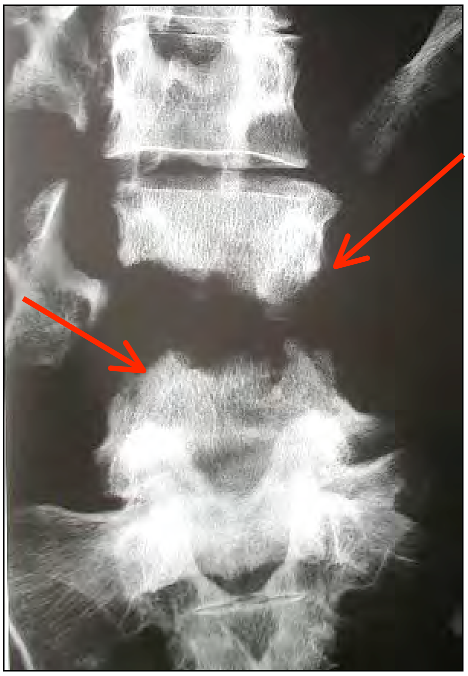
These changes were observed in a middle adult female [1128 Poundbury Camp] and were isolated to the lower lumbar vertebrae and sacrum (Figure 26).

Figure 26: Tuberculosis in the lumbar vertebrae of a middle adult Romano-British female [1128 Poundbury Camp].

26a Superior view of the 5th lumbar vertebra. The ante-mortem destruction of the superior and posterior aspects of the 5th lumbar centrum and right pedicle can be observed in this view. The right portion of the centrum also has reduced height in comparison with the left. Extensive remodelling of the trabeculae can also been seen.

26b Anterior-posterior radiograph of the 3rd to 5th lumbar and 1st sacral vertebrae.

26c Anterior-posterior and medio-lateral radiograph of the lumbar vertebrae. The areas of destruction are arrowed.

The 5th lumbar vertebra has sustained the most destruction, particularly to the right portion of the centrum. The 4th lumbar vertebra has evidence of destruction to the inferior aspect of the centrum. When the vertebrae are placed in articulation, there is only slight anterior kyphosis, due to the scooped superior surface of the 5th lumbar vertebra.

3.21.2 Romano-British period: a possible case of tuberculosis to the appendicular skeleton

Table 99 Summary table of the changes observed in a Romano-British female [223 Poundbury Camp] displaying a probable healed case of tuberculosis to the appendicular skeleton.

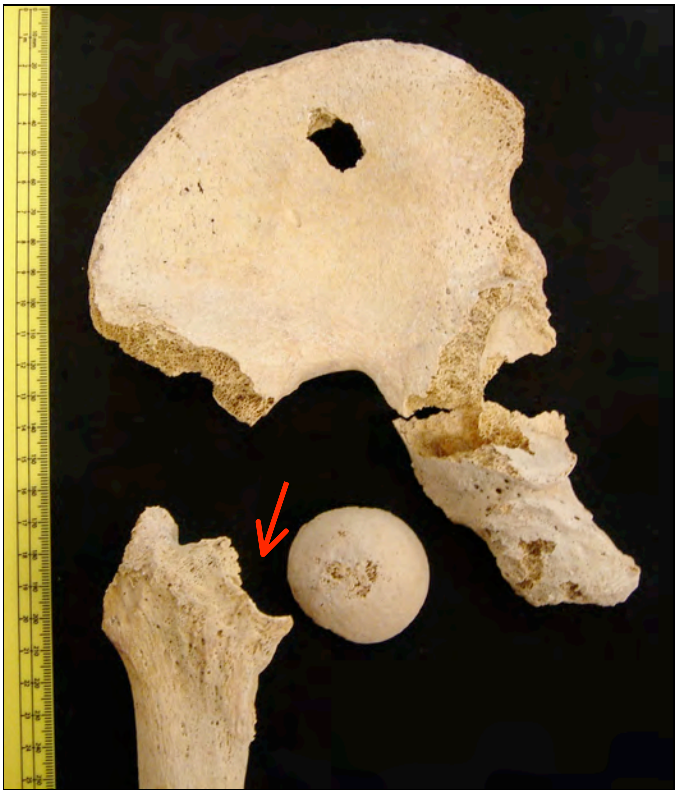
Location	**Side**	**Destruction**	**Remodelling Lamellar Bone Formation**
Femoral Surgical Neck (p1/3)	**Right**	1/46	1/46
		2.2%	2.2%

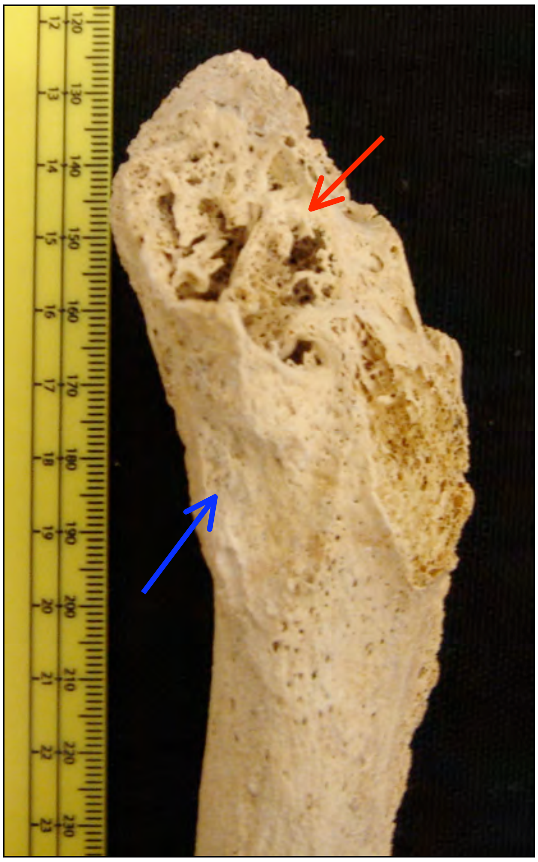
The healed destruction, most probably caused by tuberculosis, was observed in a middle adult female [223 Poundbury Camp] (Figure 27). The changes are isolated to the surgical neck of the right femur. The femoral head is still present but the trabecular bone has been destroyed, leaving a cortical 'shell'. The inner surface of the head is smoothed and it is the same size as the left. The surgical neck has been removed ante-mortem, and the diaphysis now terminates at the intertrochanteric line. The medullary cavity has been sealed by remodelled and smoothed trabeculae, which radiographically has a dense sclerotic margin. No changes were observed to the right acetabulum.

Figure 27: Example of remodelled probable tubercular infection to the right femur in an older adult female [223 Poundbury Camp]

27a Anterior-posterior radiograph of the femora. Ante-mortem destruction of the surgical neck and femoral head is arrowed.

27b Anterior view of the proximal third and articular surface of the right femur, ilium and ischium. The figure shows that there is no evidence of ante-mortem destruction to the right acetabulum and superior aspect of the femoral head. The





27c Medial view of the proximal third of the right femur. The extensive remodelling at the base of the surgical neck, demonstrates that the medullary cavity had been sealed (arrowed in red). Particularly on the anterior and medial aspects, remodelling lamellar bone is present (arrowed in blue).

27d Posterior view of the proximal third of the right femur and inner aspect of the femoral head. The ante-mortem destruction of the inner aspect of the femoral head is clearly observable, despite minor post-mortem taphonomic damage.

3.22 Dental Health

In both periods (Tables 100 and 101), the data is dominated by the evidence for ante-mortem tooth loss, occlusal wear, and calculus; the enamel hypoplastic defect data is provided in Tables 84 to 87.

3.22.1 Iron Age

Table 100 The dental health of Iron Age females; displayed by the number of teeth, dental position or number of maxillae and mandibles affected. The results are separated into maxillary or mandibular teeth.

	Maxilla	**Mandible**
Post-mortem loss	118/521	37/547
	22.6%	6.8%
Ante-mortem loss	287/521	213/547
	55.1%	38.9%
Congenitally Absent/ Not Present	6/521	10/547
	1.1%	1.8%
Erupting	2/521	1/547

	0.4%	0.2%
Supernumerary Dentition	1/403	1/510
	0.2%	0.2%
Impacted	1/521	1/547
	0.2%	0.2%
Wear	284/403	416/510
	70.5%	81.6%
Calculus	280/403	422/510
	69.5%	82.7%
Caries	26/403	32/510
	6.5%	6.3%
Abscess	31/521	31/547
	6,0%	5.7%
Periodontal Disease (N= maxillae /mandibles)	43/55	45/56
	78.2%	80.4%
Total Number of Observable Teeth	403/521	510/547
	77.4%	93.2%
Total Number of Observable Dental Positions	521	547

The highest prevalence rates were observed for ante-mortem loss, calculus and wear. The evidence for carious lesions was low, supported by the low abscess data. The female sample also has evidence for dental eruption, impaction, and the presence of supernumerary dentition.

3.22.2 Romano-British period

Table 101 The dental health of Romano-British females; displayed by the number of teeth, dental position or number of maxillae and mandibles affected. The results are separated into maxillary, mandibular or loose teeth.

	Maxilla	**Mandible**	**Loose**
Post-mortem loss	203/661	128/645	-
	30.7%	19.8%	-
Ante-mortem loss	109/661	132/645	-
	16.5%	20.5%	-
Congenitally Absent/Not Present	8/661	282/645	-
	1.2%	43.7%	-
Wear	291/410	353/459	10/36
	71.1%	76.9%	27.8%

Calculus	267/410	78/459	14/36
	65.1%	17.1%	38.9%
Caries	361/410	28/459	7/36
	88.0%	6.1%	19.4%
Impacted Dentition	2/661	-	-
	0.3%	-	-
Abscess	16/661	11/645	-
	2.4%	1.7%	-
Periodontal Disease (N= number of maxillae and mandibles)	33/78	34/154	-
	42.3%	22.1%	-
Total Number of Observable Teeth	410/661	459/645	36/36
	62.0%	70.6%	100%
Total Number of Observable Dental Positions	661	645	-

The data are dominated by evidence for occlusal wear, calculus and caries. The prevalence of caries has increased from the Iron Age, although the number of abscesses decreases, a statistically significant result (Tables 105 and 106). Statistical tests of the difference between the Iron Age and Romano-British period for ante-mortem tooth loss, dental wear, calculus, carious lesions, and periodontal disease were all found to be statistically significant (Tables 102 to 107).

3.22.3 Chi-Square test: comparison of female ante-mortem tooth loss

Table 102 Chi-Square test comparing the number Iron Age and Romano-British female dental positions with evidence for ante-mortem tooth loss.

	Present	**Absent**	**Total**
Iron Age	500	568	1068
Romano-British period	241	1065	1306
Total	741	1633	2374

Degrees of freedom = 1
Chi-square = 220.140

p is less than or equal to 0.001
The distribution is significant

Table 102 demonstrates that the difference in the number of dental positions showing ante-mortem loss between the Iron Age and Romano-British period was statistically significant.

3.22.4 Chi-Square test: comparison of female dental wear

Table 103 Chi-Square test comparing the number of Iron Age and Romano-British female teeth with evidence of wear.

	Present	**Absent**	**Total**
Iron Age	700	213	913
Romano-British period	654	905	1559
Total	1354	1118	2472

Degrees of freedom = 1
Chi-square = 280.203
p is less than or equal to 0.001
The distribution is significant

Table 103 demonstrates that the difference in the number of teeth displaying dental wear was statistically significant in females between the two periods.

3.22.5 Chi-Square test: comparison of female calculus

Table 104 Chi-Square test comparing the number of Iron Age and Romano-British female teeth with evidence for calculus.

	Present	Absent	Total
Iron Age	702	211	913
Romano-British period	359	546	905
Total	1061	757	1818

Degrees of freedom = 1
Chi-square = 259.104
p is less than or equal to 0.001
<u>The distribution is significant</u>

Table 104 demonstrates that the difference in number of teeth displaying dental wear was statistically significant in females between the two periods.

3.22.6 Chi-Square test: comparison of female caries

Table 105 Chi-Square test comparing the number of Iron Age and Romano-British female teeth with evidence of carious lesions.

	Present	Absent	Total
Iron Age	58	855	913
Romano-British period	396	509	905
Total	454	1364	1818

Degrees of freedom = 1
Chi-square = 339.378
p is less than or equal to 0.001
<u>The distribution is significant</u>

Table 105 demonstrates that difference in the number of teeth displaying dental wear was statistically significant in females between the two periods.

3.22.7 Chi-Square: comparison of female abscesses

Table 106 Chi-Square test comparing the number of Iron Age and Romano-British female dental positions with evidence of abscesses.

	Present	Absent	Total
Iron Age	62	1006	1068
Romano-British period	27	1279	1306
Total	89	2285	2374

Degrees of freedom = 1
Chi-square = 22.749
p is less than or equal to 0.001
The distribution is significant

Table 106 demonstrates that the difference between the number of dental positions with an abscess present was statistically significant between Iron Age and Romano-British period.

3.22.8 Chi-Square: comparison of female periodontal disease

Table 107 Chi-Square test comparing the number of Iron Age and Romano-British female maxillae and mandibles with evidence for periodontal disease.

	Present	Absent	Total
Iron Age	88	23	111
Romano-British period	67	165	232
Total	155	188	343

Degrees of freedom = 1
Chi-square = 76.997
p is less than or equal to 0.001
The distribution is significant

Table 107 demonstrates that the difference in the number of maxillae and mandibles with evidence for periodontal disease was statistically significant between the two periods.

3.23 Fractures

Fracture data has been divided into peri-mortem and ante-mortem tables, and the data are presented by the number of elements affected, then by number of segments affected and by location for vertebrae. The results have been divided into cranial and post-cranial tables. The location and fracture type are presented in separate tables.

Peri-mortem fractures were only observed in the Iron Age female sample, highlighting the differences observed in fracture distribution and prevalence through time. For example, during the Romano-British period, the number of affected elements is very low, and tibial plateau fractures occur for the first time.

3.23.1 Iron Age: location of peri-mortem fractures to skull elements

Table 108 Location of peri-mortem fractures to the skull elements of Iron Age females, displayed by side, number and segment affected.

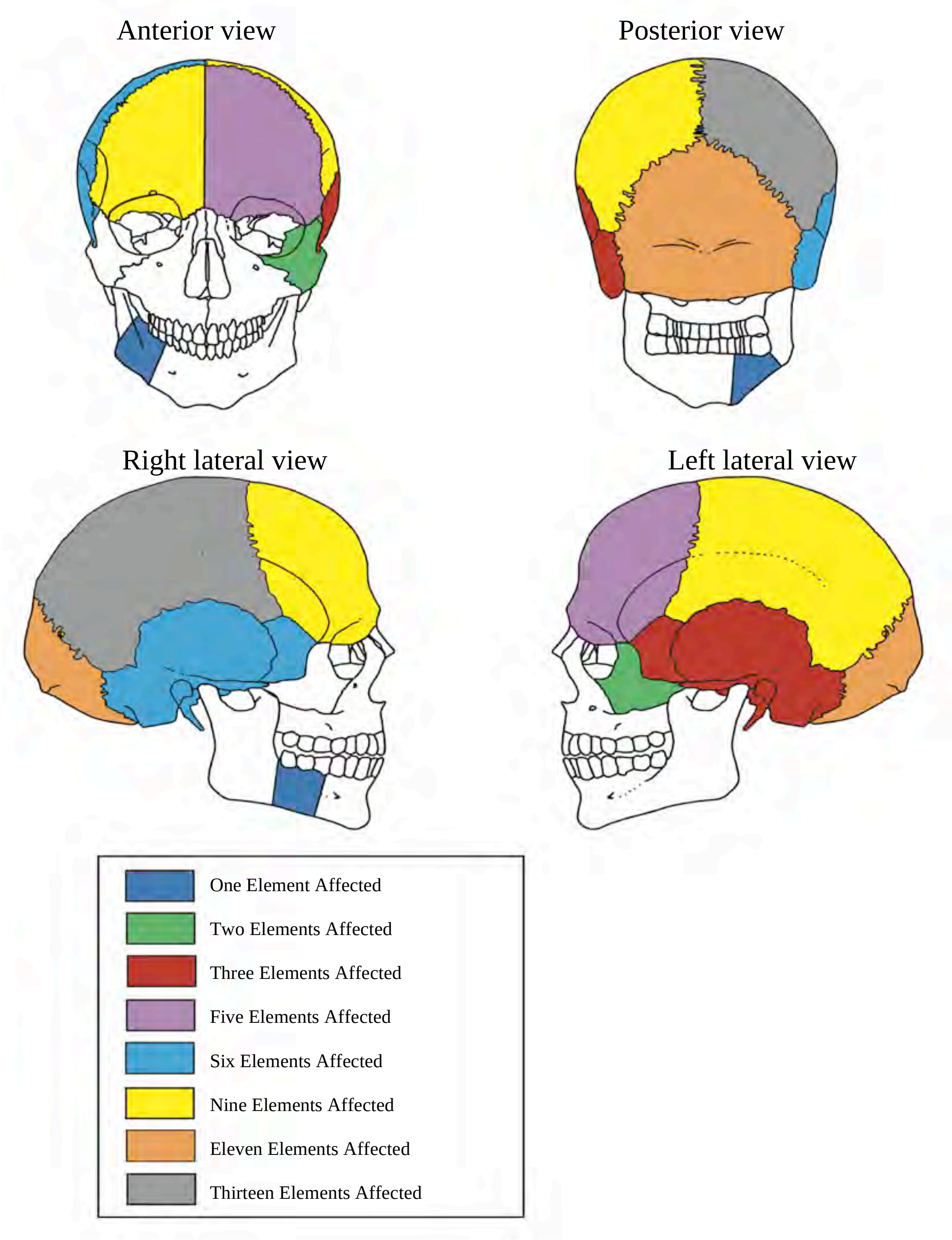
Element	Side	N	m1/3

Frontal bone	Right	9/47	-
		19.1%	-
	Left	5/46	-
		10.9%	-
Maxilla	Left	2/47	-
		4.3%	-
Parietal bone	Right	13/48	-
		27.1%	-
	Left	9/47	-
		19.1%	-
Temporo-Sphenoid bone	Right	6/48	-
		12.5%	-
	Left	3/46	-
		6.5%	-
Occipital bone	Un-sided	11/48 22.9%	-
Zygomatic bone	Left	2/42	-
		4.8%	-
Mandible	Right	1/49	1/49
		2.0%	2.0%

Table 108 shows that all cranial elements were affected by peri-mortem fracturing (Figure 28). The left side had the highest prevalence for all elements, apart from the parietal bones and frontal bone. Unlike the male sample, females have evidence for zygomatic bone fractures. The females had a far lower prevalence rate of skull fracturing compared to the males.

The skull sustained peri-mortem blunt-force fracturing which was often associated with a peri-mortem weapon injury. The peri-mortem traumas were particularly focused upon the cranium. The right parietal bone (N= 13/48, 27.1%) and frontal bone (N= 9/47, 19.1%) had the highest prevalence rates. However, fractures were also noted to all other cranial bones, because the linear fractures often ran through the ecto- and endo-cranial surfaces, thereby affecting multiple elements (Figure 29).

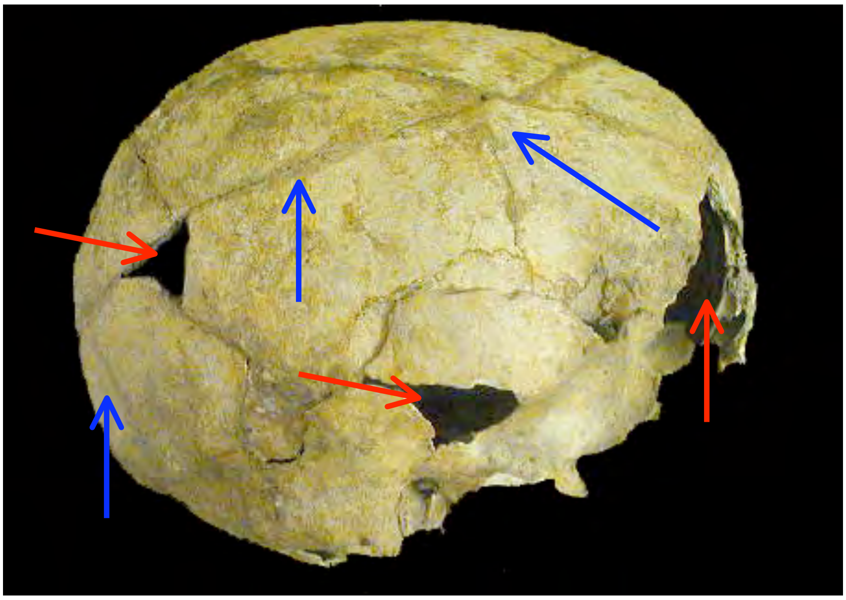
Figure 28: Diagrams showing the distribution of peri-mortem cranial fractures in Iron Age females.



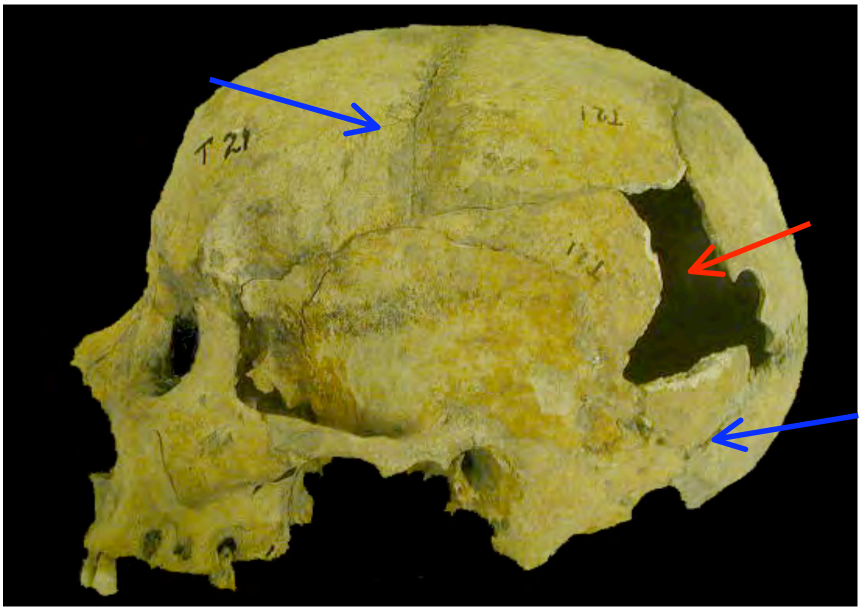
(after Buikstra and Ubelaker 1994, attachments 6a-7b)

Figure 29: Iron Age examples of female peri-mortem blunt-force cranial trauma. The impact sites of the peri-mortem blunt-force trauma (arrowed in red) are still observable in these examples, despite post-mortem taphonomic damage. The radiating fractures can also be observed (examples are arrowed in blue).

29a Right lateral view of a middle adult [T27 Maiden Castle].



29b Left lateral view of a young adult [T21 Maiden Castle].



3.23.1.1 Direction of peri-mortem cranial blunt-force trauma (N= 1 individual)

Table 109 Direction of Iron Age female peri-mortem blunt-force traumas to the cranium, following Gurdjian et al. (1950a, b).

	Direction of blunt force trauma and areas affected					
	Mid Frontal **Nasion** **Supra-orbital notch** **Lateral frontal** **Parieto-temporal**	**Anterior Interparietal** **Lateral Parietal-temporal** **Bilateral Parietal-temporal**	**Mid occipital** **Foramen magnum** **Lateral Parietal-occipital** **Bi-Parietal**	**Lateral-Frontal** **Orbital roof** **Lateral supra-orbital notch** **Frontal** **Zygomatic-sphenoid** **Bi-Frontal** **Lateral Frontal**	**Posterior-Parietal** **Tempero-frontal** **Temporal** **Supra-parietal** **Mastoid-parietal** **Frontal-temporal junction**	**Lateral Parieto-occipital** **Foramen magnum** **Mastoid-zygomatic** **Occipital-parietal**
No Sharp-force	1/49	3/49	2/49	4/49	5/49	5/49
	2.0%	6.1%	4.1%	8.2%	10.2%	10.2%
Sharp-Force	1/49	1/49	2/49	3/49	1/49	1/49
	2.0%	2.0%	4.1%	6.1%	2.0%	2.0%

Many females had sustained multiple blows and therefore are counted more than once. The majority of crania without sharp-force weapon injuries were fractured by blows directed to the lateral-frontal, posterio-parietal, and lateral-parieto-occipital portions. Crania with sharp-force weapon injuries had the majority of fractures at the lateral-frontal and mid occipital portions.

3.23.2 Iron Age: location of peri-mortem fractures to post-cranial elements

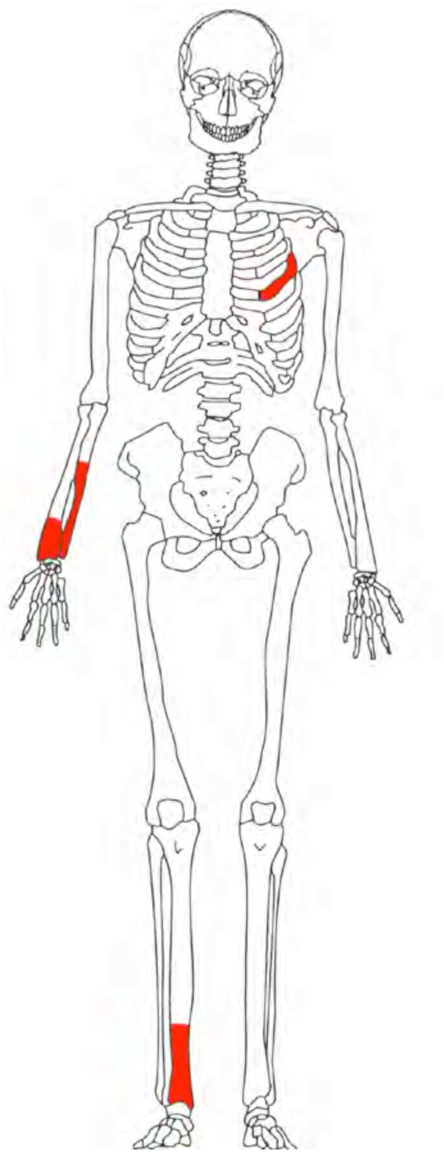
Table 110 Location of Iron Age female peri-mortem fractures to post-cranial elements, displayed by side, number and segment affected.

Element	Side	N	m1/3	d1/3
Ribs	Un-sided	6/774	-	-
		0.8%	-	-
Ulna	Right	2/45	1/40	1/36
		4.4%	2.5%	2.8%
Radius	Right	1/45	-	1/43
		2.2%	-	2.3%
Tibia	Right	1/49	-	1/47
		2.0%	-	2.1%

Table 110 demonstrates that the majority of fractures were sustained to the distal third and only right long bones were affected (Figure 30).

Figure 30: Location of peri-mortem fractures to the post-cranial elements of Iron Age females.

Red shading = segment with evidence for fracture



(after Buikstra and Ubelaker 1994, attachment 3a)

3.23.2.1 Iron Age: type of peri-mortem fractures to post-cranial elements

Table 111 Peri-mortem fracture type observed in the post-cranial elements of Iron Age females, displayed by side and number affected.

Element	Side	Complete	Transverse	Oblique	Spiral
Ribs	Un-sided	-	-	6/774	-
		-	-	0.8%	-
Ulna	Right	1/45	1/45	-	-
		2.2%	2.2%	-	-
Radius	Right	-	-	1/45	-
		-	-	2.2%	-
Tibia	Right	-	-	-	1/49
		-	-	-	2.0%

Table 111 shows that the most observed fracture type was oblique, and was most commonly observed in rib elements. Where the fracture type could be identified, it was equally distributed between transverse, oblique, and spiral forms.

3.23.2.2 Iron Age: peri-mortem radial-ulna fractures

Table 112 Details of Iron Age female peri-mortem radial-ulna fractures, displayed by the affected side, segment and the number of arms and individuals.

Element	Side	d1/3
Ulna	Right	1/36
		2.8%
Radius	Right	1/43
		2.3%
Total Number of Arms Affected		N=1
Total Number of Individuals Affected		N=1

Table 112 demonstrates that only one female had peri-mortem fractures to radius and ulna, both affecting the distal third. Fracturing to both forearm elements was not observed in the female ante-mortem fracture pattern.

The prevalence of peri-mortem fractures to the long bones and ribs is much lower than the prevalence of female skull trauma. The prevalence rates are lower than the Iron Age male sample (Table 54), but fractures to the forearm and ribs were observed in both sexes. Females displaying peri-mortem fractures often had multiple fractures present, many associated with peri-mortem fractures to the cranium.

One middle adult female [T27 Maiden Castle] has peri-mortem fractures to the distal third of the right radius (oblique) and ulna (probable transverse), and peri-mortem blunt-force cranial trauma, and one rib fracture. A middle adult female [P31 Maiden Castle] sustained a peri-mortem, probable spiral fracture, to the distal third of the right tibia in addition to peri-mortem blunt-force trauma to the cranium. Another middle adult [N2 Maiden Castle] female had multiple peri-mortem traumas present, blunt-force trauma to the occipital, a mandibular fracture at the symphysis, and a fracture to the distal third of the right ulna.

3.23.3 Iron Age: ante-mortem fracture location

Table 113 The location of Iron Age female ante-mortem fractures, displayed by side, number, segment or aspect affected.

Element	Side	N	Segment					Aspect
			pe	p1/3	m1/3	d1/3	de	Superior
Frontal bone	Right	1/47	-	-	-	-	-	-
		2.1%	-	-	-	-	-	-
	Left	2/46	-	-	-	-	-	-
		4.3%	-	-	-	-	-	-
Nasal bones	Right	1/34	-	-	-	-	-	-
		2.9%	-	-	-	-	-	-
	Left	1/35	-	-	-	-	-	-
		2.9%	-	-	-	-	-	-
Thoracic Vertebrae	Un-sided	4/494	-	-	-	-	-	4/494
		0.8%	-	-	-	-	-	0.8%
Lumbar Vertebrae	Un-sided	1/220	-	-	-	-	-	1/220
		0.5%	-	-	-	-	-	0.5%
Ribs	Un-sided	11/774	-	-	3/774	2/774	-	-
		1.4%	-	-	0.4%	0.3%	-	-
Scapula	Right	1/48	-	-	1/48	-	-	-
		2.1%	-	-	2.1%	-	-	-
Humerus	Right	3/43	-	1/42	-	-	2/42	-
		7.1%	-	2.4%	-	-	4.8%	-
Radius	Left	1/47	-	-	-	1/47	-	-
		2.1%	-	-	-	2.1%	-	-
Femur	Right	1/50	-	-	-	-	1/45	-
		2.0%	-	-	-	-	2.2%	-
Tibia	Right	1/48	-	-	-	1/44	-	-
		2.1%	-	-	-	2.3%	-	-
Fibula	Right	1/42	-	1/42	-	-	-	-
		2.4%	-	2.4%	-	-	-	-
Metacarpals	Un-sided	1/342	-	1/342	-	-	-	-
		0.3%	-	0.3%	-	-	-	-
Tarsals	Un-sided	3/307	-	-	-	-	-	-
		1.1%	-	-	-	-	-	-
Phalanges	Un-sided	1/1074	1/1074	-	-	-	-	-
		0.1%	0.1%	-	-	-	-	-

Ante-mortem fractures were sustained to the axial and appendicular skeleton. Fractures to the frontal bone, nasal bones, scapula, a metacarpal, phalanx, and tarsals were only observed in the female sample during the Iron Age. Females also sustained more fractures to the ribs, thoracic vertebrae, and humerus.

3.23.4 Iron Age: ante-mortem fracture type

Table 114 Ante-mortem fracture type observed in Iron Age females, displayed by side and number affected.

Element	Side	Compound	Complete	Oblique	Trans-verse	Colles'	Osteo-chondritis dissecans	Depressed	Comp-ression	Inter-condylar
Frontal bone	Right	-	-	-	-	-	-	1/47	-	-
		-	-	-	-	-	-	2.1%	-	-
	Left	-	-	-	-	-	-	2/46	-	-
		-	-	-	-	-	-	4.3%	-	-
Nasal bones	Right	-	1/34	-	-	-	-	-	-	-
		-	2.9%	-	-	-	-	-	-	-
	Left	-	1/35	-	-	-	-	-	-	-
		-	2.9%	-	-	-	-	-	-	-
Thoracic Vertebrae	Un-sided	-	-	-	-	-	-	-	4/494	-
		-	-	-	-	-	-	-	0.8%	-
Lumbar Vertebrae	Un-sided	-	-	-	-	-	-	-	1/220	-
		-	-	-	-	-	-	-	0.4%	-
Ribs	Un-sided	-	6/774	-	-	-	-	-	-	-
		-	0.8%	-	-	-	-	-	-	-
Scapula	Right	-	-	-	1/48	-	-	-	-	-
		-	-	-	2.1%	-	-	-	-	-
Humerus	Right	-	1/43	-	-	-	1/43	-	-	1/43
		-	2.3%	-	-	-	2.3%	-	-	2.3%
Radius	Left	-	-	-	-	1/47		-	-	-
		-	-	-	-	2.1%		-	-	-
Femur	Right	-	-	-	-	-	1/45	-	-	-
		-	-	-	-	-	2.2%	-	-	-
Tibia	Right	-	-	1/48	-	-	-	-	-	-
		-	-	2.1%	-	-	-	-	-	-
Fibula	Right	-	-	1/42	-	-	-	-	-	-
		-	-	2.4%	-	-	-	-	-	-
Metacarpals	Un-sided	1/342	-	-	-	-	-	-	-	-
		0.3%	-	-	-	-	-	-	-	-
Phalanges	Un-sided	1/1074	-	-	-	-	-	-	-	-
		0.1%	-	-	-	-	-	-	-	-
Tarsals	Un-sided	-	-	-	-	-	3/307	-	-	-
		-	-	-	-	-	1.1%	-	-	-

The most frequently fractured segments were proximal and distal thirds of long bone shafts, and the most common fracture types were complete, osteochondritis dissecans, and compression. Importantly, unlike the peri-mortem fracture distribution and type, no ulna fractures and spiral fractures to the tibia were observed.

3.23.4.1 Iron Age: details of ante-mortem tibial-fibular fractures

Table 115 Details of Iron Age female ante-mortem tibial-fibular fractures, displayed by the affected side, segment and the number of legs and individuals.

Element	**Side**	**p1/3**	**d1/3**
Tibia	Right	-	1/44
		-	2.3%
Fibula	Right	1/42	-
		2.4%	-
Total Number of Legs Affected		N=1	
Total Number of Individuals Affected		N=1	

Table 115 shows that only one individual displayed a contra-coupe fracture to the right tibia.

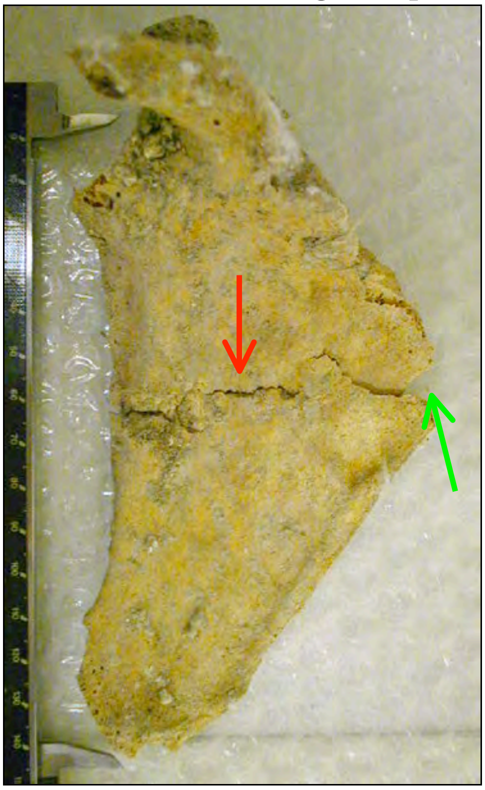
Only two females [T22 and T1 from Maiden Castle] have healed depressed fractures to the right [T22] and left [T1] posterior aspects of the frontal element. The two fractures are of different sizes, the right [T22] is 34.5 mm in length and 23.5 mm wide, the left [T1] is 14.2 mm in length and 7.4 mm wide. Both individuals have in- bending of the endo- and ecto-cranial tables and in T22, comminution of the depression can still be observed, despite extensive remodelling. These are the only two examples of ante-mortem depressed fractures in the regional sample.

A young adult female [T13 Maiden Castle] has the only regional example of a scapula fracture (Figure 31). The body of the scapula has a transverse fracture inferior to the infraglenoid tubercle, which extends circa 48 mm across the body, terminating before the medial border (it is partially obscured by post-mortem damage). The callus was still active at the time of death as it was formed from remodelling mixed reaction bone. This female also has healed fractures to the proximal third of the right humerus, first proximal pedal phalanx, and to the shaft of two ribs. The fracture of the right humerus occurred inferior to the tubercles, unfortunately radiographic analysis was not possible, and therefore the exact fracture type could not be determined.

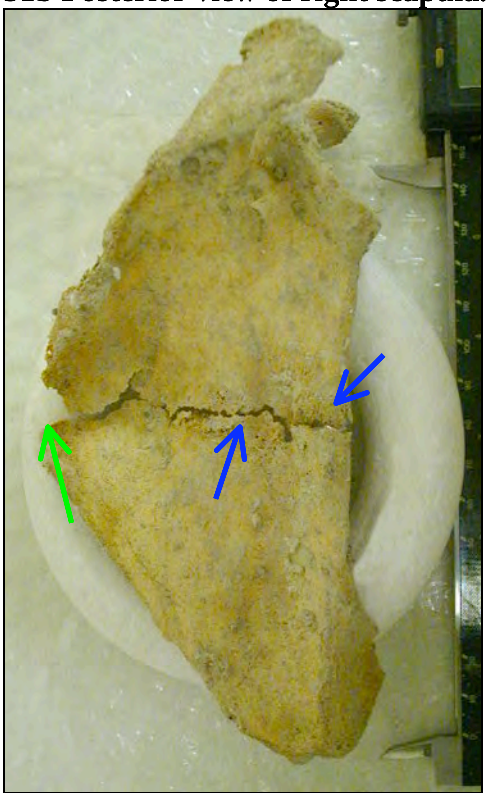
A middle adult female [P36 Maiden Castle] is the only female from the region with healed fractures to the nasal bones. P36 also has healed oblique fractures to the right tibia and fibula, and a compression fracture to the twelfth thoracic vertebra.

Figure 31: Example of a healing scapula fracture in an Iron Age young adult female [T13 Maiden Castle]. The fracture line is still visible (arrowed in red), as is the active callus (arrowed in blue). Post-mortem taphonomic processes have damaged the medial border of the element (arrowed in green).

31a Anterior view of right scapula.



31b Posterior view of right scapula.



3.23.5 Romano-British period: ante-mortem fracture location

Table 116 The location of Romano-British female ante-mortem fractures, displayed by side, number and segment.

Element	**Side**	**N**	**Segment**			
			pe	**m1/3**	**d1/3**	**de**
Nasal bones	Right	1/43	-	-	1/43	-
		2.3%	-	-	2.3%	-
	Left	1/42	-	-	1/42	-
		2.4%	-	-	2.4%	-
Ribs	Un-sided	7/530	-	4/530	3/530	-
		1.3%	-	0.8%	0.6%	-
Radius	Left	1/42	-	-	1/37	-
		2.4%	-	-	2.7%	-
Ulna	Left	1/46	-	-	1/42	-
		2.2%	-	-	2.4%	-
Tibia	Right	1/47	1/43	-	-	-
		2.1%	2.3%	-	-	-
	Left	3/46	2/45	-	-	1/45
		6.5%	4.4%	-	-	2.2%
Metacarpals	Un-sided	2/392	-	1/392	1/392	-
		0.5%	-	0.3%	0.3%	-
Tarsals	Un-sided	1/518	-	-	-	-
		0.2%	-	-	-	-
Phalanges	Un-sided	1/1232	-	-	1/1232	-
		0.1%	-	-	0.1%	-

Table 116 shows that the distal third was the most fractured segment. The number of fractured elements in the Romano-British period is far lower than the Iron Age, and the majority were observed in the appendicular skeleton.

3.23.5.1 Romano-British period: ante-mortem fracture type

Table 117 Ante-mortem fracture type observed in Romano-British females, displayed by side and number affected.

Element	Side	Complete	Compression	Oblique	Osteochondritis dissecans	Colles'	Depressed
Nasal bones	Right	1/43	-	-	-	-	-
		2.3%	-	-	-	-	-
	Left	1/42	-	-	-	-	-
		2.4%	-	-	-	-	-
Ribs	Un-sided	3/530	-	1/530	-	-	-
		0.6%	-	0.2%	-	-	-
Radius	Left	-	-	-	-	1/42	-
		-	-	-	-	2.4%	-
Ulna	Left	1/46	-	-	-	-	-
		2.2%	-	-	-	-	-
Tibia	Right	-	-	1/47	1/47	-	-
		-	-	2.1%	2.1%	-	-
	Left	1/46	-	1/46	-	-	1/46
		2.2%	-	2.2%	-	-	2.2%
Metacarpals	Un-sided	1/392		1/392	-	-	-
		0.3%		0.3%	-	-	-
Tarsals	Un-sided	-	1/518	-	-	-	-
		-	0.2%	-	-	-	-
Phalanges	Un-sided	1/1232		-	-	-	-
		0.1%		-	-	-	-

Table 117 shows that the most observed fracture type was complete, however where a specific fracture type could be identified, oblique was the most common.

The female sample has two examples of a tibial plateau fracture. One was observed in a middle adult [117 Maiden Castle Road]. An oblique fracture is present to the medial plateau of the proximal articular surface. The fracture line extends from the medial intercondylar tubercle to the medial margin of the proximal third of the diaphysis. The wedge-shaped segment has become depressed relative to the tibial plateau, but remains in anatomical alignment.

The other example was observed in an older adult female [800 Poundbury Camp], who also had a healed fracture to the middle third of a rib shaft. The fracture is situated on the lateral condyle of the left tibial plateau and conforms to a depressed type (Apley and Solomon 2000, 327). There is slight depression of the surface corresponding to the shape of the lateral femoral condyle, and the fracture site is very well healed. Clinical studies have shown that fractures in this location are particularly common in individuals suffering from osteoporosis. However, the changes observed are not suggestive of an osteoporotic fracture, as the fracture is not comminuted (Apley and Solomon 2000, 327).

The only examples of healed fractures to the nasal bones were observed in a middle adult female [1114 Alington Avenue]. The prevalence of female ante-mortem nasal bone fractures does not change from the Iron Age (Table 113). Unlike the female Iron Age sample (Table 113), a healed complete ulna fracture was observed in a young adult female [1178 Alington Avenue]. Neither female had sustained additional trauma.

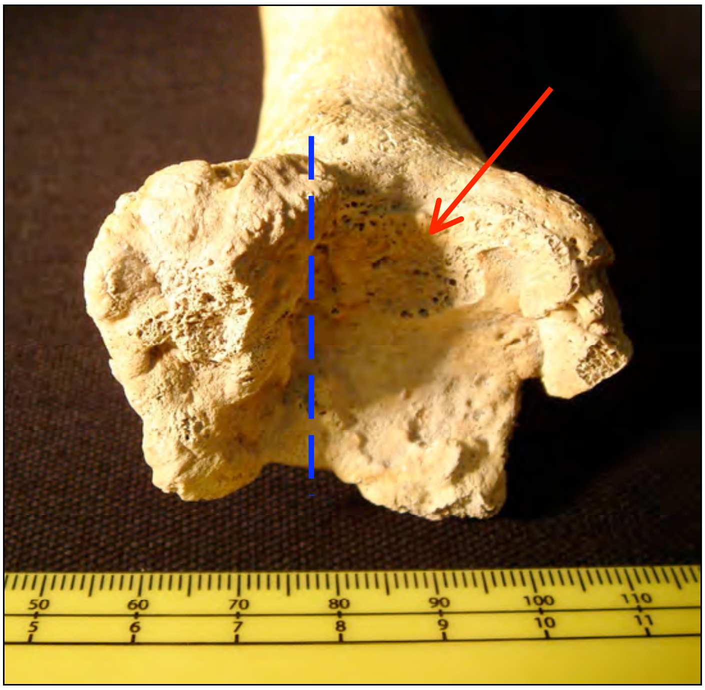
At Poundbury Pipeline, a middle adult female [143] had well healed fractures to the left tibial medial malleolus (complete) and the talar dome (compression) (Figure 32). The margin of the distal articular surface now forms an arc (Figure 32a,b), as the medial malleolus projects more medially and anteriorly than normal; and the anterior-inferior aspect of the lateral portion is flattened with an inferiorly projecting ‘hook’ extension of dense normal cortical bone (myositis ossificans). On the posterior aspect of the distal third, the malleolar groove is rugose and pronounced. The posterior-inferior margin is flattened, irregular and rugose in appearance. The distal articular surface (Figure 32b) has a deep broad groove (25.4 mm in length and 6.2 mm wide) that extends from the anterior margin to the middle of the posterior portion of the surface. The distal articular surface is formed of dense, billowy smooth bone, and has an oval area of secondary osteoarthritic degeneration, consisting of subchondral pitting and eburnation (Buikstra and Ubelaker 1994, 122). The area of osteoarthritic change corresponds to a companion area on the talus, and both indicate that despite a limited range of movement, the female continued to use the ankle joint.

On the medial aspect of the distal third of the left fibula, the attachment for the interosseous ligament is rugose and pronounced (Figure 32a). There is also a small depression in the cortex (15.8 mm in length, 12 mm wide and 3.9 mm in depth), which corresponds to an irregular dense mass on the medial aspect of the tibia that is continuous with the surrounding cortex (19.9mm in length, 12.1 mm wide and 4.9 mm depth). The margins of the articular surface are irregular and show the development of osteophytes. The inferior aspect of the talofibular ligament has been extended inferiorly by the attachment of a small spur of dense porotic lamellar bone formation, which most probably represents tissue ossification (myositis ossificans)(Figure 32a).

The left talus and calcaneus also display degenerative osteoarthritic changes (Buikstra and Ubelaker 1994, 122) to the articular surfaces, consisting of subchondral pitting, marginal osteophytes and eburnation (Figures 32c to 32e). The left talar dome has been compressed by 2 mm, and the element has a splayed appearance (Figure 32d). On the calcaneus, the peroneal tubercle is developed and rugose (Figure 32e).

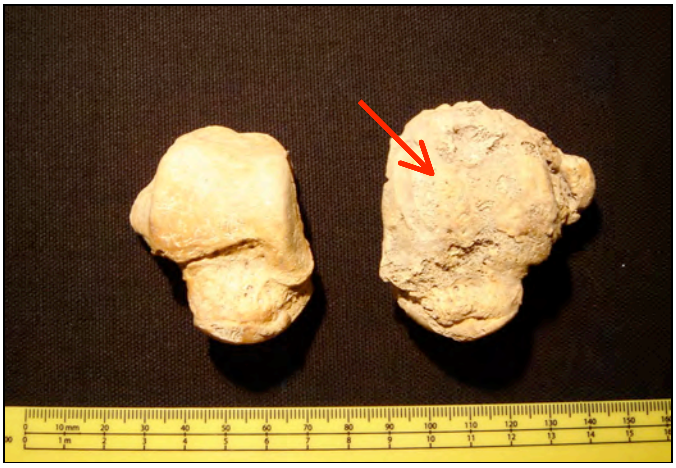
Figure 32: Trauma to the left ankle joint in a middle adult Romano-British female [143 Poundbury Pipeline]

32a Anterior view of the distal thirds of the tibiae and fibulae.



32b Anterior aspect of the distal articular surface of the left tibia. The secondary osteoarthritic changes to the superior aspect of the surface (arrowed red) correspond to those observed on the superior aspect of the talar dome.

The discontinuity in the joint surface is marked in blue and the abnormal morphology of the medial malleolus is evident in this view.



32c Superior view of tali. Eburnation, caused by secondary osteoarthritic changes are arrowed in red.

32d Inferior view of tali.

32e Superior view of calcanei. Alteration of the joint surfaces in the left calcaneus are evident in this view.

3.23.6 Chi-Square test: comparison of females with ante-mortem fractures

Table 118 Chi-Square test comparing the number of Iron Age and Romano-British females with ante-mortem fractures.

	Present	Absent	Total
Iron Age	28	23	51
Romano-British period	16	43	59
Total	44	66	110

Degrees of freedom = 1
Chi-square = 8.798
p is less than or equal to 0.01
The distribution is significant

Table 118 demonstrates that the difference in the number of females with healed fractures present was found to be statistically significant between the two periods.

3.23.7 Iron Age: secondary changes associated with fracture

Table 119 Secondary changes associated with ante-mortem fractures (N), observed in Iron Age females. Deformity includes angulation, rotation, shortening, poor alignment and apposition (section 2.4.8.1).

Element	Degenerative Joint Disease	Deformity	Overlap	Tissue Involvement
Thoracic vertebrae	-	2/4	-	-
	-	50%	-	-
Lumbar vertebrae	-	1/1	-	-
	-	100%	-	-
Ribs	-	2/6	-	-
	-	33.3%	-	-
Humerus	-	1/3	-	-
	-	33.3%	-	-
Radius	-	1/1	-	-
	-	100%	-	-
Tibia	-	-	1/1	1/1
	-	-	100%	100%
Fibula	-	1/1	1/1	-
	-	100%	100%	-
Phalanges	1/1	1/1	-	-
	100%	100%	-	-

The changes observed were directly related to the fracture type and location, especially in the case of the vertebral fractures. Deformity was the most commonly observed secondary change.

3.23.7.1 Assessment of fracture treatment

Table 120 Detail of Iron Age female ante-mortem fractures that may indicate treatment (Grauer and Roberts 1996).

Skeletal Number	Age	Element	Side	Segment	Fracture Type	Amount of Shortening	Apposition	Rotation and/or Angulation
P36 Maiden Castle	Middle Adult	Tibia	Left	d1/3	Oblique	11 mm	100%	None
		Fibula	Left	p1/3	Oblique	-	100%	Slight lateral angulation of the proximal fractured segment

The healed contre-coup fractures were observed in the left tibia and fibula of a middle adult female [P36 Maiden Castle], and may provide evidence to suggest that treatment had taken place. The amount of shortening could not be determined for the fibula, however in the tibia, a difference of 11 mm was noted, which is within the range (10 to 15 mm) allowed in successful modern clinical standards (http://www.wheelessonline.com/ortho/cast_treatment_of_tibial_fractures). There is 100% apposition of the elements, with no rotation and only the fibula displayed slight lateral angulation.

3.23.8 Romano-British period: secondary changes associated with fracture

Table 121 Secondary changes associated with ante-mortem fractures (N), observed in Romano-British females. Deformity includes angulation, rotation, shortening, poor alignment and apposition (section 2.4.8.1).

Element	Degenerative Joint Disease	Deformity
Tibia	2/2	1/1
	100%	100%
Tarsal	1/1	1/1
	100%	100%

Table 121 shows that the number of fractured elements displaying secondary changes associated with ante-mortem fractures was less than in the Iron Age female sample.

3.23.8.1 Assessment of fracture treatment

Table 122 Detail of Romano-British female ante-mortem fractures that may indicate treatment (Grauer and Roberts 1996).

Skeletal Number	Age	Element	Side	Segment	Fracture Type	Amount of Shortening	Apposition	Rotation and/or Angulation
908 Tolpuddle Ball	Middle Adult	5^{th} Metacarpal	Left	d1/3	Oblique	-	100%	Slight inferior angulation of the d1/3
848 Alington Avenue	Adult	4^{th} Metacarpal	Un-sided	m1/3	Complete	-	100%	None

The number of fractured elements that could be assessed for treatment in Romano-British females was limited to two metacarpal fractures, as the remainder of fractured elements either had un-suitable fracture types (e.g. osteochondritis dissecans), or were in locations (e.g. tibial plateau) that today would require orthopaedic surgery. Unfortunately, in both metacarpal elements, the amount of shortening could not be determined macroscopically. The metacarpals show excellent apposition of the fractured portions, the 5^{th} metacarpal fracture [908 Tolpuddle Ball] shows inferior angulation that is macroscopically estimated to be less than 10°, which is within successful modern clinical standards (30°). The lack of rotation and angulation in the 4th metacarpal fracture [848 Alington Avenue] is usually caused by the natural splinting action of adjacent metacarpals (Dye 2005).

3.23.9 Iron Age: fracture injury recidivism (N= 1 individual)

Table 123 The number of Iron Age females with zero to more than two ante- and peri-mortem injuries. The data is shown by the number of females affected at the regional level and in their age group.

Age Group in Years		No Injuries	One Injury	Two Injuries	More than Two Injuries
Young Adult	N of Regional sample	7/51	8/51	1/51	2/51
		13.7%	15.7%	2%	3.9%
	N of Age group	7/18	8/18	1/18	2/18
		38.9%	44.4%	5.6%	11.1%
Middle Adult	N of Regional sample	8/51	4/51	5/51	3/51
		15.7%	7.8%	9.8%	5.9%
	N of Age group	8/20	4/20	5/20	3/20
		40%	20%	25%	15%
Older Adult	N of Regional sample	6/51	1/51	1/51	1/51
		11.8%	2%	2%	2%
	N of Age group	6/9	1/9	1/9	1/9
		66.7%	11.1%	11.1%	11.1%
Adults	N of Regional sample	4/51	-	-	-
		7.8%	-	-	-
	N of Age group	4/4	-	-	-
		100%	-	-	-

In all age groups, the highest prevalence rates were observed in individuals without evidence of fracture, for example in older adults, the prevalence rate was 66.7% (N= 6/9). The prevalence of injuries demonstrated a clear age-related distribution, at both the regional and age group level the lowest prevalence rates were observed in older adult females (N= 1/51, 2%), and the prevalence of injuries was also equally distributed, which was not observed in any other age group. Middle adult females at the regional level had the highest prevalence of two or more injuries (N= 3/51, 5.9%) however, it was young adult females at the regional level who had the highest prevalence rate for one injury (N= 8/51, 15.7%).

3.23.10 Iron Age: fracture injury recidivism mechanism

Table 124 The fracture injury mechanism observed in Iron Age females with one or multiple injuries (over two) (N= 1 injured individual).

Injury Mechanism	One Injury	Multiple Injuries
Violence	2/26	15/26
	7.7%	57.7%
Violent and/or Accident	4/26	1/26
	15.4%	3.9%
Unknown	5/26	1/26
	19.2%	3.9%

The distribution of injury mechanism was dominated by violence, especially for multiple injuries, which had the highest overall prevalence rate (N= 15/26, 57.7%). The second highest prevalence rate was observed for individuals who sustained single injuries caused by an unknown mechanism (N= 5/26, 19.2%). The violent and/or accident mechanism had a higher prevalence rate for single injuries (N= 4/26, 15.4%) compared to multiple injuries (N= 1/26, 3.9%). The lowest prevalence rates were observed for multiple injuries caused by violent and/or accident (N= 1/26, 3.9%), and unknown (N= 1/26, 3.9%) mechanisms.

These results indicate that more individuals are present with multiple injuries, which may be a consequence of the bias towards peri-mortem fractures observed at Maiden Castle. It also indicates that the majority of peri- and ante-mortem injuries were probably created by violent mechanisms.

3.23.11 Romano-British period: fracture injury recidivism

Table 125 The number of Romano-British females with zero to more than two ante- and peri-mortem injuries. The data is shown by the number of females affected at the regional level and in their age group.

Age Group in Years		No Injuries	One Injury	Two Injuries	More than Two Injuries
Young Adult	N of Regional sample	20/59	4/59	-	1/59
		33.9%	6.8%	-	1.7%
	N of Age group	17/25	4/25	-	1/25
		77.3%	18.2%	-	4.5%
Middle Adult	N of Regional sample	12/59	4/59	-	-
		20.3%	6.8%	-	-
	N of Age group	12/16	4/16	-	-
		75%	25%	-	-
Older Adult	N of Regional sample	4/59	1/59	1/59	1/59
		6.8%	1.7%	1.7%	1.7%
	N of Age group	4/7	1/7	1/7	1/7
		57.1%	14.3%	14.3%	14.3%
Adults	N of Regional sample	9/59	2/59	-	-
		15.3%	3.4%	-	-
	N of Age group	9/11	2/11	-	-
		81.8%	18.2%	-	-

The majority of females in the region during the Romano-British period did not have evidence for injury/ies, especially the young adults (N= 20/59, 33.9%), a trend observed in the male sample. In all age groups, females with injuries had the highest prevalence rates for single injuries. At the regional level, young and middle adults have the highest prevalence rates (N= 4/59, 6.8% respectively), but only middle adults have the highest prevalence rates at the age group level (N= 4/16, 25%). This result at the age group level was also observed for older adults (N= 1/7, 14.3%) and adults (N= 2/11, 18.2%).

In direct contrast to the Romano-British male sample, young and middle adults had two injuries; females with two injuries were only observed in those older adults (N= 1/59, 1.7% at the regional level). Females with more than two injuries were only observed in young adults and older adults (N= 1/59, 1.7% respectively at the regional level). Again, female older adult data contrasts with the male sample, as these females have the highest prevalence rate at the age group level (N= 1/7, 14.3%).

3.23.12 Romano-British period: fracture injury recidivism mechanism

Table 126 The injury mechanism observed in Romano-British females with one or multiple injuries (over two) (N=1injured individual).

Injury Mechanism	**One Injury**	**Multiple Injuries**
Violence	1/14	-
	7.1%	-
Accident	1/14	-
	7.1%	-
Violent and/or Accident	7/14	2/14
	50%	14.3%
Unknown	4/14	1/14
	28.6%	7.1%

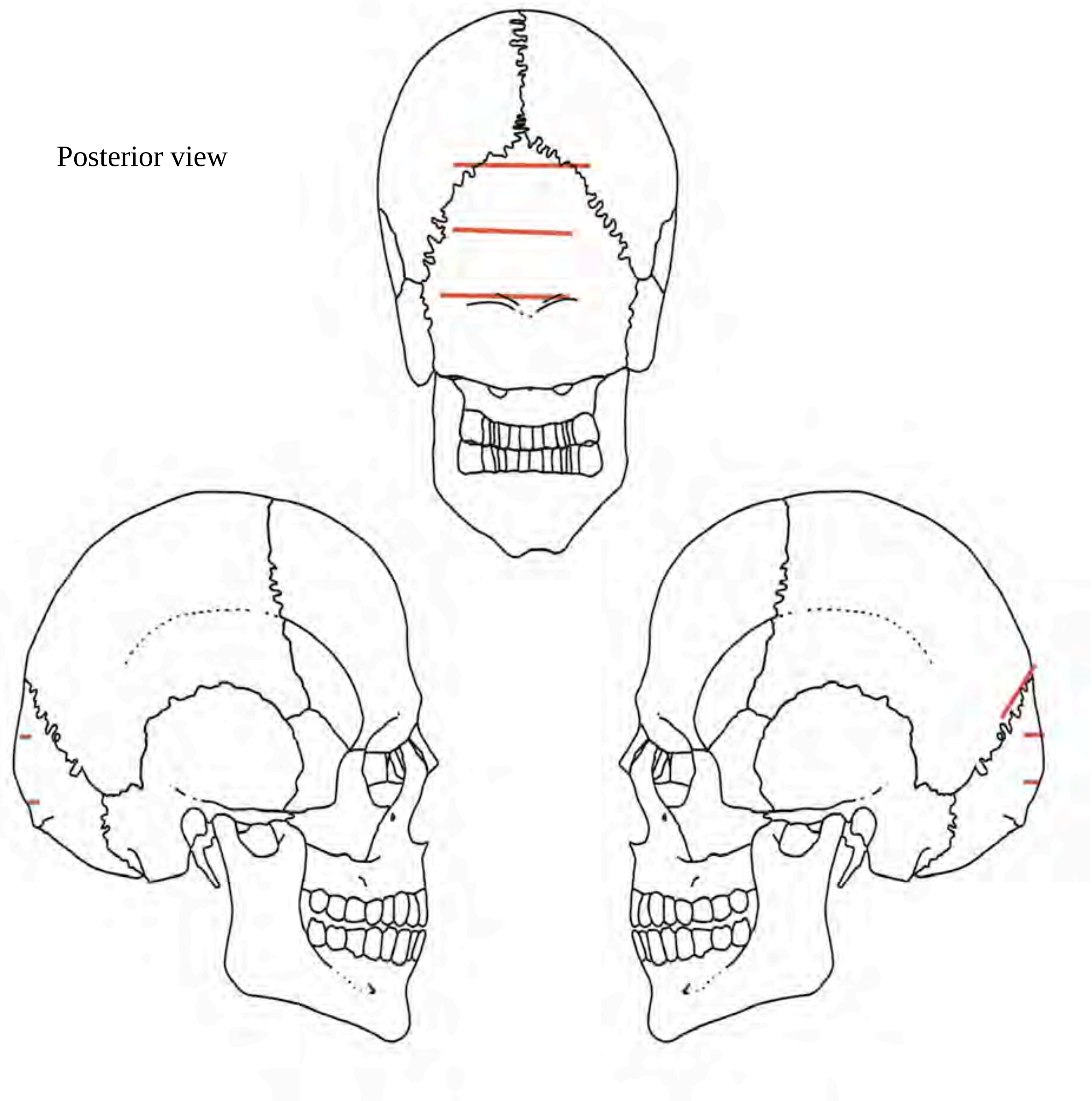
The highest prevalence rates were observed for single injuries caused by violent and/or accidental mechanims (N= 7/14, 50%), followed by unknown (N= 4/14, 28.6%). In direct contrast to the male sample, no multiple injuries were produced solely by violent mechanisms.

In comparison to the Iron Age male and female data, the number of injury recidivists in the region is far lower, only in the single and no injury categories are all age groups represented.

3.24 Sharp-force weapon injuries

Evidence for sharp-force weapon injury was only observed in Iron Age females, and unlike the Iron Age male sample, all observable instances were peri-mortem (Figure 33).

Figure 33: Diagram showing the location of cranial peri-mortem sharp-force weapon injuries in Iron Age females



(after Buikstra and Ubelaker 1994, attachments 6b -7b).

3.24.1 Iron Age: location of peri-mortem cranial sharp-force weapon injury

Table 127 Location of peri-mortem sharp-force weapon injury to the cranium observed in Iron Age females, displayed by side, number and aspect affected.

Element	Side	N	Superior	Lateral	Posterior
Parietal bones	Right	1/48	-	-	1/48
		2.1%	-	-	2.1%
	Left	1/47	-	-	1/47
		2.1%	-	-	2.1%
Temporo-Sphenoid bones	Right	1/48	-	1/48	-
		2.1%	-	2.1%	-
Occipital bone	Un-sided	1/48	1/48	-	-
		2.1%	2.1%	-	-

The parietal bones sustained the most sharp-force weapon injury, all of which was directed at the posterior aspect of the elements. Crania with sharp-force weapon injuries (section 3.20.1.1) were fractured by blows directed to the lateral-frontal and mid occipital portions. For example, P5 a young adult female [Maiden Castle] had a penetrating sharp-force weapon injury to the superior portion of the lambdoidal suture, the energy from which had opened the suture and produced linear fractures in the right parietal bone, temporal and occipital bones. The superior portion of the left temporal bone is absent, forming an oval cavity. The injury is accompanied by multiple linear fractures extending into the parietal and frontal bones.

The occipital bone of P5 [Maiden Castle] has a linear sharp-force injury (41.9 mm) to the superior-lateral aspect, which has penetrated both cranial tables, causing bevelling on the superior margin, and the production of a wastage fragment (no longer present). The second linear injury is inferior to the first; it also has bevelling on the superior margin, and has penetrated both tables. The injury was accompanied by two linear fractures at the termini of the injury, which extend to the foramen magnum creating a large rectangular piece of wastage

(65 mm in length and 29.5 mm in width). Unfortunately, it has been glued back on to the cranium and the injury can only be partially observed. The third injury is located on the temporal element at the anterior portion of the zygomatic process. There is rectangular area of bevelling on the lateral aspect (23.6 mm in length) and posterior portion of the zygomatic bone is absent. Although due to post-mortem abrasion, it is not clear whether it was caused by peri-mortem fracturing and/ or the creation of a wastage fragment. No injuries were observed on the mandible or cervical vertebrae, although an ‘attempt’ at decapitation cannot be ruled out.

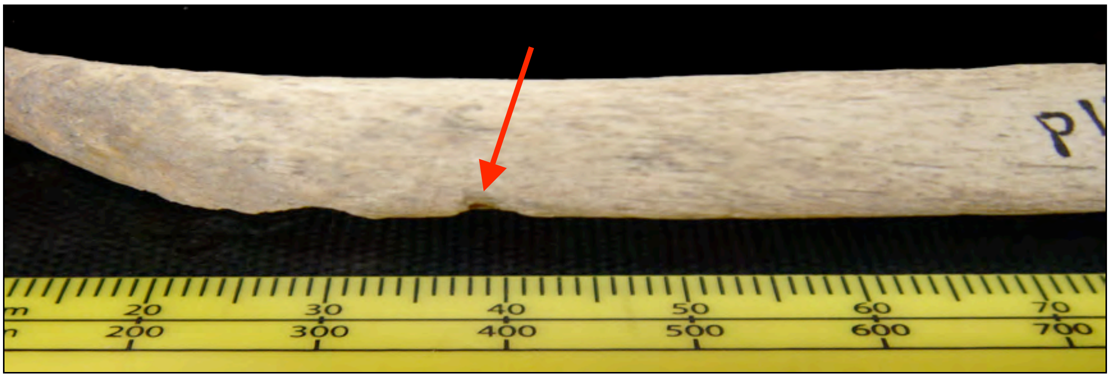
3.24.2 Iron Age: location of peri-mortem post-cranial sharp-force weapon injuries

Table 128 Location of peri-mortem sharp-force weapon injuries to the post-cranial skeleton in Iron Age females, displayed element, side, number, segment and aspect affected.

Element	**Side**	**N**	**Segment**	**Anterior**	**Posterior**
Ribs	Un-sided	1/774	-	1/774	-
		0.1%		0.1%	-
Tibia	Left	1/48	p1/3	-	1/44
		2.1%		-	2.3%
Fibula	Left	1/42	p1/3	-	1/42
		2.4%		-	2.4%

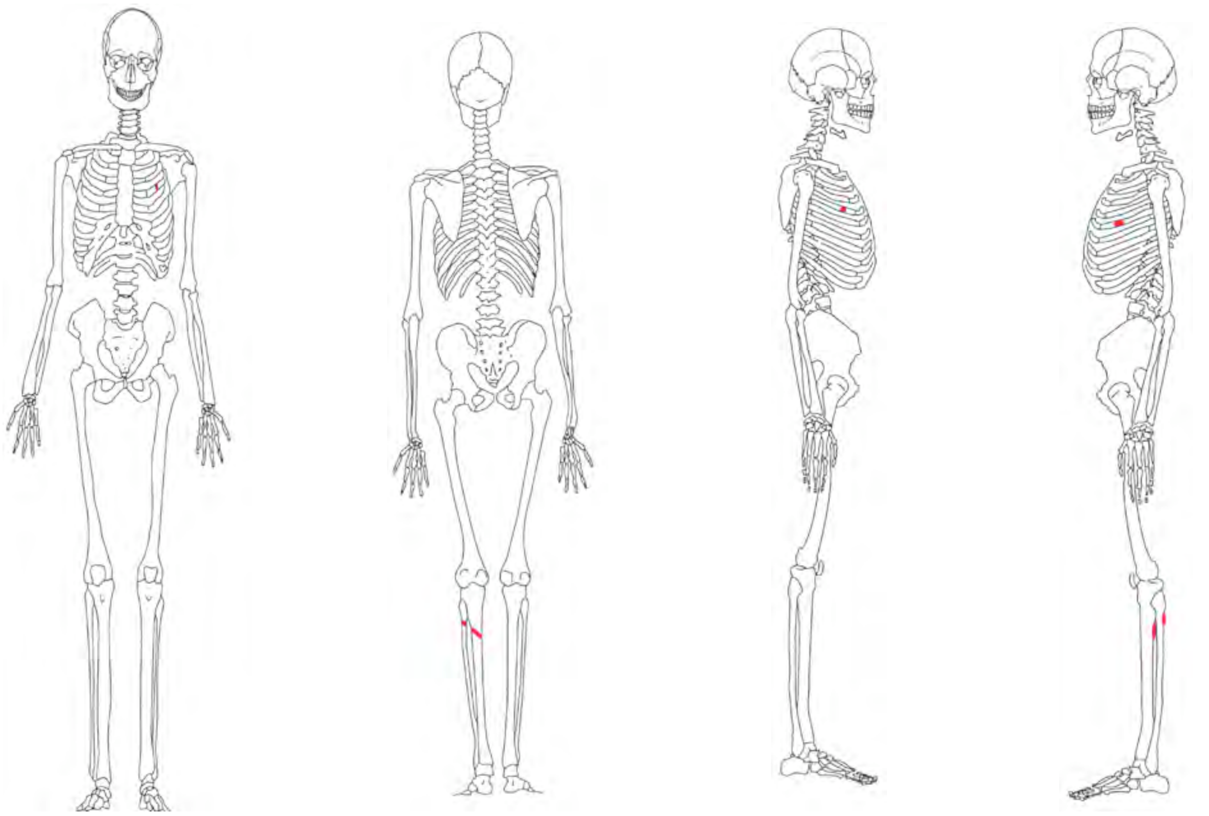
Only two females from Maiden Castle [P14 and P19] displayed peri-mortem sharp-force weapon injuries, both of who also have peri-mortem blunt-force trauma and sharp-force injuries to the cranium (Figures 34 and 35). P14 a young adult female, had three small linear cut marks on the anterior aspect of the middle third of a rib, which have forced the outer cortex into the trabecular bone. Two cut marks were at an oblique angle, and the third was perpendicular to the long axis. Also present is a cut mark on the inferior aspect of the rib, anterior to the angle (Figure 34). The young adult female (P14) also had multiple sharp-force weapon injuries to the occipital and right temporal bones.

Figure 34: Post-cranial sharp-force weapon injuries in Iron Age females.
34a Anterior view of a right rib from a young adult. The peri-mortem sharp-force weapon injury is arrowed [P14 Maiden Castle].



34b Posterior aspect of the left tibia and fibula, showing the oblique sharp-force weapon injuries to the proximal third (arrowed). Observed in a young adult [P19 Maiden Castle].

Figure 35: Diagrams showing the location of post-cranial peri-mortem sharp-force weapon injuries in Iron Age females



35a Anterior view. 35b Posterior view. 35c Right lateral view. 35d Left lateral view.

(after Buikstra and Ubelaker 1994, attachments 3a-4b)

A middle adult female P19 has sharp-force weapon injuries to the posterior aspect of the proximal third of the left tibia and fibula. The sharp-force weapon injury has removed a portion of the outer cortex (wastage fragment), forming an inferiorly extending oblique line, which may have been produced by one blow. This individual also has blunt-force cranial trauma.

3.24.3 Iron Age: sharp-force weapon injury recidivism

Table 129 The number of Iron Age females with zero to more than two peri-mortem sharp-force weapon injuries. The data is shown by the number of females affected at the regional level and in their age group.

Age Group in Years		No Injuries	One Injury	Two Injuries	More than Two Injuries
Young Adult	**N of Regional sample**	13/49	1/49	-	1/49
		26.5%	2.0%	-	2.0%
	N of Age group	13/15	1/15	-	1/15
		86.7%	6.7%	-	6.7%
Middle Adult	**N of Regional sample**	17/49	-	1/49	-
		34.7%	-	2.0%	-
	N of Age group	17/18	-	1/18	-
		94.4%	-	5.5%	-
Older Adult	**N of Regional sample**	11/49	-	-	-
		22.4%	-	-	-
	N of Age group	11/11	-	-	-
		100%	-	-	-
Adults	**N of Regional sample**	6/49	-	-	-
		12.2%	-	-	-
	N of Age group	6/6	-	-	-
		100%	-	-	-

The majority of females in the sample did not have any osseous evidence for sharp-force weapon injuries, as only three individuals had observable lesions. No clear pattern was observed, as the females were equally distributed among the age categories. The young adult female [P14 Maiden Castle] with more than two injuries had three (observable) sharp-force weapon injuries to the cranium. On the supero-lateral aspect of the occipital bone, a linear sharp-force injury (41.9 mm) penetrated both cranial tables, creating bevelling on the superior margin, and produced a fragment of wastage (no longer present). The second linear injury is inferior to the first, with bevelling on the superior margin and it has penetrated both tables. The second injury was accompanied by two linear fractures at the termini of the blow, which extend to the foramen magnum creating a large rectangular piece of wastage (65 mm in length and 29.5 mm in width). Unfortunately, the wastage flake has been glued back on to the cranium and the injury can only be partially observed. The third injury is located on the temporal bone at the anterior portion of the zygomatic process. There is a rectangular area of bevelling on the lateral aspect (23.6 mm in length) and the posterior portion of the zygomatic element is absent. Although due to post-mortem abrasion, it is not clear whether this resulted from peri-mortem fracturing and/or the creation of a wastage fragment. No trauma was present on the mandible or cervical vertebrae.

None of the females with two or more injuries had sharp-force weapon injuries to the cranial and post-cranial elements. In all cases, the injuries were directed to the posterior aspect.

3.25 Neoplasms

Benign neoplasms were observed in the Iron Age and Romano-British female samples, whereas malignant neoplastic changes were only recorded in the Romano-British sample.

3.25.1 Iron Age: benign osteochondroma

Table 130 Location of benign osteochondromas observed in an Iron Age female [1364 Poundbury Camp], displayed by side, number and segment affected.

Element	Side	N of elements	N of p1/3 segment
Tibia	Right	1/49	1/46
		2%	2.2%
	Left	1/48	1/44
		2.1%	2.3%

The benign osteochondromas were observed in a young adult female [1364 Poundbury Camp] and were confined to the tibiae. The neoplasms extended inferiorly from the inferior margin of the medial condyles, and have a 'hook-like' appearance (Figure 36).

Figure 36: Anterior view of the tibiae and fibulae, showing the benign neoplastic changes (arrowed) in a young Iron Age adult female [1364 Poundbury Camp].

3.25.2 Romano-British period: benign osteochondroma

Table 131 Location of the benign osteochondroma observed in a Romano-British female [104 Poundbury Pipeline], displayed by side, number and segment affected.

Element	**Side**	**N of elements**	**N of d1/3 segment**
Fibula	Right	1/48	1/47
		2.1%	2.1%

The benign osteochondroma was observed in a young adult female [104 Poundbury Pipeline] (Figure 37). It is located on the medial aspect of the distal third segment, superior to the supra-articular margin (taphonomically damaged post-mortem). The osteochondroma consists of an irregular dense mass of lamellar bone formation (19.9 mm in length, 12.1 mm wide and 4.9 mm in depth), which is continuous with the surrounding cortex. On the lateral aspect of the distal third of the right tibia, there is a ‘companion’ depression (15.8 mm in length, 12 mm wide and 3.9 mm in depth) into the cortex. The depression is formed of normal cortical bone, but the superior margin has more porosity present.

Figure 37: Benign neoplastic change in a young Romano-British adult female [104 Poundbury Pipeline].

37a Antero-medial view of the distal third of the right fibula.

37b Lateral aspect of the distal third of the right tibia and antero-medial aspect of the distal third of the right fibula. The osteochondroma on the fibula is arrowed (red) and the corresponding depression on the tibia is also marked (blue).

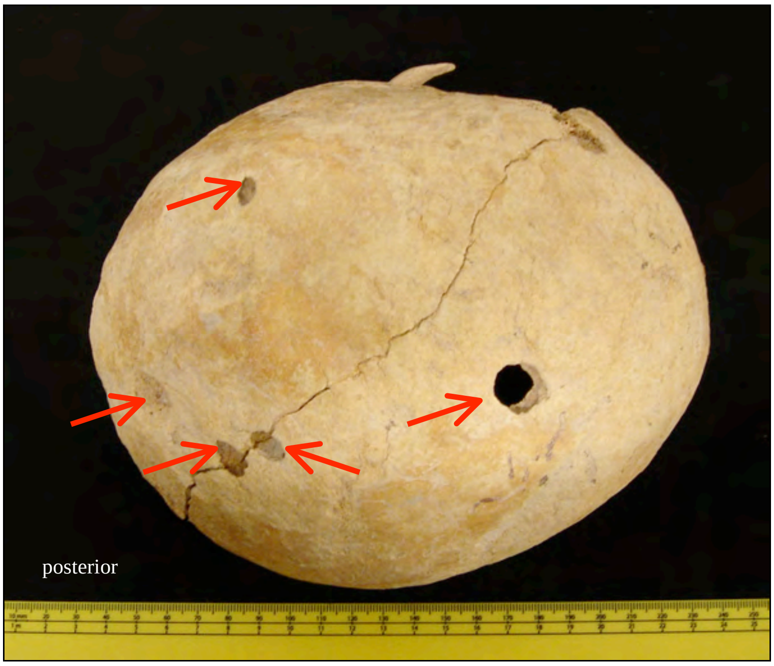
3.25.3 Romano-British period: malignant neoplasm

Table 132 The distribution of axial and appendicular elements with evidence of multiple myeloma observed in an older adult female [3 Poundbury Camp]. Displayed by side and number affected.

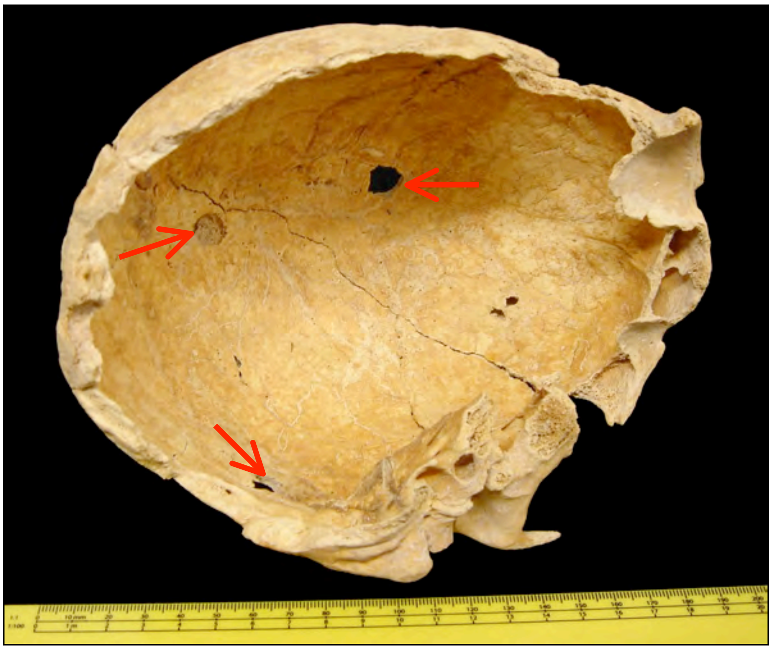
Element	Right	Left	N
Frontal bone	1/44	1/46	-
	2.3%	2.2%	-
Parietal bone	1/42	1/42	-
	2.4%	2.4%	-
Occipital bone	-	-	3/42
	-	-	7.1%
Temporal bone	1/43	1/42	-
	2.3%	2.4%	-
Zygomatic bone	1/39	1/38	-
	2.6%	2.6%	-
Maxilla	1/39	1/39	-
	2.6%	2.6%	-
Mandible	1/38	1/37	-
	2.6%	2.7%	-
Thoracic Vertebrae	-	-	2/345
	-	-	0.6%
Lumbar Vertebrae	-	-	1/160
	-	-	0.6%
Sternum	-	-	1/18
	-	-	5.6%
Ilium	1/45	1/47	-
	2.2%	2.1%	-
Ischium	1/33	1/38	-
	3.0%	2.6%	-
Pubis	1/30	1/27	-
	3.3%	3.7%	-
Femur	1/46	1/48	-
	2.2%	2.1%	-

The destructive changes caused by a malignant neoplasm were observed macroscopically and radiographically in an older adult female [3 Poundbury Camp] (Figure 38). The most marked changes were observed in the cranium, which macroscopically, had nine lesions present. The majority of lesions had penetrated both cranial tables. Radiographic analysis demonstrated that lesions were also present in thoracic and lumbar vertebrae, sternum, pelvis, and femora. The destructive lesions conform to the palaeopathological and clinical criteria of multiple myeloma (Resnick 2002e; Ortner 2003, 376-382).

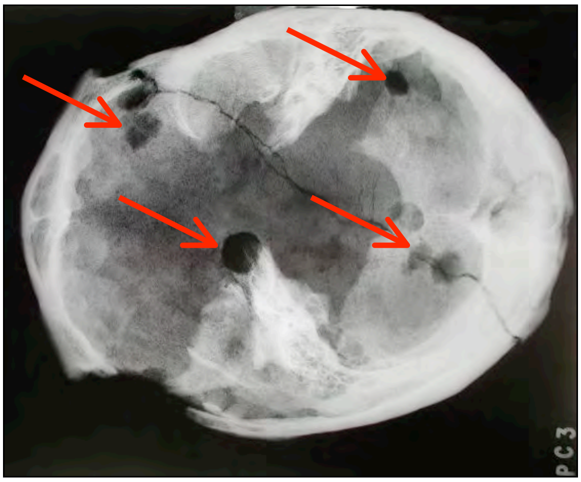
Figure 38: Malignant neoplastic change in an older Romano-British adult female [3 Poundbury Camp].



38a Superior view of the cranium. The ante-mortem destructive lesions to the cranium are arrowed.



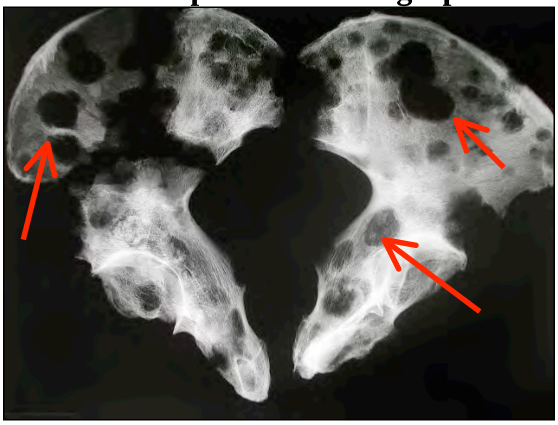
38b Endocranial view, the destructive lesions are arrowed.



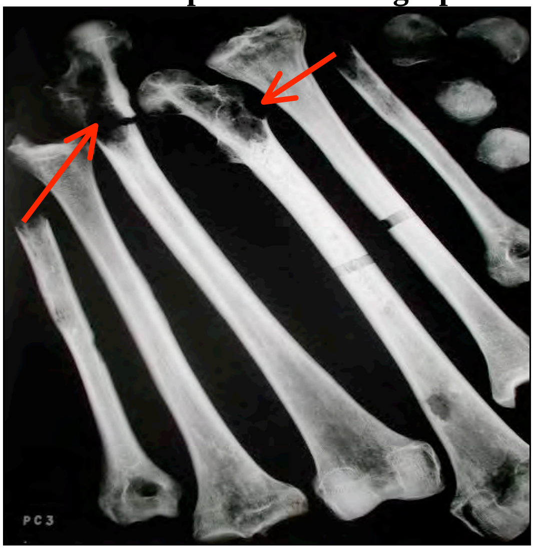
38c Supero-inferior radiograph of the cranium.

Examples of the destructive lesions are arrowed in 38c. to e.

38d Anterior-posterior radiograph of the ilia and ischiums.



38e Anterior-posterior radiograph of femora, tibiae, and humerii.



3.26 Developmental Anomalies

Developmental anomalies were not observed for the Iron Age and were only recorded in one individual from the Romano-British period.

3.26.1 Romano-British period: dyschondrosteosis (Langer type dwarfism) and mild Madelung deformity

Table 133 Summary table showing the elements affected by dyschondrosteosis and mild Madelung deformity in a young adult female [766 Alington Avenue].

Element Affected	Right	Left
Mandible	1/38	1/37
	2.6%	2.7%
Radius	1/43	1/42
	2.3%	2.4%
Ulna	1/46	1/46
	2.2%	2.2%
Tibia	1/47	1/46
	2.1%	2.2%
Fibula	1/48	1/48
	2.1%	2.1%

A young adult female [766 Alington Avenue] displays dyschondrosteosis, a rare and unusual form of dwarfism (Langer 1967; Rogers 2002, 154-157) (Figure 39a to 39g), and mild bilateral Madelung deformity to the radius and ulna (Langer 1967, 659; Aufderheide and Rodríquez-Martín 1998, 72). The radial changes are bilateral, the distal articular surface is triangular and tilted to the palmar and ulnar aspect (Figure 39c, d). However, the ulna does not appear to be dislocated, and the remaining carpals are normal in appearance, apart from the right radial-scaphoid articular surface, which is enlarged and has a pronounced margin (Figure 39e). Nevertheless, the ulna is longer than the radius, the head is enlarged, but not distorted (Aufderheide and Rodríquez-Martín 1998, 72).

3.26.1.1 Measurements

Table 134 Comparison of the measurements of the elements affected by dyschondrosteosis and mild Madelung deformity and those from a Romano-British female of average stature.

Element (left)	Measurement (mm)	766	Average
Mandible	Length	89.30	91.1
Radius	Maximum Length	102	202
	Anterior-Posterior Diameter	8.7	10.8
	Medial-Lateral Diameter	16.3	14.7
Ulna	Maximum Length	122	221
	Anterior-Posterior Diameter	9.2	10.7
	Medial-Lateral Diameter	13.9	12.5
Tibia	Length	187	336
	Maximum Proximal Epiphyseal Breadth	68.9	68.3
	Maximum Distal Epiphyseal Breadth	54.2	50.9
	Maximum Diameter at Nutrient Foramen	23.9	28.9
	Medial-Lateral Diameter at Nutrient Foramen	25.2	23.7
	Circumference at the Nutrient Foramen	83	90
Fibula	Maximum Length	204	325

The effect that the dwarfism has had upon bone morphology is marked when the measurements are compared with a female of average stature (156 cm) from the region. Interestingly, the anterior-posterior diameter of the ulna and the maximum proximal epiphyseal breadth are very similar.

Figure 39: Dyschondrostosis with mild Madelung deformity observed in a Romano-British young adult female [766 Alington Avenue]

39a Superior view of the mandible.

39b Right lateral view of the right mandible.

39c Anterior view of the upper limbs.

39d Superior view of the right wrist joint.

39e Superior view of the hand elements.

39f Superior view of the femora, tibiae and fibulae.

39g Superior view of the foot elements.

3.27 Circulatory Disease

Evidence for the disease type was only observed in the Romano-British female sample.

3.27.1 Romano-British period: hypertrophic osteoarthopathy

Table 135 Summary table showing the elements with evidence for hypertrophic osteoarthropathy by side, aspect, segment and osseous response observed.

		Lamellar bone formation				Sclerotic bone formation				Woven bone formation		
Element	**Side/ Aspect**	**N**	**p1/3**	**m1/3**	**d1/3**	**N**	**p1/3**	**m1/3**	**d1/3**	**N**	**p1/3**	**m1/3**
Scapula	Right	-	-	-	-	-	-	-	-	1/42	-	-
	Anterior	-	-	-	-	-	-	-	-	2.4%	-	-
	Left	-	-	-	-	-	-	-	-	1/42	-	-
	Anterior	-	-	-	-	-	-	-	-	2.4%	-	-
Humerus	Right	1/48	-	-	1/46	-	-	-	-	-	-	-
		2.1%	-	-	2.2%	-	-	-	-	-	-	-
	Left	1/51	-	-	1/51	-	-	-	-	-	-	-
		2%	-	-	2%	-	-	-	-	-	-	-
Ulna	Right	1/46	1/46	1/44	1/39	-	-	-	-	-	-	-
		2.2%	2.2%	2.3%	2.6%	-	-	-	-	-	-	-
	Left	1/46	1/46	1/45	1/42	-	-	-	-	-	-	-
		2.2%	2.2%	2.2%	2.4%	-	-	-	-	-	-	-
Radius	Right	-	-	-	-	1/43	1/43	1/42	1/40	-	-	-
		-	-	-	-	2.3%	2.3%	2.4%	2.5%	-	-	-
	Left	-	-	-	-	1/42	1/42	1/40	1/37	-	-	-
		-	-	-	-	2.4%	2.4%	2.5%	2.7%	-	-	-
Femur	Right	-	-	-	-	-	-	-	-	1/46	1/46	1/46
		-	-	-	-	-	-	-	-	2.2%	2.2%	2.2%
	Left	-	-	-	-	-	-	-	-	1/48	1/47	1/48
		-	-	-	-	-	-	-	-	2.1%	2.1%	2.1%
Tibia	Right	-	-	-	-	-	-	-	-	1/46	1/46	1/47
		-	-	-	-	-	-	-	-	2.2%	2.2%	2.1%
	Left	-	-	-	-	-	-	-	-	1/46	1/45	1/45
		-	-	-	-	-	-	-	-	2.2%	2.2%	2.2%
Metacarpals	Unsided	-	-	-	-	-	-	-	-	10/392	10/392	10/392
		-	-	-	-	-	-	-	-	2.5%	2.5%	2.5%
Metatarsals	Unsided	-	-	-	-	-	-	-	-	10/389	10/389	10/389
		-	-	-	-	-	-	-	-	2.6%	2.6%	2.6%
Phalanges	Unsided	1/1232	1/1232	1/1232	1/1232	-	-	-	-	-	-	-
		0.1%	0.1%	0.1%	0.1%	-	-	-	-	-	-	-

The disease affected a young adult female [2.22 Fordington Old Vicarage] (Figure 40) and the periosteal new bone response varied from older lamellar bone, to new woven bone formation. The new layers of bone formation were finer on the arms, whereas those on the leg bones (particularly on the tibia) were denser and thicker. In the long and short bones, the distribution was particularly focused on the middle and distal thirds of the diaphyses.

Figure 40: Hypertrophic osteoarthropathy in a Romano-British young adult female [2.22 Fordington Old Vicarage]

40a Superior view of the left metatarsals, the deposits of new woven bone formation are arrowed.

40b Posterior view of the right 5th metacarpal and left lateral views of the 2nd to 4th right metacarpals.

40c Anterior view of right scapula showing the new bone formation to the superior aspect of the element.

3.28 Chapter summary: temporal changes

- **Total sample** N= 270.
  - A chi-square test demonstrates that there is no statistical significance between the numbers of males and females included in the sample, therefore, no significant difference between archaeological periods.

- **Total sample demography**: majority of individuals died during young adulthood. Male mortality is greatest in all age groups.

- **Stature**: average male attained stature does not change through time. Average female stature reduces in the Romano-British period.

- **Indicators of stress**: differences in the number of elements and dentition displaying an osseous response were found to be statistically significant through time in both sexes.

- **Metabolic disease**: the difference in the number of male orbits and cranial bones displaying cribra orbitalia and porotic hyperostosis were found to be statistically significant between the Iron Age and Romano-British period.

- **Non-specific infectious disease**: the difference in the number of males and female lower long bones displaying periosteal new bone formation were found to be statistically significant between the Iron Age and Romano-British period.

- **Specific infectious disease**: the number of individuals displaying a healed tubercular infection increases through time.

- **Dental health**: differences in the number of dental positions with evidence for ante-mortem tooth loss, periodontal disease, and abscesses were found to be statistically significant in females through time. The same result was found for males, except for periodontal disease. The prevalence of caries increases in the Romano-British period, particularly in females.

- **Fractures**:
  - the difference in the number of Iron Age and Romano-British females and males with ante-mortem fractures was found to be statistically significant.
  - tibial plateau fractures were only observed in Romano-British females.
  - the number of injury recidivists is higher in the Iron Age.

- **Sharp-force weapon injuries**: peri- and ante-mortem injuries were only observed in the Iron Age. The majority of individuals affected were young males.

- **Neoplasms**: malignant neoplasms were only observed in the Romano-British period.

- **Circulatory disease**: evidence for hypertrophic osteoarthropathy was only observed in a young adult female [2.22 Fordington Old Vicarage].

- **Surgical intervention**: evidence was only observed in the Romano-British period, in a young adult male [852 Alington Avenue] and consisted of an amputation to the right humerus.

- **Developmental anomalies**: one female from the Romano-British period [766 Alington Avenue] was affected by dyschondrosteosis and mild bi-lateral Madelung deformity.

3.28.1 Iron Age

- **Total sample** N= 115, male N= 64 and female N= 51.

- **Demography**: males have the highest number of individuals in the young and older adult age groups. Only the middle adult group has equal age-at-death percentages for males and females.

- **Stature**: average male stature is 169.2 cm and 156.2 cm in females.

- **Indicators of stress**: there is a statistically significant difference between the number of male and female elements and dentition displaying an indicator of stress.

- **Metabolic disease**: cribra orbitalia and porotic hyperostosis were the only changes observed. The majority of changes were healed. Only the difference in the number of male and female cranial bones with evidence for porotic hyperostosis was found to be statistically significant.

- **Non-specific infectious disease**: the tibia was the most affected element by periosteal new bone formation, and the majority of responses were of lamellar bone and healed.

- **Specific infectious disease**: only one middle adult male [AB 2 Tarrant Hinton] has a healed tubercular infection to the lumbar spine.

- **Dental health**: differences in the number of dental positions with evidence for ante-mortem tooth loss and, maxillae and mandibles with periodontal disease was statistically significant between the sexes. The difference in the number of teeth displaying calculus, carious lesions, and dental wear was also statistically significant between the sexes.

- **Fractures**:
    - **Peri-mortem fractures:** males had the highest prevalence rates for peri-mortem blunt force trauma, but the result is not statistically significant. Males and females had evidence for peri-mortem fractures produced by inter-personal violence. Only in males, was the location of peri-mortem fractures not observed in the ante-mortem data. For both sexes, the right parietal bone was the most commonly fractured cranial bone; in post-cranial skeleton, the most fractured elements in males were the left ulna and ribs. The most fractured segments were the middle third. In females, the rib elements sustained the most fractures, and no particular fracture type predominated.

- **Ante-mortem fractures**: in males, the most fractured elements were the lumbar vertebrae, ribs, and left clavicle; and the proximal third was the most fractured segment. The most commonly observed fracture type was complete and osteochondritis dissecans. Females sustained more fractures to the ribs, thoracic vertebrae and right humerus, and have the only examples of fractures to the frontal bone, nasal bones, scapula, metacarpal, phalanges, and tarsals. In females, the most frequently fractured segments were the proximal and distal thirds.
- **Assessment of fracture treatment**: two male humerii, and a female contre-coup fracture to the left tibia-fibula show evidence for treatment.
- **Fracture injury recidivism**: the majority of males sustained one or two injuries. The young male adult age group had the highest prevalence rates at both the regional and age group level. Middle adult males had the highest prevalence rate for more than two injuries. Middle adult females at the regional level had the highest prevalence of two or more injuries, and young adult females at the regional level had the highest prevalence rate for one injury.
- **Injury recidivism fracture mechanism**: the majority of individuals, sustained injuries produced by violent mechanisms.

- **Sharp-force weapon injuries**: in both sexes, the majority of injuries were sustained to the skull. The majority of post-cranial injuries were focused to the arm and ribs. Only one male [P7A Maiden Castle] has evidence of an embedded weapon to the 12^{th} thoracic vertebra. Ante-mortem injuries were only observed in three males. Young adult males sustained the majority of injuries.

- **Neoplasms**: only a young adult female [1364 Poundbury Camp] had benign osteochondromas at the proximal thirds of the tibiae.

3.28.2 Romano-British period

- **Total sample** N= 155, male N= 96 and female N= 59.

- **Demography**: the majority of the sample died before reaching older adulthood, with the majority of males dying in young adulthood. Male mortality exceeded female in all age categories. The majority of females died during middle adulthood.

- **Stature**: mean male stature is 169 cm and 153 cm in females.

- **Indicators of stress**: statistical tests demonstrate that the difference in the number of male and female elements and dentitions displaying an indicator of stress was statistically significant.

- **Metabolic disease**: cribra orbitalia and porotic hyperostosis were the only changes observed, the majority of which were healed. The difference in the number of orbits with cribra orbitalia was found to be statistically significant between males and females.

- **Non-specific infectious disease**: the tibia was the most affected element, and the majority of changes observed were healed, and of lamellar bone formation.

- **Specific infectious disease**: the only disease observed was tuberculosis. Two middle adult females displayed healed response to axial [1128 Poundbury Camp] and appendicular elements [223 Poundbury Camp].

- **Dental health**: the difference in the number of teeth displaying wear, calculus, carious lesions, was found to be statistically significant between males and females; as was the number of dental positions with evidence for abscesses and maxillae and mandibles with periodontal disease.

- **Trauma**:
  - **Peri-mortem fractures:** cranial fractures were only observed in one middle adult male [EU 1.3.216 Hod Hill].
  - **Ante-mortem fractures**: in males, the most commonly fractured elements were the rib and left tibia. The middle and distal thirds were the most fractured segments. The most observed fracture types were oblique and complete. In females, ribs were the most fractured elements, the distal third was the most fractured segment, and the most commonly observed fracture type was oblique.
  - **Assessment of fracture treatment**: in males, one middle adult individual [6 Poundbury Camp] had a healed left middle third tibia fracture that suggested a lack of, or inadequate treatment. In females, the only fractured elements that could

be assessed were metacarpal fractures, which most probably display a combination of natural and medical practices.

- **Fracture injury recidivism**: in males, middle adults at the regional level had the highest prevalence rate for one injury. Young adult males had the highest prevalence rates for two or more injuries. In females, all age groups displayed the highest prevalence rates for one injury. Evidence for two injuries was only observed in younger and older adults.

- **Injury recidivism fracture mechanism**: for both sexes, the majority of injuries were caused by violence and/or accidental mechanisms. No multiple injuries were caused by violence in the female sample, and only two males had multiple injuries produced by violent mechanisms.

- **Sharp-force weapon injuries**: none was observed in the sample.

- **Neoplasms**: A middle adult male [955 Poundbury Camp] has radiographic and macroscopic evidence for osteolytic metastatic changes to the cranial and post-cranial skeleton. One older adult female [3 Poundbury Camp] has radiographic and macroscopic evidence for multiple myeloma to the cranial and post-cranial skeleton. Benign osteochondromas were observed in both sexes.

- **Developmental anomalies**: one female from the Romano-British period [766 Alington Avenue] was affected by dyschondrosteosis and mild bi-lateral Madelung deformity.

- **Circulatory disease**: evidence for hypertrophic osteoarthropathy was observed in a young adult female [2.22 Fordington Old Vicarage].

CHAPTER 4.0 – DISCUSSION

“Myths regulate our relationship with various modes of knowledge …
conversely, anything that has the status of knowledge can
turn out to be riddled with mere beliefs” (Le Doeuff 2003, x)

4.1 Introduction

The chapter will discuss the results of the study, and how these change through time in response to changing gender roles and socio-cultural frameworks. The separation of the discussion by biological sex enables different aspects of the interpretation to be emphasised, and to determine the extent to which health-statuses change through time. The socio-cultural frameworks, biological, and gender statuses that may have operated in the Iron Age and Romano-British Period have been outlined in Chapter 1.0. The present chapter is separated into four themes: (1) The relationship between socio-cultural gender status and health status; (2) violence and changing social roles and/or responsibilities; (3) diet and (4) health and the changing environment.

The first three themes will be separated by biological sex, allowing us to investigate gender roles, although an individual’s gender role cannot be assigned from their skeleton. The use of skeletal characteristics to assign biological sex has been questioned by many researching into gender. For example, Claassen (1992) asserts that the determination of a skeleton’s biological sex is a cultural action, “there are numerous [sexual] traits that are used in a statistical manner … the reliance on an implicit or explicit set of criteria is a cultured act. Both terms [male and female] are cultural” (Claassen 1992, 153). Although this viewpoint is accepted by this present study, it is considered that the biological data is the only data from these periods that has not been culturally adjusted or manipulated, and consequentially are the ‘safest ground’ from which to investigate the influence of gender upon health during the life course.

4.2 Socio-cultural status and health-status

The importance of the relationship between health status and social status has been exemplified by many palaeopathological studies (e.g. Powell 1988), and socio-cultural factors have been shown to influence health and wellbeing (Steckel et al. 2002, 85; Roberts and Cox 2003, 7). The role of society and culture upon health was recognised in the ancient world, and continues in the modern world. Society and culture influence health, because they permeate and frequently determine the entire life course (Rousham and Humphrey 2002, 127). For example, a recent contemporary study of children demonstrated that social status (especially of the mother) influenced the child's height, weight, and bone shape, and these factors predisposed their risk of fracture in older age (http://www.wellcome.ac.uk/doc_WTX024650.html).

People who are disadvantaged both socially and economically have a higher risk of developing a serious illness, and have a shorter life expectancy. Disadvantaged individuals have a higher risk of suffering more illnesses throughout their life course, due to the accumulative effects of an inadequate diet, limited access to treatment, and poor conditions in the local environment. It is now well established that an individual's health status during childhood directly affects their well being during adulthood. Poor diet and social conditions during childhood could result in failure to achieve the growth potential. These poor conditions allow infectious and metabolic diseases to flourish, and permit the development of anti-social behaviour (McElroy and Townsend 1996, 100-105, 11-117; Courtenay 2003, 12-13; Roberts and Cox 2003, 7; Wilkinson and Marmot 2003, 7-15). The effect of society and culture upon health is exemplified by Rousham's (1999) contemporary study of child growth and nutritional status in South Asia. Rousham's (1999) medical anthropology study demonstrated that the excess female mortality resulted from the preferential treatment of males, and that gender biases in nutritional provision were frequently employed during episodes of economic adversity (Rousham 1999, 49-50).

As stated in chapter 1.0, the ranking of Iron Age and Romano-British burials in Dorset by biological sex, gender, age, and social status is not available at the time of writing (see Hamlin forthcoming). Therefore, the relative biological sex, gender, and age ranking in the two archaeological periods can only be viewed at the macro-scale and unfortunately, only in general terms.

4.2.1 Socio-cultural status and health-status: females

> "Born women are all too aware of a disharmony between who they are and what their gender role requires of them" (Greer 2000, 93).

The natural biological advantage of being female is only maintained when socio-cultural frameworks do not disadvantage the status of females or women, for example in food provision, access to healthcare, and treatment (Hanson 1999; Pollard and Hyatt 1999). Therefore, how these frameworks transform over time may be reflected in female health-statuses.

The social status of females during the Iron Age and Romano-British period has been outlined in sections 1.5.2.1 and 1.6.9.2, and section 1.7.2 provides information on their biological status. Attempting to understand female life-ways, social roles and responsibilities during both periods and how they impacted upon health has been problematic. The research undertaken has highlighted the lack of available information on the 'realities' of daily life in both periods, which is exacerbated by the absence of information on variations in female social status (apart from in the crudest forms) and therefore variation in health status.

In order to investigate the influence of gender upon biological advantage and treatment of female individuals through time, key aspects of osteologically derived data were analysed, namely demography, stature and indicators of stress.

4.2.2.1 Demography

Comparison of the data displayed in Figures 6 and 7 very clearly indicate that peaks in female mortality changed through time. Primarily, the female mortality data concurs with the historical and contemporary clinical data for greater female longevity (Austad 2001, 6; Hazzard 2001, 451). The data corresponds to expected models of human mortality curves, in which after 15 years of age there is accelerated rise (Wood et al. 2002, 137).

In the Iron Age, there are fewer females than males present in the sample. A result observed in other Iron Age populations, for example Jankauskas's (2000) study of a Lithuanian population found 449 females compared to 553 males. Due to the good preservation of bone in Dorset, the difference in the numbers of males and females is unlikely to be the result of taphonomic factors. Recent research by Walker (2005) suggests that this result may be due to older individuals appearing more male thereby, creating the false impression that males out-live females in archaeological samples (Walker 2005, 389-391) (see section 4.2.4.1 for further discussion of this result).

In the present study, the Iron Age demographic spread (Figure 6) is weighted towards individuals dying before old adulthood years (N= 39/51, 76.5%), with the majority of individuals dying in middle adulthood (N= 21/51, 41.2%). The spread may be biased by osteological ageing methods, which create a peak at the 30 to 45 year age group (Chamberlain 2000, 105). However, the peak is artificially inflated from a normal attritional profile (Wood et al. 1992), by the Maiden Castle sample being biased by young and middle adult females who had probably died from a violent encounter(s). A hypothesis supported by Bishop and Knüsel's (2005) assessment of Morant and Goodman's (1943) demographic data, and concluded that it could have been an attritional cemetery, which included victims of small attacks (Bishop and Knüsel 2005, 209). The demographic pattern is also observed in the male sample (Figure 6), suggesting that the risk of death from violence was not clearly divided between the two biological sexes.

The low number of older females (N= 8/51, 15.7%) is a result also observed in east Yorkshire, where only 6.95% (N= 7/101) of the female sample was aged over 45 years (Stead 1991, 127). Stead (1991) suggests that the low number was a result of their less robust skeletons and taphonomic destruction (Stead 1991, 126). The paucity of older female skeletons has been observed in other archaeological studies, for example Gordon and Buikstra (1981). In Dorset, where the preservation of bone is very good, factors such as life course ranking, with older males being preferentially buffered compared to females (e.g. Arber et al. 2003) may have influenced the number of females surviving into old age (this conclusion is tentatively suggested in light of Walker's (2005) findings).

The low number of females over 50 years may be related to high mortality risks associated with pregnancy (see below). A result also observed in the Iron Age population from Majorca (Spain), where only 22 females aged between 40 to 60 years were present, compared to 40 males (Alesan et al. 1999, 290). Alesan et al. (1999) suggest that the outcome results from the hazards of pregnancy and nursing for females and "the fact that the possibility of reaching these ages [over 40 years] in males is higher", due to preferential male treatment (Alesan et al. 1999, 290). The authors suggest that low numbers of older adults of both sexes in their sample, relates to socio-cultural factors such as care of the elderly, social status and conception of death (Alesan et al. 1999, 296). These factors may explain the demographic profile of the Iron Age females in the present study.

In the Romano-British period, the demographic profile changes (Figure 7). The number of young adult females (N= 25/59, 42.4%) is comparable to the Iron Age (N= 18/51, 35.3%). Fewer middle adult females (N= 16/59, 27.1%) are present compared to the Iron Age (N= 20/51, 39.2%) and their number is dramatically lower than the number of young adult Romano-British males (N= 43/96, 44.8%). Older adult females (N= 7/59, 11.6%) have a higher mortality rate compared to older adult males (N= 6/96, 6.2%) but their number is comparable to the number of females in the Iron Age (N= 9/51, 17.6%). The demographic profile may again be biased by osteological ageing methods, which frequently create a peak in the 30 to 45 year age group (Chamberlain 2000, 105), suggesting that in the Romano-British period, mortality risk changed. It is also posited that the demographic profile is biased by the role of migration e.g. women attached to the Army (Roxan 1991).

Both demographic profiles (Figures 6 and 7) indicate that many females in both periods were able to reach older adulthood. Demonstrating that for many females, their biological advantage was not compromised and some were able to outlive their male counterparts. Unlike the Iron Age, where the peak in female mortality is influenced by the Maiden Castle sample, the peak in the Romano-British period is perhaps influenced by increased migration, the “accident hump” (typically observed in males) (Wood et al. 2002, 138-139) and by unknown socio-cultural factors. Frier (2002) cautions that demographic results during the Roman period are likely to vary temporally and regionally, therefore these results may suggest patterns specific to Dorset (Frier 2002, 89, 100-101).

Pregnancy and/or childbirth cannot be ruled out as causes of death for many females. No particular age group is highlighted in the discussion, as it is not reliably known when menstruation and menopause occurred in the Iron Age. Whereas, in the Romano-British period these biological events are noted in Roman texts, but the majority are based upon Mediterranean populations (Clark 1994 76, 88; Flemming 2000, 273, 283, 361). Earlier attempts to find females from Poundbury Camp with parturition scars identified a number of adolescent girls (Molleson 1993, 181). However, the finding is rejected, because it is not possible to reliably sex adolescent skeletons (Scheuer and Black 2000b, 15-16) and parturition scars are not reliable indicators of child-bearing (Cox 2000).

The Iron Age sample includes a young adult female [Kimmeridge] who had peri-natal remains (37 to 38.5 weeks) adhering to the inner surface of the ilium (O'Connell 2000, 1). Suggesting the fetus was in utero at the time of the mother's death or that the fetus had not been delivered and the female died during parturition (O'Connell 2000, 35). Death of the adult may have resulted from (amongst other causes) cardiac or renal disease, diabetes mellitus or anaemia (O'Connell 2000, Table 10.5). As no other palaeopathological indicators were present to suggest other causes for the maternal death, such as sharp-force weapon trauma, it is highly probable that the mother died from complications associated with pregnancy and/or parturition. No study has specifically addressed childbirth and pregnancy during the Iron Age, although Beausang (2000) has researched childbirth in prehistory. Her study has raised important questions for our understanding of Iron Age female social status, such as some females may be socially denied the right to become pregnant (Beausang 2000, 70). Unfortunately, knowledge concerning differences in status between females in the Iron Age is absent and any influence upon health must be suggested from anthropological work.

McElroy and Townsend's (1992) research has shown that some women continue to work until the third trimester of pregnancy or until the uterine contractions begin (McElroy and Townsend 1992, 16). They note that women's productive activities influence or dictate reproduction, and this pattern is most visible within farming communities (McElroy and Townsend 1992, 22). For example, in southern India conception peaks are observed in October and November, which are the slack period in-between rice planting and harvesting (McElroy and Townsend 1992, 22). Bioarchaeological information from Iron Age Dorset has shown that cereals were sown in the spring and autumn, allowing the community to spread labour load and harvest times (Jones 1981, 105). Isotopic analysis of weaning in British Iron Age populations has shown that the duration of breast-feeding was short, suggesting that females may have returned to work (Jay pers.comm.). Female involvement in farming is supported by their ante-mortem fracture patterns (see section 4.5.1.1), although primary sources for Britain are lacking on the subject. These data suggest, somewhat tentatively, that females were involved in the agrarian economy, which may have influenced their risk of injury during pregnancy and/or determined when that took place.

No females with peri-natal remains in situ were observed in the Romano-British sample (one female [812] from Poundbury Camp did have fetal remains in situ, but was not included in the sample), however the health risks of pregnancy were known in the Roman Empire and were included in Soranus' Gynaecology. Soranus noted that miscarriage could result from strenuous physical work, falls, diarrhoea and malnutrition (*Gynaecology* 1. 46). Females who wished to terminate a pregnancy may have placed their lives in danger with the method they employed, as it was recognised by medical writers that although some drugs were efficient, they were potentially lethal (Kapparis 2002, 16). Abortants included drugs (internally and externally applied), surgery, and mechanical means (Kapparis 2002, 9-26).

4.2.2.2 Stature

Female biological advantage can be investigated using stature, as females have the capacity to fulfil their growth potential under adverse conditions (Overfield 1995, 166). Attained stature also provides an insight into their non-adult growing environment and nutritional status (Bogin 1999, 269, 275). The average stature for females during the Iron Age was 156 cm (Figure 8 and 3.3.1), which is seven cm shorter than the national average of 162 cm (Roberts and Cox 2003, 103). During the Roman period, the average was 153 cm (Figure 9 and 3.3.2), six cm smaller than the national average of 159 cm (Roberts and Cox 2003, 163). In both periods, mean female stature is lower than the mean male stature (3.3.1 and 3.3.2), which is a normal result (Overfield 1995, 166). It should be noted that the disparity between the stature of Dorset females and the national mean could result from differences in the element/s used to calculate stature (in the present study it was the femur) (e.g. Jantz et al. 1995), rather than regional disparities in growth.

During the Iron Age, the tallest female statures (158 to 166 cm) do overlap with the shortest male statures (158 to 167 cm), but the majority of females would have been shorter than their male counterparts. The presence of tall females may reflect intra-gender differences in status, in which a minority of females had experienced preferential buffering from cultural and environmental stress during growth and development, allowing them to fulfil their growth potential. It may also reflect a ‘history’ of high female status; which would have allowed privileged females to fulfil their growth potential, and during pregnancy provided them with sufficient and quality food, and reduced their risk of environmental and cultural stress. Such preferential buffering would result in normal to high birth-weight infants, who were more likely to become tall adults (Ulijaszek and Strickland 1993, 136; Bogin 1999, 275, 311; Goldberg 2000, 300-302). The female stature data, and the lack of osseous evidence for poor nutrition, show that for the majority of females their growth potential was not compromised by a poor diet (Bogin 1999, 269). Although sex differences in dental disease suggest that food-ways may have been influenced by gender-roles/status (section 4.4.2.2), nutritional anthropology studies show that practices such as food taboos, unless depriving the woman of protein-rich foods, may not always adversely affect health (Ulijaszek and Strickland 1993, 115-116). As the majority females were shorter than their male counterparts, the pattern could reflect female participation in the agrarian economy. Physical anthropology studies have shown that stature is linked to physical activity levels, as individuals with physically demanding occupations are shorter and more robust (Bogin 1999, 303). Holden and Mace's cross-cultural study of sexual dimorphism and stature, found that the amount of subsistence work undertaken was more influential upon attained stature than the economic strategy employed (hunter-gatherer versus agrarian) (Holden and Mace 1999, 42).

In the Romano-British period, there is greater overlap with the male sample (146 to 169 cm), but females do not exceed 171 cm in height. Interestingly, during the Romano-British period the height of the shortest females decreases to less than 134 cm, which is below the stature of the shortest Iron Age female. These results may have been caused by food-way changes, as high protein societies and those with abundant food supplies show greater sexual dimorphism in attained stature (Gray and Wolfe 1980, 452). The decrease in the height of the shortest females could reflect a genetic adaptation in body size, as low status children have a higher risk from infection, and experience poor nutrition but have the same weight velocity as their higher status peers up to one year of life. After their first year, they make the unhealthy adaptation of 'becom[ing]' small, in order to cope with their poor living conditions (Ulijaszek and Strickland 1993, 137). It may also indicate a poor uterine environment, and/or that growth disruption was sustained beyond maturation, preventing ‘catch-up-growth’ (Clark et al. 1986, 148; Goldberg 2000, 300-302). These environmental and cultural stressors may reflect status differences, such as slave life-ways, or growth and development during an episode of transition.

The greater over-lap with the male data in the Romano-British period may have been influenced by female migration. For example, a strontium stable isotope analysis of 70 individuals from a cemetery associated with a Roman fort in Germany, showed that 30% had migrated from elsewhere in the country, and the majority of migrants were female (Schweissing and Grupe 2003). Female migrants in Dorset have been identified using stable isotope testing at Poundbury Camp (Richards et al. 1998). The act of migration may have increased their stature, as Singh and Harrison’s (1996) study of 459 sedentary and migrant adult Sikhs, found that female migrants were taller than their sedentary peers, despite completing physical growth in India (Singh and Harrison 1996).

The influence of Romanization upon the female life course may have resulted in female biological advantage only being compromised in some individuals. The greater variation in Romano-British female stature may reflect a number of processes for example, growing up in more Romanized areas of the Empire (e.g. the Mediterranean), the local adoption of ‘unhealthy’ Roman cultural practices, and nutritional and environmental stressors (Ulijaszek and Strickland 1993, 121-142; Woolf, G. 1997; Woolf 1998, 6-23, 54-75; Hope 2000a).

4.2.2.3 Indicators of stress

When discussing stress in populations using the medical ecology approach, it should be remembered that tolerance to stress is governed by individual and cultural buffers. It extends to the coping or adaptive mechanisms that result from an episode of stress. These can be influenced by an individual's nutritional, psychological and health statuses, in addition to inherited traits (McElroy and Townsend 1996, 241-242; Schell 1997). Differential exposure may have occurred from a young age. By acknowledging the cumulative effect of past actions throughout the life course (Hareven 2001, 142), differences in the formation of indicators of stress can be investigated.

Derevenski (1997a) has shown that gender awareness begins from a very young age, through engagement with gendered material culture or tasks. Engendering develops throughout non-adulthood and allows older individuals to have a 'flexible' framework, which is frequently culturally specific (Derevenski 1997a, 196-198; Messner 2004). Derevenski (1997b) has shown that gender "must be constantly renegotiated in the light of increased gendered knowledge … the acquisition of gender knowledge is time dependent" (Derevenski 1997b, 487). By engendering the life course from a young age, males and females may have experienced differences in cultural and biological stressors.

Differences in the number of male and female elements with evidence for indicators of stress were found to be statistically significant in the Iron Age (Tables 6, 11 and 21). The result suggests that female life-ways were differentially buffered, which may have been based on gender. Such social practices may not have disadvantaged biological females, because no archaeological evidence could be found to demonstrate that females were disadvantaged during the Iron Age (see Sørensen 2000, 26-28, 92 for a critique of material culture ranking). Jay's (pers. comm.) isotopic analysis of Iron Age male and female diets has shown that there were no differences in the types of food consumed, suggesting this was not disadvantaging females.

The majority of cribra orbitalia seen was not active at the time of death (Table 81), indicating that individuals had recovered from the cycle of stress associated with non-adulthood. Such as the burden or exposure to disease was broken in adulthood (although it is not known when this transition occurred culturally). Statistical significance was found between the number of female and male teeth displaying an enamel hypoplastic defect (Table 6) and the pooled percentage data indicates that there is a difference of 7.6% between the sexes (Males N= 95, 17.1% and Females N= 51, 9.5%). Palubeckaite et al. (2002) consider a higher male prevalence represents greater social buffering for males, arguing that it enabled them to survive and develop markers, whilst the females died (Palubeckaite et al. 2002, 198). Palubeckaite et al.'s (2002) conclusion is acceptable for that study, because it was only observed in the elite samples which were derived from known elite burial contexts, a situation not present in the present study. Understanding how differences in the prevalence of enamel hypoplastic defects relate to social practices is unclear, as other causative factors may have played a role in the formation of the response. These include differences in how the stress is 'recorded' in the dentition (wilson bands versus enamel hypoplastic defects) (King et al. 2005) and that enamel hypoplastic defects have a multifactorial origin (Guatelli-Steinberg and Lukacs 1999, 79; King and Ulijaszek 1999).

Guatelli-Steinberg and Lukacs' (1999) research into interpreting sex differences in enamel hypoplasias, concludes a higher female prevalence may indicate greater female buffering and their biological advantage, "elevated levels of EH [enamel hypoplasias] in male children cannot be taken as indicative of greater male vulnerability … [or] a result of parental bias in favor of females" (Guatelli-Steinberg and Lukacs 1999, 88). Therefore, in the present study it is only tentatively suggested, in combination with other palaeopathological and social evidence, engendering did not significantly influence the treatment of individuals in non-adulthood.

Investigating the timing of the occurrence of enamel hypoplastic defects may aid our understanding of how these indicators developed (Hillson 2000, 252). These data show (Table 83) that the majority of defects developed before the age of four and it is possible that they represent a response to weaning and other changes in diet. Recent research has shown that macroscopic analysis results in a weaning peak and histological analysis provides more reliable data (Goodman and Song 1999; Simpson 1999; Reid and Dean 2000). The remainder of defects developed during the ages of five to six years, which may indicate a response to infections sustained during these years (Lewis 2000, 45). It should be noted that due to tooth morphology, lines formed between two to four years are most prominent when recorded macroscopically and this may be acting as a bias in these results (Hillson and Bond 1996, 102; Hillson 2000, 252).

The results of the enamel hypoplastic defect data may suggest that diseases/stresses were sustained through engendered tasks. Anthropological work in Kerala (India) has shown that individuals aged five to 15 years worked in the domestic environment for up to seven hours a day, with females undertaking more tasks in the home such as housekeeping and childcare (Panter-Brick 1998, 85). Such a gender division would create differential exposure to environmental pollutants such as fires and pathogens from processing animal products. Studies in agrarian villages have shown that cultural timing influences the amount of time and energy expended by children as they grow older and work is frequently structured along gendered divisions (Panter-Brick 1998). Nag et al.'s (1978) study of Javanese village children found that older children (12 to 19 years) of both sexes do more agricultural work than those aged six to 11 years and those aged six to eight years spent the most time looking after other children (Nag et al. 1978, 294). Their study included data from Nepalese villages, and gendered analysis of labour from both villages showed that female children undertook more work compared their male peers (Nag et al. 1978, 296).

Information on female life-ways during the Iron Age is extremely sparse consequentially the level of interpretation achieved is constrained. The collated evidence does suggest that gendered ranking did exist during the Iron Age, but it may not have resulted in one sex being disadvantaged.

The Romano-British data (Table 82) showed that the number of elements displaying indicators of stress were lower than in the Iron Age. The data suggests that the number of affected individuals decreased, perhaps because female exposure to disease and cultural buffering changed with Romanization. A hypothesis further supported by the statistical significance between the Iron Age and Romano-British female data (Tables 85, 88 and 94) and between the Romano-British male and female data (Tables 8, 13 and 23). Previous studies by the author (Redfern 2003; Redfern and Roberts 2005) based on individuals from Romano-British urban cemeteries, found that females were less affected by indicators of stress, a result that was statistically significant (Redfern 2003, 156; Redfern and Roberts 2005, 119-120). Dorset’s conformity to a national pattern indicates that female biological advantage may not have been compromised by stressors produced by Romanization i.e. cultural and environmental changes.

As stated earlier, understanding the life-ways of females in Dorset during the Romano-British period is problematic and information on female lives and status must be integrated from within the Empire. Fischler (1994) notes the Roman ideals of women were beauty, fertility, faithfulness and a focus on the household (Fischler 1994, 117). Male authors formed such stereotypes and there is limited evidence to suggest that females had to conform to these ideals (Rawson 1986, 26-27, 2003a; Harlow and Laurence 2002, 18). Nevertheless, the Roman life course did contain stages in which certain ideals were supposed to be reached and reflected in behaviour (Harlow and Laurence 2002, 17). These stereotypes conform to the paradigm that Roman women were culturally buffered, protected, and denied freedoms, because they were regarded as the 'weaker' sex (see Crook 1986; Pomeroy 1994, 151-157). The stereotype not only denies reality, but also changes in Roman law; as from A.D. 88, the convention for females to have guardians disappears (Gardner 1993, 85-109; Dixon 2003, 75-78).

A decrease in the prevalence of indicators of stress also occurs for the male sample (Table 4), which further supports the decrease to be the result of wider social and environmental changes caused by Romanization, rather than solely dependent on changing female status. As observed in Iron Age females, the majority of cribra orbitalia lesions were remodelled, indicating that the evidence (as supported by the enamel hypoplastic defects) reflects non-adulthood stressors (Table 82).

The timing of the enamel hypoplastic defects during the Romano-British period, indicates they were formed over a longer time, birth to seven years (Table 83). The majority developed in the first two years of life, suggesting that they may be a response to changing feeding patterns, although it is recognised that determination of formation may be imprecise (Goodman and Song 1999, 212; Lukacs 1999; Lukacs et al. 2001). The formation of hypoplastic defects, as in the Iron Age sample, will indicate a response to illnesses sustained during non-adulthood (Lewis 2000, 45). As in the Iron Age, the exposure of female non-adult stressors may have resulted from engendered tasks (Derevenski 1997a, b). Knowledge of children's tasks in Roman Britain is poorly understood. Roman textual evidence emphasises the involvement of girls in domestic duties (Gardner and Wiedemann 1991, 72-73; Harlow and Laurence 2002, 52-53), or in occupations such as hairdressers and cookery (Rawson 2003b, 191). Apprenticeships typically began at 12 or 13 years and more informal arrangements may have existed for freed individuals, but "children [were] expected to do useful work" from the age of five (Rawson 2003b, 192, 194). These activities may have exposed them to a range of diseases/pathogens associated with animal products, water sources and pollutants from combustibles and sanitation (Henshall Momsen 2003, 90). Their participation in domestic duties may have increased with age and responsibility, because within the Empire it was common for girls to marry and move households (Harlow and Laurence 2002, 54-60).

Primary evidence of girls experiencing culture as a possible stressor can be inferred from texts about slaves. Slavery did exist in Roman Britain (Tomlin 2003; Vindolanda Tablets Online) and was not restricted to adult individuals (Bradley 1994). It is possible that slavery was causative factor in the development of stress indicators and poor health in some individuals. Unfortunately, it is not known whether the archaeological record of Dorset can be used to identify slaves and such work lies outside this research. Textual evidence (from the Mediterranean) has shown that apprenticeships were more common for slave girls, and children were most frequently trained in weaving, cooking, agriculture and servant-hood (Bradley 1991, 108-115). As for freed apprentices and other children, such tasks would have exposed them to pathogens and pollutants in the local environment (Henshall Momsen 2003, 90), increasing their susceptibility to developing a range of infectious diseases (e.g. tuberculosis).

The un-clear nature of the primary and secondary evidence for female lives in Roman Dorset, limits the understanding of the extent to which culture acted as a stressor in their life course. Consequentially, it is suggested that the indicators of stress represent a response to a complex interaction of illnesses sustained during non-adulthood (in Britain and elsewhere) and changes brought about by Romanization, such as environmental conditions, social status and responsibilities.

Our poor understanding of past female life-ways during both periods and the multi-factorial origin of indicators of stress makes the extent to which Romanization acted as a cultural stressor for females unclear. However, Romanization and colonisation were responsible for causing cultural and environmental stress, as Hingley (1997) states "large numbers of men, women and children were killed and maimed, crops and animals were destroyed and requisitioned, houses and settlements burnt. During the pacification … roads, camps and forts were built … taxes taken by force, and new power-structures were enforced" (Hingley 1997, 81).

No published osteological studies assessing the impact of Romanization upon another population could be found and therefore, it is unknown the extent to which the findings are isolated to Britain, or represents a wider response to Roman colonisation. The only studies found that addressed the impact of colonisation were from the New World and Australia. Stodder et al.'s (2002) study of pre- and post- European contact communities in southwest (North) America, suggested that pre-contact enamel hypoplastic defects represented post-weaning dietary stress and infection. In contrast to the present study, Stodder et al. (2002) observed that the prevalence of enamel hypoplastic defects increased (in addition to other osseous indicators of stress). The increase of hypoplastic defects in the New World sample is suggested to have been caused by changes in population density, settlement and resources (Stodder et al. 2002, 494, 496). Littleton's (2005) analysis of dental casts from Aboriginal peoples born between 1890 and 1960 in Central Australia, did not find a significant difference between pre- and post-Contact samples, despite the number of defects increasing in conjunction with greater European control (Littleton 2005, 302-303). The reasons why the results of these studies are different to the present study include, time period, nutrition/food-ways, socio-cultural frameworks and local and wider environments.

4.2.3 Socio-cultural status and health status: males

> "Man has been termed, with strict propriety, a microcosm, a little world in himself. – He is so;- yet must, however, be reckoned an ephemera" (Wollstonecraft 1989, 69).

The social status of males during these periods has been outlined in sections 1.6.2.2 and 1.6.9.3, as has the role of their biological status in section 2.9.2. Attempting to understand male life-ways, social roles and responsibilities during both periods and how they impacted upon health has been problematic and to a certain degree more so than for females. The research undertaken has highlighted the lack of available information on the 'realities' of British daily life in both periods. A situation exacerbated by the absence of information concerning variations in male social status (apart from in the crudest forms) and therefore variations in health status. In order to investigate the influence of gender upon males through time, key aspects of osteologically derived data were analysed, namely demography, stature and indicators of stress.

4.2.4.1 Demography

In both periods, more males than females are represented between the ages of 20 to 50 years (Figures 6 and 7). The result conforms to the lower life expectancy observed in the clinical sciences for males from conception onwards (Pollard and Hyatt 1999, 2-3). The peaks in both periods for the highest number of males during young adulthood may to a certain degree, reflect the bias introduced by the methods employed to age archaeologically derived skeletons (Kemkes-Grottenthaler 2002). A peak in male mortality during these ages is observed in contemporary societies and is known as the ‘accident hump’ (Wood et al. 2002, 138-139), as clinical data has shown that majority of individuals dying between the ages of 15 to 24 years are male (Courtenay 2003, 13). The determining factor in male mortality during these ages is suggested to be the degree to which boys develop masculine behaviours (Sabo 1999, 2004), adopt adult responsibilities (Derevenski 2000), and engage in risk-taking activities (Courtenay 2002, 298).

In the present study the young adult category in the Iron Age (Figure 6) is dominated by the sample from Maiden Castle (Table 136). Therefore, young adults may have had an elevated mortality risk associated with exposure to and engagement with violence, a pattern observed in tribal societies (Haas 1990, 178) (see section 4.3.3.6). Consequentially, it is not clear the extent to which the demographic peak is ‘normal’ for Iron Age Britain, especially as the burials at Maiden Castle represent an attritional sample, which also includes victims of small skirmishes (Bishop and Knüsel 2005, 209). The number of males dying between the ages of 35 to 50 years (N= 20/64, 31.2%) matches the female mortality (N= 20/51, 39.2%) and suggests during these ages neither sex were exposed to more risk. Male risk taking activity during middle adulthood may have declined, with changes in concepts of male ageing and social roles. As in the young adult category, a number of middle adult males (Maiden Castle) have peri-mortem trauma and therefore, for some males, engagement in risk-taking activities continued (see section 4.3.3.6).

The higher number of older adult males (N= 14/64, 21.8%. Females N= 9/51, 17.6%) in the Iron Age may suggest that many males were able to sustain a sufficient biological response to environmental and cultural stresses, enabling more of them to live longer (Figure

6). The number of older adult males is higher than observed for east Yorkshire (N= 10/90, 1.1%), but the result may be compromised by the poor bone preservation in Yorkshire (Stead 1991, 126-127). The data implies that for some males, their culture was able to provide sufficient buffers (which may have been related to social status). Nevertheless, Hoppa and Saunders (1998) state that when male and female mortality rates are markedly different, it does not represent living sex ratios and therefore may provide an inaccurate perception of sex differences in health (Hoppa and Saunders 1998, 10).

In the Romano-British period (Figure 7), a result for the over-representation of males (see Parkin 1992, 15-16) has been suggested for many urban cemeteries (e.g. Wenham 1968). Davison's (2000) study of 25 cemeteries in England, found there was only an over-representation of males in urban cemeteries (i.e. Poundbury Camp), with 62% of the sexed population being male and 38% female (Davison 2000, 232). In this present study, the majority of Romano-British individuals (Table 2) were identified as males (N= 96/155, 61.9%) compared to only 38.1% (N= 59/155) of the sample being female, but the results were not statistically significant (Table 3). The result is a marked change from the Iron Age sample, in which more males were represented (N= 64/115, 57.4%), and a higher percentage of females (compared to the Romano-British period) are present (N= 51/115, 42.6%).

The Romano-British percentages in the present study (Figure 7) are comparable to Davison's (2000) data, and suggest that this result is typical for all scales of analysis and not just urban cemeteries. The extent to which this result reflects long-term change, or is biased by intensive short-term changes is not clear. For example, at Kempston (Bedford) cemetery, detailed analysis of the phasing has shown that in the early and middle periods of use more males were present, compared to later use (Boylston 2000b). Therefore, conclusions may be reached (e.g. Watts' (2005) suggestion for female infanticide) that are not borne out by closer examination of the cemetery phases.

Other factors, only touched upon in Davison's (2000) work, that are not immediately recognisable within his samples, include the systematic bias of sexing skeletons as male. Weiss' (1972) study found that in 43 populations from the Americas, Europe, Africa and Japan, 33 had an excess of males present (Weiss 1972, 240-241). This factor is supported by Walker's (2005) study, which found that younger individuals have more female sciatic notches and cranial morphology compared to older individuals, which appear more male (Walker 2005, 389-391) (see also section 2.7.2).

The over-representation of males has been interpreted by other authors to reflect men retiring from the Army and/or the influence of female infanticide (Davison 2000, 233). The influence of greater male mobility upon demographic profiles may be a false view, as recent ancient DNA and stable isotope analysis of the Romano-British cemetery at Atlantic House (Bishopsgate, London) found that many females were also newcomers to Britain (Watson 2003, 30). The role of infanticide cannot be ruled out as a biasing factor (Scott 1999, 113-114) although osteological studies (Gowland and Chamberlain 2002) refute the extent to which the British evidence supports this explanation (for alternative interpretations see Mays 1993, 2000; Watts 2005, 51-56). Parkin's (1992) assessment of data from the Empire concludes that infanticide may have occurred, but did not result in a skewing of demographic ratios (Parkin 1992, 98-101). In the present study (the first to examine this result at a regional scale), the ratio of males to females was 1.3:1 in the Iron Age and 1.6:1 in the Romano-British period. The data show that a regional perspective of ratios provides an insight into the makeup of the population that differs from site and national data (Parkin 1992, 51-55; Davison 2000; Watts 2005, 50-51). Such a perspective provides a different result from the percentage data (see above). The implications of both the ratio and percent results are unclear, because disparities between male-female mortality rates do not reflect living sex ratios (Hoppa and Saunders 1998). Without such qualification, the results of the present study (and those in other studies) may create a misleading impression of the make-up of Romano-British society (in combination with lack of analysis through a cemetery's use). As Walker (2005) states, "age-related changes in sexual dimorphism provide a plausible explanation for the puzzling longevity of prehistoric males" (Walker 2005, 391).

Davison (2000) does state that his data may be skewed by the lack of a completely excavated urban cemetery and the use of older skeletal reports, but he also suggests that the result may represent "a manifestation of the disenfranchisement of women" (Davison 2000, 234-235). Davison's (2000) conclusion is challenged by a study on late Romano-British burial practice by Quensel-von-Kalben (2000). Quensel-von-Kalben's (2000) study did not find any difference in the location of female and male burials (Quensel-von-Kalben 2000, 222-223). Crowe's (2001) research into Romano-British cemeteries highlights several problems in the national dataset, which are yet to be explored in sufficient detail, and continue to create bias. These include the 'over-representation' of urban cemeteries from southern Britain dating to the late 4th century A.D., which have only been partially excavated (e.g. Poundbury Camp) (Crowe 2001, 145). Rather than observing 'normal' funerary rites, we may instead, be examining minority burial rites and variables in funerary expression (Crowe 2001, 146). Crowe (2001) suggests that what we should "see is that society made distinctions between … individuals and groups of individuals" (Crowe 2001, 162), a perspective that would provide a more nuanced understanding of the Romano-British period.

Davison's (2000) interpretation does not touch upon the biological factors or concepts of masculinity associated with male mortality. The present study also found more males to be present in both periods (Figures 6 and 7) and consequentially in the sample as a whole (Table 1). The result suggests that despite the role of colonisation upon cemetery use, biological differences and the incomplete nature of the archaeological evidence also influenced the number of males recovered from Romano-British cemeteries.

It is suggested by the present study, that without further analysis of male-female ratios/percentages in terms of cemetery phases through time, which are researched at local, regional and national scales, in combination with stable isotope analysis, any suggestions of shifts in cultural practice or population change cannot be made based upon available evidence. Crucially, none of the studies discussed above analysed these ratios/percentages in comparison to the preceding Iron Age or later Anglo-Saxon period, neither have they compared their results to cemeteries elsewhere in the Roman Empire. Unfortunately, such analysis exceeds the remit of this present study, but these under-researched areas have influenced the conclusions reached by many authors who have concentrated solely upon Roman Britain (e.g. Watts 2005).

For the Romano-British period, concepts of masculinity and ageing may be employed to further understanding the cultural aspects of the demographic profile. These aspects are dominated by evidence from Rome/Mediterranean and therefore are used with caution, especially as anthropological age studies have shown social ageing varies between communities (Ikels and Beall 2001), however the cultural information has been included to provide a better sense of social ageing in Roman Britain.

Once males had reached 25, the cultural mind-set acknowledged that the boy had developed into an adult male whose masculinity was reflected in his body (Harlow and Laurence 2002, 65, 76-78). As the transition was culturally, rather than physically sanctioned, it could be delayed if physical development and bodily appearance had been compromised. Children culturally aged in relation to their personal development and their parental means (Rawson 2003b, 136), as “a person was as old as he or she acted” (Parkin 2005, 189). As in the Iron Age (Figure 6), the peak in male mortality was in young adults (Figure 7) (N= 43/96, 44.8%). As previously stated, it may not represent ‘normal’ demographic patterns, due to elevated risks or risk-taking behaviour. Roman life course research has shown that military training began at 17 years for males (Rawson 2003b, 138), which may have increased their mortality risk. Risk may have increased with greater involvement or responsibility in their occupation/apprenticeship, for example in agriculture.

The older male category will probably contain individuals who may have reached advanced old age, but cannot be identified due to problems with osteological ageing methodologies (section 2.6.3). The category represents an important stage in the Roman life course (it is recognised the extent to which the Roman life course was practiced in Britain is highly subjective). The beginning of old age was dependent upon an individual’s physical health and of course their socio-economic status, which could enable them to retire from an active life and begin a new social role, with the obligations of a child. Based upon textual information, this phase could begin from the ages of 46 to 60 years (Harlow and Laurence 2002, 117-123), which would have implications for their health status. Parkin’s (2005) analysis of old age in the Empire, concludes that older males may not have been exempt from fulfilling public duties to the community, such as the giving of labour (unless aged over 70 years), with the exception of veterans (Parkin 2005, 129-131, 135-136). Engagement in these tasks may have elevated their mortality risk, by injury or heart attack. Many older males may have had to continue employment, because there was no state welfare and support was normally through family (Parkin 2005, 204, 219). Support may not have been provided by slave-owners, as many older slaves were manumitted and as a consequence, many social commentaries noted elderly beggars in urban areas (Parkin 2005, 221 and 225).

Parkin's (1992) life tables of median life expectancy shows a peak between the ages of 15 and 35, followed by a steady decline to 80 years (Parkin 1992, 151). A pattern reflected in the Romano-British demographic result of this present study (Figure 7). Parkin (1992) suggests that the average life expectancy was 25 years (Parkin 1992, 92), which may explain the peak mortality rate for males (N= 43/96, 44.8%) and females (N= 25/59, 42.4%) in the young adult age group (Figure 7). Parkin (1992) believes such results to be representative of a population in which mortality and fertility rates are always high (Parkin 1992, 92). In these populations, of those who live to five years only 30% will reach 60 years and those who survive past five years are likely to survive (at least) until 45 years (Parkin 1992, 92). The demographic model does correspond to the data from the Dorset region (Figure 7) and it is concurred with Parkin (1992, 93), that it also reflects environmental and cultural stressors during the Romano-British period.

4.2.4.2 Stature

The range of male stature increases in the Romano-British period, due to the lowest stature decreasing to 144.6 cm, and there is greater over-lap with the female data (Figure 9). The difference in stature between the tallest males of both periods is 0.4 cm, suggesting that a small increase in attained stature did occur in the Romano-British period, despite the mean stature remaining at 169 cm. Unlike the female sample, mean male stature is the same as the national mean (168 cm and 169 cm respectively) (Roberts and Cox 2003, 103, 163).

The mean male stature in the Iron Age (169.2 cm), despite being comparable to that of the Romano-British period (169 cm), is lower than the preceding Bronze Age's mean of 172 cm (Roberts and Cox 2003, 86). The decrease may reflect a response to changing social frameworks, as Cunliffe (2004) suggests that during the late Iron Age, the Durotrigians formed a periphery to the proto-state core in southeast England, and as such may have experienced greater tribal instability (Cunliffe 2004, 66-68, 86), which may have impacted upon health. For example, the Durotrigians may have experienced social stress by the tribes from the southeast core exploiting the periphery for human and natural resources (e.g. slaves) to trade with the Roman economy (Cunliffe 2004, 100).

Roberts and Cox (2003) note that the decrease in mean stature contrasts with evidence for improving living conditions during the Iron Age, and suggest that it may have been caused by intensification of industries (metal) and the agrarian economy (Roberts and Cox 2003, 103). In Dorset, the supposition is borne out by bioarchaeological data. Colluvial sequences and ditch fills recovered from the Dorchester bypass excavations show a reduction in organic and nutrient levels, which would have made cereal farming difficult (Allen 1997, 280-283). The geoarchaeological and bioarchaeological data indicates that the Durotrigians were investing in large settlements (i.e. hillforts), rather than moving agricultural production to other areas of the region. The investment was so focused, the Durotrigians changed from a variety of bread wheat to barley, which could be more successfully grown on poor soils (Allen 1997, 280-283). Due to greater male environmental sensitivity (Stinson 1985), the decline in stature from the Bronze Age may reflect the nutritional consequences of changes to the landscape and agrarian economy. For example, a physical anthropology study of Javanese males showed that a change in basic food staples caused a reduction in male stature (Ulijaszek and Strickland 1993, 93). The influence of the environment upon attained stature must have been quite significant, as physical anthropology studies of communities with milking herds found that they are more likely to attain a greater proportion their genetic growth potential, compared to communities without access to the nutrition that milk provides (Gray and Wolf 1980, 446).

The failure to reach growth potential may reflect a change in infant and child feeding practices from the Bronze Age and/or earlier Iron Age, as studies have shown that these can account for differences in nutritional status and growth (Bogin 1999, 275). The decline in male stature could also reflect an unhealthy adaptation that reduced body size (Ulijaszek and Strickland 1993, 137), and the strong heredity component that determines attained stature (Henneberg and van den Berg 1990, 464).

The spread of the Iron Age male data from Dorset (158 to 181 cm) (Figure 8) is wider than that observed nationally (164 to 174 cm) (Roberts and Cox 2003, 103), although it should be noted, that this may have been caused by the element used to calculate stature. The data spread is similar to Hungarian Iron Age males, whose mean stature was 168 cm, with a data spread of 158 to 178 cm (Ubelaker and Pap 1998, 246). The variation in attained stature reflects the role of plasticity in the male sample, deriving from their biological influences, which allowed them to adapt to environmental and cultural stressors (Bogin 1999, 267) that unfortunately are not wholly detectable within the archaeological record.

The proposed stratification of Iron Age society (section 1.6.2) would have also influenced attained stature, with high status individuals receiving greater buffering from cultural and environmental stress, and males engaged in the agrarian economy achieving lower stature due to their higher physical activity levels (Bogin 1999, 303, 311) (see 4.2.2.2). In the male sample, socio-economic pressures associated with male participation in violent episodes, may have determined male stature. Individuals who actively sought violent life-ways, and participated in intra- and inter-tribal conflict (see section 4.3.3.6 for discussion) may have received preferential treatment from non-adulthood. For example, if their family was high status they were more likely to be taller and they may have been given more nutritious food (Komlos 1993, 240-241; Bogin 1999, 275, 311).

The variation in male stature during the Romano-British period is determined by the heredity component in attained stature, which as in the female sample reflects greater variability in population origin (Figure 9). Unfortunately, due to the lack of stable isotope data, this cannot be investigated further, but anthropological work suggests that it may be an area of great promise. Analysis of the personnel records of American military units, dating from 1755 to 1763, show that males aged over 20 years, who had been born in America, had an average stature of 172.2 cm, whereas foreign born males (also aged over 20 years) had an average stature of 167.5 cm (McElroy and Townsend 1996, 222). Variation in attained stature was also influenced by manual occupations, the unhealthy adaptation of some status groups towards a smaller body size, differences in non-adult feeding practices, and the inability to achieve ‘catch-up-growth’ (Clark et al. 1986, 148; Ulijaszek and Strickland 1993, 137; Bogin 1999, 275).

The small rise in male stature during the Romano-British period (Figure 9) suggests that environmental stressors and conditions (Bogin 1999, 267) were such that males could only adapt so far, with male stature not increasing until the early Medieval period to 172 cm (Roberts and Cox 2003, 220). This finding is in contrast to Maat’s (2005) analysis of male stature in the Low Countries, which found that stature decreased in the post-Roman period (Maat 2005, 283).

The agricultural intensification of Dorset rapidly expanded during the Romano-British period, evidenced by an increase in tillaged land, use of the mould-board plough and an increase in livestock farming (Allen 1997, 283) (see section 1.6.1). Expansion of the agrarian economy suggests that an increase in food production and secure of food supplies should have been accompanied by a rise in male stature (Bogin 1999, 269). The reasons for the plateauing of male stature despite such improvements, suggests that localised factors not readily identifiable in the archaeological record were responsible. It may also imply that not all the food grown in the county was made available to its inhabitants, or that social stress could not be offset by greater environmental buffering. Due to a lack of published data from other cemeteries within the Roman Empire, the extent to which this results from the nature of British Romanization, rather than inclusion in the Empire is unknown.

4.2.4.3 Indicators of stress

A medical ecology approach emphasises that tolerance to stress is governed by individual and cultural buffers (McElroy and Townsend 1996, 241-242). The results of the indicators of stress show that Iron Age males had a higher prevalence and the difference between the sexes in the number of elements affected was statistically significant (Tables 8, 11, 21). These results correlate with the stature and bioarchaeological data, indicating that environmental stressors may have worsened during the Romano-British period and may reflect underlying biological differences. The result implies that Romanization demanded a certain degree of biological 'trade-off' (i.e. stature). As discussed in section 4.2.2.3, the socio-cultural and environmental conditions following the invasion may have had a causative effect in some individuals (see Santos and Coimbra 1999). Due to the lack of precise dating of the funerary evidence at the time of writing, individuals from the transition period could not be identified and the hypothesis investigated further (see Sharples 1991b/c for why this cannot be undertaken on Maiden Castle).

The results from the Iron Age sample (Tables 4, 7, 12, 22), suggest that males may have experienced different social care. This may not have equated to preferential buffering, but may reflect a different gendered life-way experience (the extent to which this was 'knowingly' implemented by society is questioned, as our understanding of the British Iron Age is very limited). The higher prevalence may stem from differential exposure during the life course, in which past actions can have a cumulative effect (Hareven 2001, 142). As discussed in section 4.2.2.3, the results may not have been influenced in the types of food consumed.

The higher prevalence and statistical significance of enamel hypoplastic defects between the sexes (Tables 3, 6 and 81) (pooled data Males N= 95, 17.1% and Females N= 95, 9.5%) and its' meaning for Iron Age society is problematic. For example, some researchers have inverted the buffering explanation. A higher prevalence rate was found in high status males from 15th to 18th century (A.D.) Lithuania. The researchers interpreted the data to reflect the preferential treatment of male children, which enabled them to recover from an episode of stress (Palubeckaite et al. 2002, 198). Nevertheless, because preferential cultural treatment of males cannot be reliably proven for Iron Age Dorset, it is concluded that the results reflect greater male environmental sensitivity (Stinson 1985) and differential exposure by their gender role, rather than gender ranking (see below).

The timing of enamel hypoplastic defects in the Iron Age male sample (Table 5) displayed the same results as the females (Table 83). Formation occurred between birth and seven years, with the majority occurring before the age of four (see Hillson and Bond 1997, 646; Hillson 2000, 252). The data suggests that differential buffering did not heavily impact (if at all) upon the period of weaning, post-natal care and exposure to/care of non-adult illnesses. That is to say, parental and community care/support was not preferentially biased towards males during the period when children are dependent upon others for food and protection (Bogin 1998, 22). For example, studies in Bangladesh have shown that unequal food distribution did not occur, but male children received more health care and were more likely to be bought medicines (Rousham 1999, 42).

It is inherently Western and Euro-centric to assume that non-adults automatically received protection from cultural and environmental stressors. Studies of non-adults in developing countries have shown that for the vast majority of individuals this is not true (Derevenski 1997b, 193; James 1998, 52-58). Derevenski's (1997b) work on the gendering of children has shown it occurs through their participation in gendered tasks and responsibilities (Derevenski 1997b, 196-198). Males may have had differential exposure to environmental and cultural stressors through their tasks and responsibilities, which combined with their greater environmental sensitivity (Stinson 1985) led to their higher prevalence of indicators of stress.

Anthropological work in societies outside Europe shows that in agricultural communities, children actively participate in daily activities, particularly those that are more energy efficient for them to undertake compared to adults (Panter-Brick 1998, 86). Children under the age of eight may have aspects of their life-way that expose them to environmental and cultural stressors. For example, children aged seven in the Hadza Tribe (Africa) regularly walk 10 kilometres on foraging trips (Panter-Brick 1998, 86). Anthropological studies of employment have shown that boys aged between five to 15 years spent seven hours a day employed in waged, un-waged and domestic work, which frequently occurred outside the household (Panter-Brick 1998, 85). Exposure to stressors may have been through other children, in Gambia (Africa) older siblings take care of infants whilst their mothers work away from the village and frequently feed poorly prepared or contaminated food to their charges (Panter-Brick 1998, 87-88).

Goodman et al. (1988) state that indicators of stress in prehistoric populations “are best at tracking the effect of general patterns of exposure to traumatic conditions, infectious agents, and nutritional deficiencies” (Goodman et al. 1988, 197). For the male sample, the data suggests that males experienced the same exposure as females during early childhood. Their gender identity may have lead to males being exposed differently to females in older childhood and combined with their greater environmental sensitivity, lead to a higher prevalence of indicators of stress.

The prevalence of indicators of stress declines in the Romano-British sample (Table 4), although the number of the elements affected increases, a result which was found to be statistically significant (Tables 9, 14 and 24). Interpreting indicators of stress in the present study is more problematic, despite primary and secondary evidence for greater population mobility compared to the Iron Age (de la Bédoyère 1999). The number of individuals who developed an osseous response to stress experienced elsewhere in the Empire is still unknown (no isotopic work is available to provide further information).

The decline in prevalence rates indicates that many stressors associated with Iron Age life-ways may have been removed with Romanization, such as an end to inter-tribal warfare. Romanization may have improved or created new social buffers, such as a regular food supply to the region. The introduction, adoption or continuation of Romanized concepts of masculinity and biological sex ranking by Durotrigians and newcomers to the region may have provided enhanced cultural buffering for males. Harlow (2004) notes that Roman concepts of masculinity and “Roman-ness” were fluid enough to adapt to the different communities that became incorporated into the Empire (Harlow 2004, 68). Differential buffering based concepts of gender began during pregnancy, as it was considered that males did not develop at the same rate as females (Harlow and Laurence 2002, 38-39). The differential treatment of male children enabled them to have greater freedom and more engagement with society and culture outside the household (Harlow and Laurence 2002, 52). Such treatment may have lead to them having greater exposure to agents of disease in the local and wider environment. Hingley (1997) and Webster's (1996, 2001) work on Romanization demonstrates that we cannot assume that changes were accepted and/or taken up by the local community. "Becoming Roman was not a matter of acquiring a ready-made cultural package, then, so much as joining the insiders' debate about what that cultural package did or ought to consist of at that particular time" (Woolf 1998, 11). A variety of stressors associated with Iron Age life-ways may have continued, especially in the peripheries of Dorset, where local environmental conditions or cultural practices such as weaning, may not have considerably altered (e.g. Schurr and Powell 2005, 291). New pathways of disease exposure were formed with the foundation of *Durnovaria*, and newcomers to the region may have continued cultural practices formed elsewhere in the Empire. These may have caused stressors to develop, in addition to the act of migration as a cause of stress (Bogin 1999, 395).

The enamel hypoplastic defect data changes in the Romano-British period (Table 7), which was found to be statistically significant (Table 6). The formation period finishes one year earlier, at six years and the peak in formation occurred at the age of three, one year earlier than in the Iron Age (Tables 5 and 7). It is accepted that these results are influenced by the macroscopic recording of these enamel defects (Hillson 2000, 252). In Rome during the 2nd century A.D., the age of weaning was recorded as beginning at two years (Rawson 2003b, 126), although this probably varied between families, status-groups and communities (McElroy and Townsend 1996, 216-220; Bogin 1998, 19-22). The male data differs from the female data, in which the enamel hypoplastic defects formed up to seven years of age and the majority of defects developed before the first and second years (Table 84). The differential treatment of males and females in the Romano-British period is emphasised by the data, because there is a relationship between general living conditions and the occurrence of enamel hypoplastic defects (Goodman and Rose 1991, 283). The data demonstrates that cultural buffering reduced the length of time in which males were exposed to stressors (see Goodman and Song 1999; Simpson 1999; Reid and Dean 2000), suggesting they experienced a different weaning pattern, which in turn was influenced by variations in cultural practices.

In the Romano-British period, the statistical difference in the number of enamel hypoplastic defects between males and females (Table 9) corresponds to the statistically significant result observed at the national level (data from urban cemeteries), in which 70.3% of males and 91% of females were affected (Redfern 2001). The results in Redfern (2001) and the present study, emphasises the role of Romanization upon the formation of these defects, rather than results that are specific or local to Dorset. Consequentially, enamel hypoplastic defects may represent responses to changes in (amongst others) settlement types and architecture, diet/weaning practices and gender hierarchy.

Unfortunately, due to the lack of information and research on the nature, composition and acceptance of Romanization in communities post-conquest (Jones 1991, 118; Mattingly 2004), it is difficult to understand the social implications of the osteological inferences.

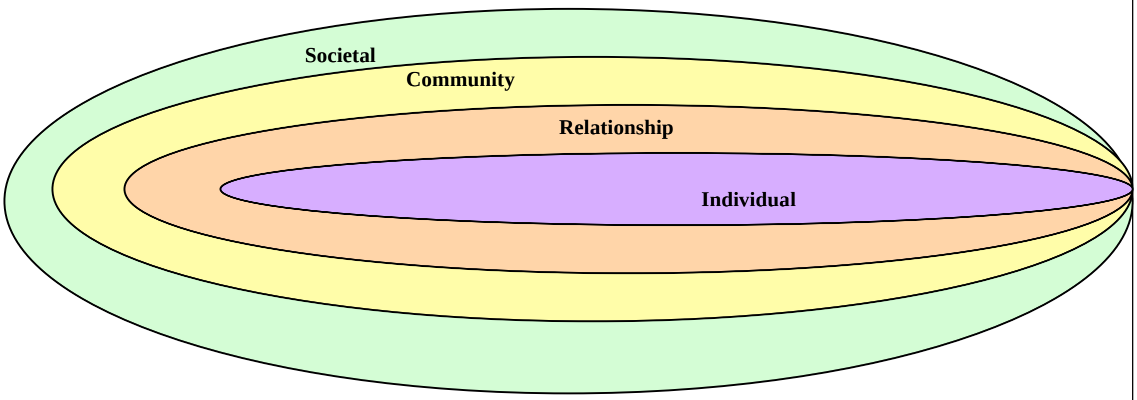
4.3 Violence and society: evidence for inter-personal trauma and sharp-force weapon injuries

"Violence … is a near-inevitable outcome of the dynamics
of self-interested, rational social organisms" (Pinker 2002, 329).

The analysis of violence forms an important insight into past life-ways, because it is present in every society, and violence is the leading cause of death for individuals aged between 15 to 44 years (WHO 2002, 1). The patterning of lesions in a skeleton can provide insights into past life-ways and socio-cultural frameworks (Goodman and Martin 2002, 40). Walker's (1997) study of violence in archaeological samples has demonstrated that culture can play a determining role in the patterning of violence (Walker 1997, 146). Therefore, with changes in culture, a change in the pattern of violence may be expected, "culture plays a key role, setting the boundaries around what is acceptable behaviour and what is considered abusive" (WHO 2002, 19).

In this section, the definition of violence follows that of the WHO (2002), "the intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community, that results in or has a high likelihood of resulting in injury [and] death" (WHO 2002, 4). The WHO's (2002) definition enables the relationship between gender and exposure to and engagement in violence to be explored through time. In order to assess the evidence using a medical ecology approach, the WHO's (2002) ecological model for violence (Figure 41) will be used (as far as is possible within the limits of palaeopathology) to aid the interpretation of fractures and sharp-force weapon injuries.

Figure 41 Ecological model of violence.



after the WHO (2002, 9. Figure 3)

The model enables a user to distinguish between the different influences leading to violence and therefore, provides a structure to determine how they interact (WHO 2002, 9). The individual level identifies biological and personal factors that influence an individual's behaviour and their risk of becoming a victim or aggressor. Relationships, examines how social connections can influence an individual's risk of becoming a victim or aggressor. Community provides the context in which social relationships occur and aims to locate characteristics that increase the risk of violence. The societal level aims to identify the ways in which violence is perceived, tolerated and contextualised (WHO 2002, 9). The WHO's (2002) model enables integration of all relevant information into understanding the evidence for ante- and peri-mortem fractures that have been produced by a violent mechanism and ante- and peri-mortem evidence of sharp-force weapon injuries. The limiting factor in the analysis is the lack of discussion within Iron Age and Romano-British research on how violence was structured during these periods and therefore interpretation relies upon comparison to other archaeological samples, primary sources and anthropology.

4.3.1 Iron Age Dorset

The evidence for sharp-force weapon injuries, peri- and ante-mortem fractures produced by violent mechanisms is dominated by the Maiden Castle sample, particularly for females. The Iron Age period had the largest body of evidence for inter-personal violence and injury recidivism, indicating the relationship between violence and culture (3.10 and 3.14). Data from the region is compromised by limited archaeological surveying and excavation of hillforts and the loss of 'catastrophic' samples, such as those from Spetisbury Rings hillfort. The construction of a railway line in 1857 cut a ditch in the northeast corner of the hillfort. In this ditch, a large pit containing 80 to 90 skeletons in a disorganised state was un-covered. Observation of the remains noted sharp-force weapon injuries to many crania and one cranium had an embedded spear point (Gresham 1939, 116).

4.3.2 Iron Age females

"Consider how many of you are fighting- and why. Then you will win this battle, or perish. That is what I, a woman, plan to do! - let the men live in slavery if they will"
(Tacitus *Annals* XIV.35).

Female engagement in violence has not been addressed within British Iron Age studies (e.g. Watts 2005), despite the presence of females throughout Britain with evidence of peri- and ante-mortem violent injuries, for example in east Yorkshire (Boylston 2000a, 367). When the same injuries are observed in males, their active engagement with violence becomes implicit, and the evidence not closely questioned (e.g. Wainwright 1979, 192), the same is true of burials with weapons. In Dorset, the majority of males and females are not interred with weaponry. James (forthcoming) notes that within Wessex (of which Dorset forms a part) there are very few deposits of weapons and their numbers change throughout the period. Therefore, using non-osteological evidence to prove engagement in violence is not reliable, as the inclusion of weapons in a burial is only one way to deal with an individual killed in battle (Vencl 1984, 126-127).

Female engagement in violence is a frequent occurrence in Celtic literature, particularly in the Insular myths of Ireland and Wales (Green 1997, 11-14). Scáthach was a prophetess who was highly proficient in warfare and ran a school of warfare that trained heroes such as Cú Chulainn (Green 1997, 148-149). Women such as Scáthach should not be viewed as direct evidence for female warriors. Márkus's (1992) review of female agency in Celtic myths concludes that the texts do not provide evidence for their active participation in a society that accepted them as equals. Instead, their power and influence is shown to be dangerous (Márkus 1992, 379, 387).

Moore's (2000) anthropological analysis of female life-ways using a feminist methodology has shown that status, age and access to power will allow some females to have life-ways outside of the domestic sphere. Females are able to use kinship and non-kinship connections to access resources outside of their household, enabling them to take on different roles (Moore 2000, 53, 61). Milledge Nelson's (1997, 1999), feminist approach to female power in archaeological societies, has demonstrated that past females with evidence of engagement or exposure to inter-personal violence are often regarded as anomalies, because past female roles are homogenised and interpretation occurs in a framework in which female association with power is questioned or discounted (Milledge Nelson 1999, 189).

Sections 4.3.2.1 and 4.3.2.2 examine, in comparison with clinical and palaeopathological data, the evidence for female engagement in or exposure to violence. Primarily, the comparison has been undertaken by examining the mechanical cause of the fracture and considering how this may have been achieved in the socio-cultural framework in which they lived, in addition to the age and sex of the individual (Walker 2001, 578). The evidence will be interpreted with reference to other archaeological populations, anthropological research and clinical data (see Walker 2001, 580) in order to address the relationship between gender and biological sex, thereby gaining a better understanding of female life-ways.

4.3.2.1 Iron Age females: peri-mortem sharp-force weapon injuries and fractures

The female prevalence of inter-personal violence was considerably lower than the male sample; but the difference in the number of male and female elements with peri-mortem sharp-force weapon injuries was not statistically significant (Table 57). The cranial elements were the most frequently affected (Tables 108 and 109) and post-cranial elements were less affected compared to the male sample. The high number of cranial elements observed with evidence of fracture is due to the presence of multiple fractures, originating from different locations in single individuals (Table 109) (Figure 42). The radiating linear fractures were of sufficient energy to penetrate the ecto- and endo-cranial surfaces of multiple elements, indicating that the out-bending away from the site of impact (where in-bending occurs) was very severe, resulting in tearing apart forces that created a linear fracture. The pattern and severity of fractures demonstrates that a high degree of energy was transferred by a blunt object. Gurdjian et al. (1950a) experiments with cadavers found that fractures could be produced by 400 inch-pounds of energy and multiple fractures could be created by only a small increase in energy (Gurdjian et al. 1950a, 323). The blunt-force fractures observed in these females conform to the pattern created by a baseball bat, brick or hammer, as they typically affect both cranial tables and produce an oval/circular area of bone which is fragmented by three to six radial fractures (Gurdjian et al. 1950b, 106-113). In many cases, the number of fractures exceeded this and finding points of termination was frequently impossible (also due to glueing and other restorative work see Appendix 1), suggesting that many females had received multiple blows.

Figure 42: An example of peri-mortem blunt-force cranial trauma in a young adult female [P19 Maiden Castle]. Superior view of the right parietal bone, showing the impact site and radiating fractures.

By comparing the distribution of cranial fractures to the data produced by Gurdjian et al. (1950a), the probable direction of force could be postulated (Table 109). Demonstrating that for females without sharp-force weapon injuries, the blows were directed to the lateral-frontal, posterio-parietal and lateral-parieto-occipital portions. A pattern also observed in the male sample (Table 53). Females with sharp-force weapon injuries had the majority of fractures directed to the lateral-frontal and mid-occipital portions. In these individuals, the fractures were produced by the blade penetrating the cranium, causing the adjacent bone to fracture in many directions at both ends of the blade (Courville and Kade 1964, 37). The targeting of these cranial portions is present in the male sample (Table 53), suggesting that the aggressors did not change their assault methods between males and females.

The head is a common site for stoning injuries, because it is very exposed and a great deal of harm can be produced (Judd 1970, 16). Determining whether an individual had been struck by a sling stone is problematic, because only the mechanism (blunt force) can be identified. However, some females (e.g. T21 Maiden Castle) have circular areas of the cranium missing, which could have been the impact site of a peri-mortem sling stone injury (Figure 29b). Unfortunately, no intact peri-mortem depressed fractures are present in the sample and consequentially further analysis was not possible.

Near to the eastern gateway of Maiden Castle, Wheeler discovered numerous piles of sling stones flanking the entrance, with one pile containing over 20,000 stones (Wheeler 1943, 47), all of which are similar in dimension and weight (50 grams) (Ritchie and Ritchie 1997, 52). The use of sling stones by Iron Age peoples was recorded in the primary sources. Caesar noted that the Gauls slung moulded bullets of hot slag and burning darts (Ritchie and Ritchie 1997, 52). The weight of the stone to a certain extent dictates the amount of damaged caused for example, a small stone (dimensions and weight not provided) may only cause a localised depressed fracture (Judd 1970, 14). Judd's (1970) clinical study of 20 patients from Western Samoa, had depressed fractures caused by falling coconuts (N= 8) and stoning (N= 12). Subsequent to the injury, 12 patients were unconscious for a short time and three patients had neurological problems. The majority of wounds were between 30 and 60 mms and many contained other material (Judd 1970, 15). None of the patients in Judd's (1970) study died or suffered from post-traumatic epilepsy, despite many fractures being open and one patient developing a sub-dural haematoma. However, all of these individuals received surgical treatment (including trepanation) (Judd 1970, 14-15), therefore their chances of survival were significantly increased in comparison to prehistoric peoples.

Post-cranial peri-mortem sharp-force weapon injuries (Table 110) was observed in two females from Maiden Castle, who had peri-mortem blunt-force trauma and sharp force injuries to the cranium. P14 (young adult) had three lesions on the anterior aspect of the middle third of a rib (Figure 34). The lesions consisted of small linear cut marks (2 to 3 mm in length), which had forced the outer cortex into the trabecular bone. Two were at an oblique angle and the third was perpendicular to the long axis. The individual also had multiple sharp-force weapon injuries to the occipital bone and right temporal bone. In forensic contexts, stabbing injuries are most commonly found to the torso, as in this case. The marking of the rib demonstrates that considerable force was applied to the blow, as the overlying tissue and clothing provide considerable resistance. However, if the blade penetrates the skin, it can easily pass through the underlying soft tissue without requiring additional force. The role of the victim must be taken into consideration. If they fall or run against the blade, counter-pressure can be produced forcing it further into the body. The wound may not have caused immediate death, because the individual may not have been aware of the injury, as external evidence of blood loss may be minimal and internal blood loss could be slow (http://www.dundee.ac.uk/forensicmedicine/11b/woundsdjp.htm). In this case, the injury may have been minor, as only the anterior aspect of the element was affected.

The female [P19] (middle adult) (Figure 34) has sharp-force weapon injuries to the posterior aspect of the proximal third of the left tibia and fibula. The sharp-force injury has removed a portion of the outer cortex (wastage fragment), forming an inferiorly extending oblique line, which may have been produced by one blow. The female also has blunt-force cranial trauma. Such an injury would have disabled the female, as it would have severed the soft-tissues used to move the leg (Stone and Stone 1999, 191-201) and caused massive haemorrhaging, as arteries and veins would have been cut (Gray's Anatomy 2001, 110-114).

The prevalence of peri-mortem sharp-force weapon injuries is very low in the female sample, as the majority of individuals from all the age groups do not have any osseous evidence present (Tables 128 and 129). The prevalence is highest in young adult females (N= 2), with only middle adult females present with two injuries and only one young adult female in the sample with multiple injuries (Table 129).

In the Dorset sample, the prevalence of peri-mortem fractures (Table 110) to the appendicular skeleton was lower than the prevalence of cranial trauma and included one middle adult female [T27 Maiden Castle] (Figure 43a) who had fractures to the distal third of the right radius (oblique) and ulna (probable transverse). The fracturing of both forearm elements was not observed in the ante-mortem pattern. Another middle adult female [P31 Maiden Castle] (Figure 43b) sustained a probable spiral fracture to the distal third of the right tibia, in addition to peri-mortem blunt-force trauma to the cranium. The spiral is short in length, suggesting that it may have been produced by a fall (Galloway 1999, 193-194), when a rotational force and a torsion mechanism were acting upon the element (Resnick and Goergen 2002, 2712). As this fracture is in association with cranial trauma, it may have been produced by involvement in or exposure to a violent life threatening situation, for example falling whilst trying to flee (see Judd 2004, 46-47). A middle adult female [N2 Maiden Castle] sustained multiple injuries, blunt-force trauma to the occipital bone, a symphyseal mandibular fracture and a fracture to the distal third of the right ulna. Fractures to the distal third of the ulna are most frequently produced when it is in pronation and the individual is attempting to defend their body from blunt-force injuries (Galloway 1999, 145). As the fracture is associated with skull fractures produced by direct blunt-force trauma, it is highly suggestive that the female had sustained the injury from exposure to/or engagement in violence. A young adult female [T27 Maiden Castle] has blunt-force trauma to the cranium and fractures to one rib and the distal third of the right radius and ulna (both transverse) (Table 109). The radius and ulna can only be fractured at the same segment when a direct blow or an angulated force is sustained (Apley and Solomon 2000, 283) and it is a common assault injury (Galloway 1999, 145). As with the previous two females, the association of limb and cranio-facial fractures suggests that these individuals received these injuries during a violent encounter.

Figure 43: Examples of peri-mortem post-cranial fractures in Iron Age females

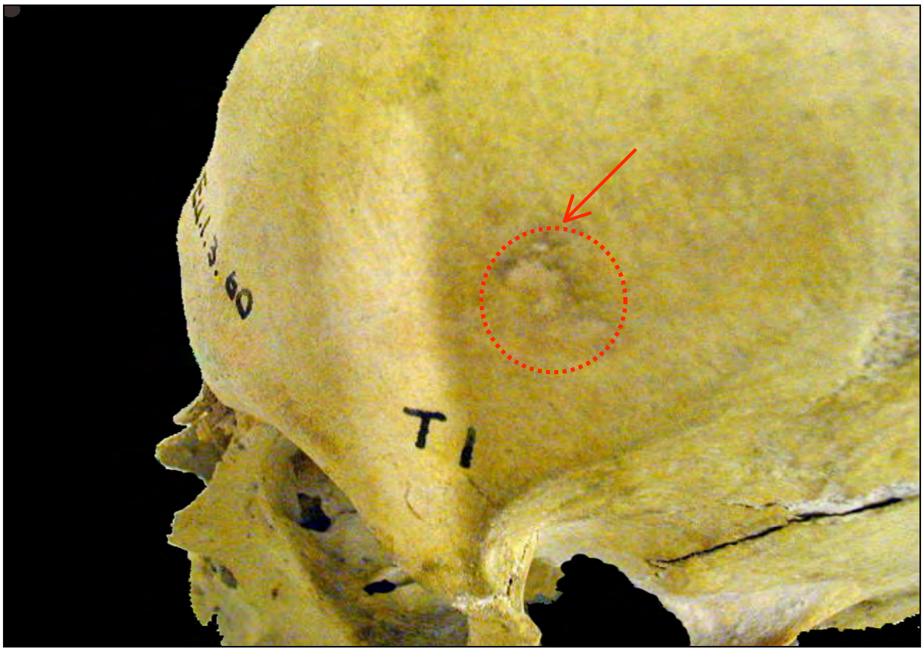
43a Anterior view of the peri-mortem fractures to the right radius and ulna in a middle adult [T27 Maiden Castle].

43b Lateral view of the right tibial distal third in a middle adult [P31 Maiden Castle].

4.3.2.2 Iron Age females: ante-mortem evidence for fractures associated with inter-personal violence

As stated in section 4.3 only ante-mortem fractures produced by a violent mechanism were included in this discussion (Tables 114 and 115). Only two middle adult females [T1 and T22 from Maiden Castle] have healed depressed fractures to the right [T22] and left [T1] anterior aspects of the frontal element (Figure 44). These could reflect healed sling stone injuries (although this suggestion is tentative) or an episode of inter-personal violence, as T1 has extensive ante-mortem tooth loss, including the loss of the left maxillary incisors (1-5, 9-16, Buikstra and Ubelaker 1994, attachment 14a).

Figure 44a An example of ante-mortem blunt-force cranial trauma in a young adult female [P19 Maiden Castle]. Superior view of the right parietal bone, showing the impact site and radiating fractures.



44b Right lateral view of the frontal bone. The blunt-force trauma is arrowed and defined [T22 middle adult female Maiden Castle].

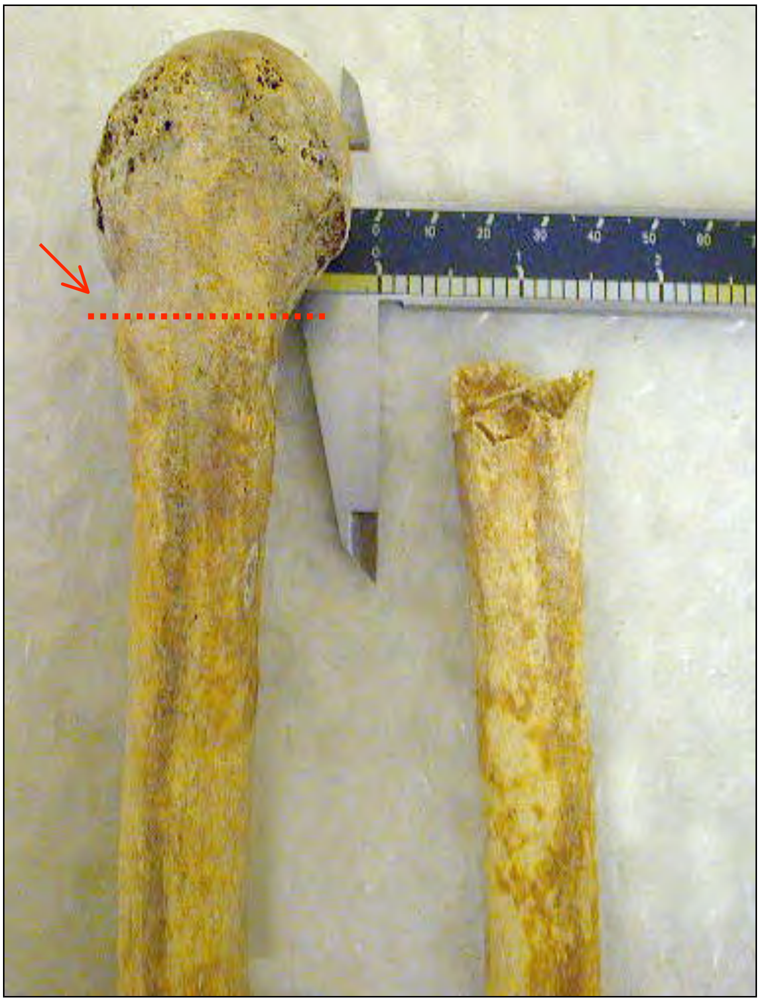
P36 [Maiden Castle] a middle adult is the only female from the region with healed fractures to the nasal bones (Figure 45a). Fractures to the nose are most frequently sustained during assaults and in Western societies, the nose is a common fracture location for victims of domestic violence (Walker 1997, 160). P36 [Maiden Castle] also has healed oblique fractures to the right tibia and fibula, and a compression fracture to the 12th thoracic vertebra. T13 [Maiden Castle] a young adult has the only regional example of a scapula fracture (Figure 31**)**. Scapula fractures are rare, due to the mass of overlying muscles. The body of the scapula is the most frequently fractured portion of the element. These fractures are most frequently observed in individuals aged between 40 and 60 years old and are usually produced by a high degree of force during direct violence or by a crushing force. When a blow is directed to the body of the scapula, the ribs can act as a fulcrum, causing it to fracture along the length of the vertebral border (Galloway 1999, 117-118; Solomon and Apley 2000, 271;

Resnick 2002e, 2816; Veysi et al. 2002). The female also has healed fractures to the proximal third of the right humerus, first proximal pedal phalanx, and to the shaft of two ribs. The fracture of the right humerus occurs inferior to the tubercles (Figure 45b), unfortunately radiography could not be undertaken, therefore the exact fracture type could not be determined. In young individuals, the humerus is most frequently fractured by a fall from a height or during sports, when the hand is outstretched. Humeral fractures can also be produced by direct blows to the upper arm, but these are more likely to be associated with trauma to the glenoid cavity (Galloway 1999, 120-121), which was not observed in this case. Fracturing of the ribs can be caused by accidents, falls and direct blows to the chest. The fracture location may not indicate where the force was directed for example, anterior-posterior compression usually results in fractures at the rib angle (Galloway 1999, 107). Pedal phalanges are usually fractured by sustaining a blow from a heavy object (Apley and Solomon 2000, 343).

Figure 45: Examples of ante-mortem fractures caused by violent mechanisms in Iron Age females.

Figure 45a Anterior view of fractures to the nasal bones in a middle adult [P36 Maiden Castle].

Figure 45b Right lateral view of the humerii, the healed fracture to the proximal third of the right humerus is arrowed and defined [young adult T13 Maiden Castle].

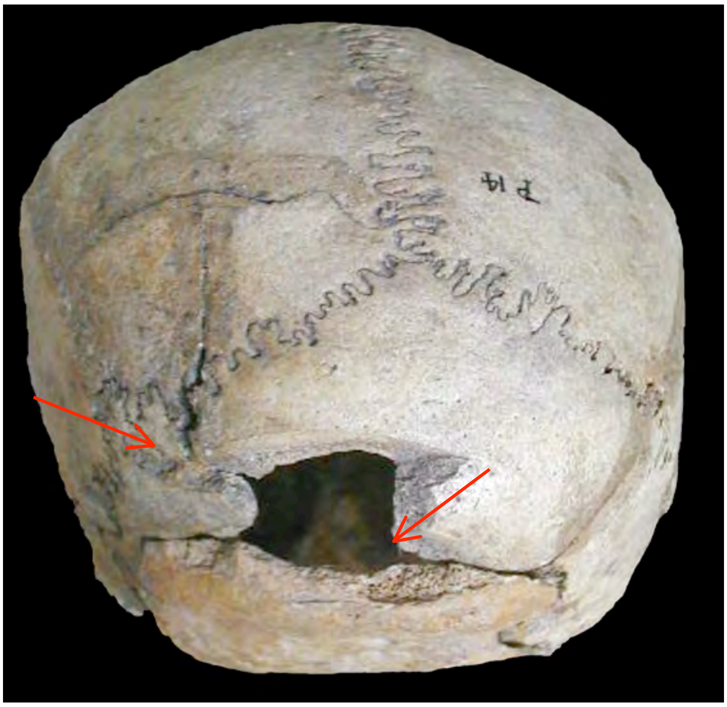


4.3.2.3 Iron Age females: sharp-force weapon injury recidivists

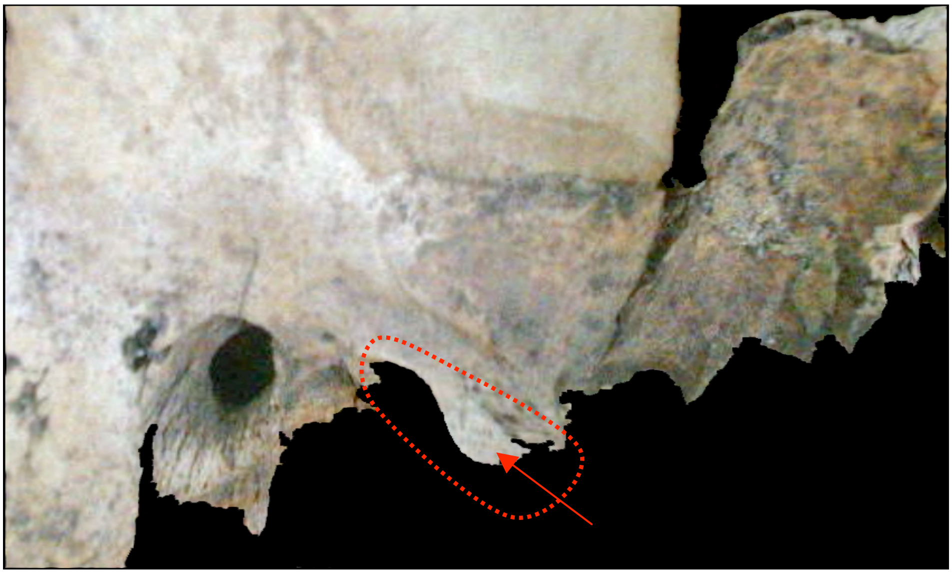
The majority of females in the sample did not have any osseous evidence for sharp-force weapon injuries, as only three individuals had observable lesions (Tables 128 and 129) (Figure 46). No clear pattern emerged, as the individuals were equally distributed among the age categories (Table 129). Sharp-force weapon injuries to the cranial and post-cranial skeleton were only observed in P14 [Maiden Castle] (Figures 34, 46a, b).

Figure 46: Examples of cranial sharp-force weapon injuries in Iron Age females.

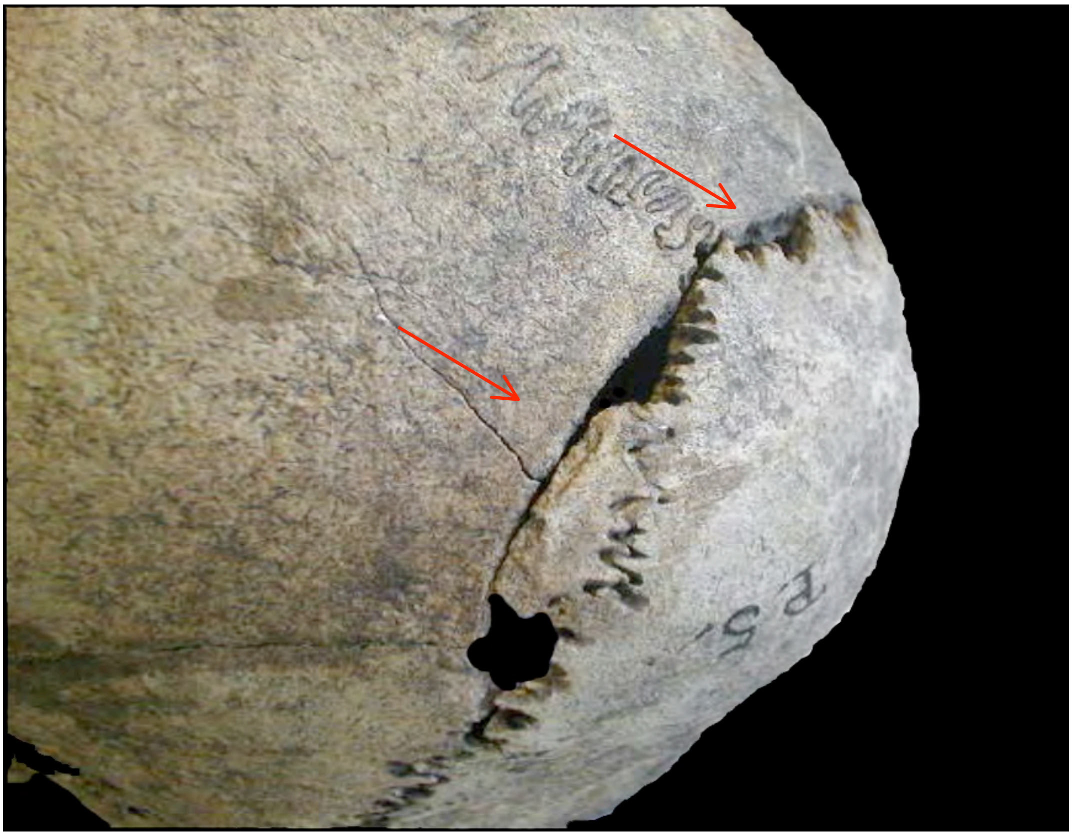
46a Posterior view. The sharp-force weapon injuries to the occipital bone (arrowed) in a young adult [P14 Maiden Castle].



46b Right lateral view of the sharp-force weapon injury to the zygomatic process (defined) [P14 Maiden Castle].



46b Superior view of a sharp-force weapon injury (arrowed) to the parietal bones of a young adult [P5 Maiden Castle].



4.3.2.4 Iron Age females: fracture injury recidivists

In all age groups, the highest fracture prevalence rates were observed in individuals without evidence of fracture for example in older adults, the rate was 66.7% at the age group level (N= 6/9) (Table 123). The prevalence of injuries demonstrated a clear age-related distribution, at both the regional and age group level, with the lowest fracture prevalence observed in older adults (N= 1/51, 2% and N= 1/9, 11%). No clear pattern emerged, as they had lived the longest and therefore had the greatest opportunity to accumulate fractures. The prevalence of injuries was also equally distributed, which was not observed in any other age group. The result differs from other archaeological populations, for example analysis of the prehistoric Libben population (Ohio, United States of America), found that individuals over 45 years had a high risk of fracture (Lovejoy and Heiple 1981, 541), a result also observed in a prehistoric sample from Northern Chile (Neves, Barros and Costa 1999, 257). However, in Powell's (1988) analysis of the Moundville population (Mississippi, USA), females aged over 45 years had the lowest fracture prevalence (Powell 1988, 146). In Dorset, middle adult females at the regional level had the highest prevalence of two or more injuries (N=3/51, 5.9%). However, it was young adult females at the regional level, who had the highest prevalence for one injury (N= 8/51, 15.7%). The high fracture prevalence of middle adult females may correspond to the mortality peak for this age observed, which may indicate that females had an elevated mortality risk during these years. A hypothesis supported by the high prevalence of violent injury mechanism, particularly for multiple injuries (Table 119).

The results from Dorset indicate that more individuals are present with multiple injuries, which may be a consequence of the bias towards peri-mortem fractures at Maiden Castle. It indicates that the majority of peri- and ante-mortem injuries were created by violent mechanisms. The observed data suggest that many females were active participants in episodes of violence, or were members of an at risk group.

4.3.2.5 Iron Age female aggressors

"Just because all women are not as physically strong and courageous as men generally are, this does not mean that the entire female sex is lacking in such qualities"
(de Pizan 1999, 34).

Gender and feminist theories allow us to deconstruct implied reconstructions of past societies, as we are now more aware that each society has constructed its own gendered division of labour, which may be at odds with our Western perspectives (Conkey 2005; Gibbs 1998, 249). Lorber's (1994) examination of gender demonstrates that the division of labour along social concepts strengthens a society's evaluation of a particular gender-role (Lorber 1994, 30). Consequentially, it may be 'normal' in some societies for females to be involved in acts of violence. For example, in the literature it is frequently implied that men are more responsible for protecting communities, often this is not the case, as may be shared by the whole community (Conkey and Spector 1984, 23). The WHO's (2002) report on violence found that females were active participants, particularly in domestic contexts (WHO 2002, 15). Nevertheless, it is only recently that feminist scholarship has recognised, accepted and researched the female capacity for violence (Kimmel 2004, 272; McClennen 2005). Research on female violence is based upon data from clinical settings, violence in lesbian relationships and female violence in society, which has concluded "women are as, or even more, violent than men" (Kelly 1997, 33-36). Peach's (2005) analysis of women's involvement in military service has shown that the American military acknowledge that females do meet the physical standards necessary for combat duty and that some females are stronger than males (Peach 2005, 22-23; see also Lorber 1994). Peach's (2005) research found that the American Military acknowledge that there is no empirical evidence to demonstrate that females cannot be trained to exhibit the same degree of aggressiveness as males and that mixed sex combat units perform as effectively, often more so than all male units (Peach 2005, 22-27). As one female Tamil Tiger soldier states "instead of dying screaming … it is a relief to face the army with your own weapon" (Greer 2000, 209; see also Matthews 2003).

The female burials from the Iron Age (8^{th} to 3^{rd} Centuries B.C.) cemeteries at Aymyrlyg (south Siberia) contain many individuals with evidence of engagement in violence, which is supported by archaeological and historical evidence for female warriors (Davis-Kimball and Behan 2002, 54-61; Murphy 2003, 98). Unlike the Dorset sample, no females were present with peri-mortem cranial fractures, however they do display a range of healed fractures produced by violent mechanisms, in addition to peri- and ante-mortem sharp-force weapon injuries (Murphy 2003). Both samples have similar number of elements with sharp-force weapon injuries (Aymyrlyg N= 8/2149, 0.4% and Dorset N= 7/6108, 0.1%) and ante-mortem fractures (N=39 respectively) (Tables 110, 111, 114, 115). The female Dorset pattern of sharp-force weapon injuries (Table 129) differs from Aymyrlyg, which has closer similarities to the male Dorset sample (Table 80). For example, an Aymyrlyg female aged 35 to 45 years old [XXXVI.115] has multiple sharp-force weapon injuries to the cranial and post-cranial skeleton. The cranium has two linear defects to the temporal and zygomatic bones, and the post-cranial skeleton has defects to the scapula, proximal humerus, and radius (Murphy 2003, 213).

Analysis of the ante-mortem fractures at Aymyrlyg concluded that many females were involved in inter-personal violence (Murphy 2003, 97-98). As stated previously, both samples have comparable numbers of fractured elements. Both samples have fractures to the frontal bones, nasals, lumbar vertebrae, ribs, humerii, radii, fibulae, metacarpals, and phalanges (Tables 114 and 115). However, it should be noted that despite the small sample size, Dorset has the only example of a scapula fracture, suggesting that cultural targeting could account for this case. A hypothesis supported by the Aymyrlyg sample having a higher number of fractured cranial bones, particularly the nasals (Murphy 2003). In contrast, Dorset has a higher number of rib fractures and fractures to the frontal bone (a peri-mortem example of a radial-ulna fracture is present see Table 109). Murphy (2003) suggests that many of the Aymyrlyg females received these injuries during exposure to/or engagement in inter-personal violence, in addition to falls (Murphy 2003, 97). For example, one older female [XXIII.8] has healed fractures to the right 4^{th} and 5^{th} metacarpals, the mid shaft of a rib, and at the distal third of the left ulna (Murphy 2003, 178). Therefore, similarities between the two sites suggest that some Dorset females may have been active participants in violence.

Comparison of the fracture injury recidivist data shows that Dorset has a higher prevalence of recidivists (N= 26/51, 51.1%) (Table 123) compared to the seven at Aymyrlyg (N= 7/37, 18.9%), although the ages affected are comparable as in both samples, young to old adults are affected. The majority of female recidivists from Aymyrlyg are middle adults (N= 4/37, 10.8%)(Murphy 2003, 130-231) a pattern present in Dorset, where the majority of recidivists were middle adults (Table 123). Dorset differs from Aymyrlyg by having more individuals present with multiple injuries (this is biased by the peri-mortem data from Maiden Castle) with the majority of peri- and ante-mortem injuries created by violent mechanisms. The similarity of the fracture injury recidivist data between Dorset and Aymyrlyg suggests that females were engaged in, or exposed to episodes of inter-personal violence.

The number of recidivists in the region may have been higher, as experienced/good combatants may have only sustained soft-tissue injuries. The loss of catastrophic samples, the incomplete excavation of the Maiden Castle cemetery and other hillforts in Britain has curtailed our understanding of past female aggressors.

In Iron Age Dorset, female participation in acts of violence (whether small or large scale) may have occurred as an aspect of their gender role. Adams's (1983) anthropological study of female participation in warfare found that accepted female participation occurred when the society only engaged in external conflict, with female engagement varying from combatant status to only being involved when the home-ground was attacked (Adams 1983, 200-202).

Female involvement may have occurred by becoming a third gendered individual, Gilchrist (1999) states that gender identity is a private experience which influences the way in which individuals express themselves physically and materially (Gilchrist 1999, 54). A point well made in the social sciences, particularly in the recognition of a variety of female masculinities (Halberstam 1998, 46). Halberstam (1998) notes “masculinity, of course, is what we make it” (Halberstam 1998, 144) and therefore can be individual specific. It is different from masculinity associated with the male body and it does not mean that a masculine woman is copying a man. Instead, it refers to women who use masculine gender codes to create their own gender identity and rejects some or all feminine restraints. It may take the form of wearing men’s clothes, hairstyles, or cross-dressing as a man to undertake traditional male occupations (e.g. pirates) in societies with strict gendered occupations (Halberstam 1998, 59,120). Many societies construct gender as a quality of person (Moore 1994, 144), thereby allowing females to engage in inter-personal violence. Despite the recognition of masculine females, who wish to participate in male activities, the acknowledgement of these individuals in archaeological contexts is mixed. For example, Gilchrist’s (1999) critique of Treherne’s (1995) research into material culture and the warrior status, demonstrates that many of the artefacts he cites are not exclusively recovered from male graves and that Treherne (1995) assumes continuity in warrior-hood from Homer to Beowulf (Gilchrist 1999, 66).

Arnold’s (1995) examination of late 5th and early 4th century B.C. high status Hallstatt and La-Tène burials in Iron Age northern Europe, has shown during this period the number of female burials with elite goods increases. Arnold (1995) suggests that it represents a response to male migration to the south, where they were frequently employed as mercenaries (Arnold 1995, 155-157). In the subsequent power vacuum, Arnold (1995) suggests that high status females were able to adopt male attributes of leadership and control, which are reflected in their funerary goods (Arnold 1995, 159). However, it is the interpretation of this status shift that raises interesting possibilities for the Dorset sample. Arnold (1995) suggests, that these ‘honorary males’ or ‘appendage syndromes’ may have been active within society during this period but, are the exception within patriarchal societies and are not truly reflective of female status (Arnold 1995, 161). Females undertaking this status would have been responsible for maintaining clientage networks (Arnold 1995, 160) and perhaps instigating or becoming involved in violence against other communities. Arnold (1995) makes the important observation that alternatives to assuming male life-ways did exist and cites Boudica's skill as a leader in warfare as an example (Arnold 1995, 164).

In historical societies, female engagement and involvement in violence is well attested (Thorpe 2005, 5). The native peoples of the Northern Plains (USA) have many documented forms of female masculinity. 'Manly-hearted' females in the Blackfoot Tribe were able to engage in male activities, but were still regarded as female. Other communities record a female who rescued her husband and scalped many enemies and a mother who killed her son's enemy (Hollimon 2001, 181-183). Infrequent involvement in aggression by females is different to those who became Berdaches that was a socially recognised third gender role instigated by the individual or family, in which a female assumed male roles, clothing, identities and occupations. It is a role recorded in post-Contact societies from the USA, for example a female chief of the Crows, had been captured from the Gros Ventre Tribe by Crow raiders and was adopted by a male warrior. She was known for her skill at horseback riding, rifle shooting and for killing many warriors. After the death of her adoptee, she attained control of his lodge and took responsibility for his children (Williams 1997, 208-209). In the sub-arctic, Kaska Indians rely on sons to hunt food for older members of the family, when families do not have a son they choose a daughter 'to be like a man'. When the daughter is nearly five years old, the parents perform a transformation ceremony, during which the dried ovaries of a bear are tied to her belt to prevent menstruation and pregnancies and to provide luck during hunting. After the ceremony, she is dressed like a male and trained to do male tasks (Williams 1997, 203). The Yumas Indians of southwest (North) America acknowledge that during childhood alternative female gender identities can be constructed. One 'kwe'rhame' daughter was acknowledged as being unfeminine from birth. During childhood, she only kept male company and engaged in hunting. In adulthood, she had a muscular build, dressed as a man, engaged in warfare and was renowned for her bravery. She also married a woman and established her own household (Williams 1997, 202-203).

Wheeler (1955) opined that "the women had stood shoulder to shoulder with their menfolk" (Wheeler 1955, 107), an assumption that cannot be dismissed, as evidence for involvement in inter-personal violence is present. Hollimon's (2001) evaluation of female evidence of inter-personal violence on the Great Plains (USA) concluded, "some of these injuries may have been incurred during conflicts where the women were not passive victims, but may have been active combatants" (Hollimon 2001, 188). It is suggested that the same is true of Dorset. By recognising the spectrum of female experience and possible life-ways during the Iron Age, female involvement in violence can be better understood and recognised.

4.3.2.6 Iron Age female victims

"Violence is often seen as an inevitable part of the human condition –
a fact of life to respond to" (WHO 2002, 1).

Violence directed against females is regarded as more complicated than male directed violence, because it is usually the result of complex social and cultural situations, most frequently set in a private social sphere and consequentially, it can become endemic in female life-ways (Radford and Stanko 1997, 66-72; Kimmel 2004, 278-283). The United Nations (1993) defines female-directed violence as, "any act of gender-based violence that results in, or is likely to result in physical, sexual or psychological harm or suffering to women" (United Nations 1993 cited in Watts and Zimmerman 2002) and is applied to the sample.

Watts and Zimmerman's (2002) global review of female directed violence found that the majority of violence and aggression had been committed by their partner. For example in New Zealand, a national survey of 2000 males (aged over 17 years) conducted during 1994 found 35% had physically assaulted their partner and 21% had committed an assault in the previous year (Watts and Zimmerman 2002, 1233-1234). Many studies have shown that the definition of a violent act occurs in the socio-cultural frameworks that govern an individual's life-way (Krohn-Hansen 1994, 368). The WHO (2002) has highlighted many risk factors for violence, which may have been present in past societies, such as a history of violence within a family, alcohol abuse, partner conflict, psychological and behavioural disorders, early exposure to violence and harsh physical punishment. Their analysis of inter-personal violence has shown that physical aggression in a family is typically produced by objects, fists and feet, whereas social violence is produced by lethal weapons (WHO 2002, 15, 19).

Ethnographic studies of violence have shown it to be associated with warfare, the socialisation of aggression, kinship and the level of violence tolerated by a community (Russell 1972, 300; Ross 1985, 564; Ember and Ember 1994, 621-643). Schmidt and Schröder (2001) suggest that the 'cultural grammar' of violence enables meaning to be given to an aggressive act (Schmidt and Schröder 2001, 5). Therefore, Iron Age socio-cultural frameworks may have accepted acts of female-directed violence as part of normal behaviour.

Clinical studies of female directed violence have shown the most frequently sustained injury to be an abrasion, contusion or laceration. Dislocations and fractures, particularly blunt-force fractures to the head, are the second most frequently occurring trauma (Greene et al. 1999, 289-290; Kyriacou et al. 1999, 1895; Spedding et al. 1999, 401; Crandall et al. 2004, 43). Clinical studies have shown that females are more likely to have multiple injuries, particularly to the head and arms and fractures to the head, spine and torso. Fractures and injury to the head were the most common findings (Fanslow et al. 1998, 345; Spedding et al. 1999, 401; Crandell et al. 2004, 43). However, Walker's (2001) review of the archaeological evidence for violence, found facial targeting to be a modern pattern and injuries to the nose are "highly culturally contingent" (Walker 2001, 582).

Recognising female directed violence in an archaeological setting is reliant upon comparison to a clinical dataset (e.g. Shermis 1983). It is acknowledged that domestic violence has not been identified in all human societies, particularly in peasant cultures. Hautzinger (2003) has shown that it "relies on a cultural foundation where violence is a conditioned response to conflict, supported by specific sets of cultural values" (Hautzinger 2003, 101). A situation that cannot be proved or disproved for Iron Age and Romano-British Dorset, due to the paucity of the social research. The identification of Dorset females, who may have sustained episodes of violence throughout their life course, will be undertaken by comparison to archaeological samples in which female victims have been identified.

Wilkinson's (1997) analysis of female directed violence in Michigan (USA) from 1000 to 1300 A.D. found there was an over-representation of females aged 20 to 30 years and the high prevalence of depressed fractures or 'openings' in female crania was statistically significant (Wilkinson 1997, 23-25). The study found that the majority of blunt-force blows were directed to the posterior two-thirds of the skull, although injuries were observed in all areas (Wilkinson 1997, 28, 33). Wilkinson (1997) suggests that these injuries may represent occasional violence, such as that sustained during abduction (Wilkinson 1997, 38-39).

Martin's (1997) analysis of female fractures from La Plata River Valley (south-west USA) found that they had a higher prevalence of healed cranial and post-cranial fractures.

The majority of cranial blunt-force trauma was directed anteriorly or posteriorly. Martin's (1997) analysis included other palaeopathological evidence, which enabled her to demonstrate that females with enamel hypoplastic defects had a higher prevalence of cranial trauma. Martin (1997) suggests this evidence may indicate a sub-class of females who were repeatedly abused (Martin 1997, 53-69). However, despite her detailed analysis Martin (1997) concluded that, "the pattern regarding violent interaction seems to be that *there is no pattern*" (Martin 1997, 49 emphasis in original text). Martin's (1997) conclusion supports research conducted by the social sciences into violence, which emphasises that its manifestations are often unique to a culture (Krohn-Hansen 1994, 367-368; Schmidt and Schröder 2001). For example, a study of Australian Aboriginal females, found they had the highest frequencies of physical injury and were equally injured by both sexes (Burbank 1990, 266-267).

In the Iron Age female sample, fractures to the torso, spine, cranium and arms were recorded. No un-reduced dislocations are present in the region, but are known in Iron Age Britain (in a male) (Roberts and Cox 2003, 98). The spinal injuries observed consist of compression fractures in thoracic and lumbar vertebrae. T18 [Maiden Castle] a middle adult female has compression fractures to the 11th and 12th thoracic vertebrae and to the 3rd lumbar, which has resulted in slight anterior kyphosis in the thoracic vertebrae. Compression fractures to the thoracolumbar junction are frequently observed in a clinical setting (Pathria 2002, 2985) and are frequently produced by indirect forces caused by acute movement of the body or by forces directed at the legs and buttocks, which are transmitted through the spine (Galloway 1999, 95). Healed fractures to the torso of T18 [Maiden Castle] consisted of rib fractures (although rib fractures can be produced by coughing (de Maeseneer et al. 2000)).

Ante-mortem fractures to the arm (Figure 47) consist of a non-adult injury inter-condylar injury to the right humerus [1364 Poundbury Camp] (Figure 47a), osteochondritis dissecans to the distal articular surface of a right humerus [796 Alington Avenue] and a complete fracture to the proximal third of a right humerus [P36 Maiden Castle] (Figure 45). Two Colles' fractures were observed, but neither was associated with a cranial injury [796 Alington Avenue and 369 Poundbury Camp] (Figure 47b, c). One older adult [796 Alington Avenue] also has a compound fracture to the proximal third of a metacarpal, and an osteochondritis dissecans fracture to the right humeral trochlea. These fractures may be produced by accident (e.g. a fall) and perhaps related to occupation (e.g. throwing) or age (Resnick and Goergen 2002, 2689-2705; Resnick 2002e, 2834 and 2853). However, the intention behind such injuries cannot be assumed to always be benign.

Figure 47: Examples of ante-mortem fractures in Iron Age females.

47a Anterior view of the humerii, ulnae and radii of a young adult, the healed fracture to the right trochlea is marked [1364 Poundbury Camp].

47b Medio-lateral radiograph of the Colles' fracture (arrowed) to the left radius of an older adult [369 Poundbury Camp].

47c Anterior view of the radii distal thirds, showing the healed Colles' fracture to the left radius (arrowed) of an older adult [796 Alington Avenue].

Other individuals discussed in section 4.3.2.2 may have received their fractures during an episode of violence set in a domestic context (or as abductees). As the majority of fractures were created by violent mechanisms, such as those observed in the females from Maiden Castle with healed blunt-force depressed cranial fractures [T1 and T22]. Trauma data from injury recidivists with fractures produced by violence and/or accident and unknown mechanisms (Table 125), shows that the number of individuals with multiple injuries is very low (N= 1/26, 3.9% respectively), but the highest prevalence was observed for females with multiple injuries caused by violence (N= 15/26, 57.7%).

Following Martin's (1997) finding of a relationship between females with enamel hypoplastic defects and trauma (Martin 1997, 53-69), the hypothesis was applied to indicators of stress observed in the sample. No ante-mortem blunt-force traumas were observed in individuals with enamel hypoplastic defects and peri-mortem blunt-force trauma was only observed in one individual with hypoplastic enamel defects. The hypothesis was repeated for indicators of stress, and only one individual with blunt-force trauma was noted. Therefore, no individuals could be identified as having a secure association between indicators of stress and fractures. The result could reflect the equal status hypothesised for females in Iron Age societies (Arnold 1999). Although Websdale and Chesney-Lind (1998) suggest that even when females have high social status, female directed violence could still exist, because there is "tension between the relatively high structural position of women and the interfamilial ascendancy of men" (Websdale and Chesney-Lind 1998, 57).

Females can be victims of warfare or small-scale skirmishes. Otterbein's (2000) anthropological analysis of captured enemies has shown that dependent peoples and chiefdoms are more likely to kill all enemies, including females and non-adults (Otterbein 2000, 441). Females may be killed in such episodes, because highly visible violence can be used as a mechanism of social advancement (Krohn-Hansen 1994, 370-371). Schmidt and Schröder (2001) suggest that when violent acts are connected to a basic state of conflict, violence is never meaningless or senseless to the victim or observer, as it produces unique experiences that are culturally reconciled (e.g. formed into stories or ceremonies) and remembered by the community (Schmidt and Schröder 2001, 3,8). The reconciliation results in the production of cultural models of appropriate action, which can sanction future behaviour, such as over-kill (Schmidt and Schröder 2001, 8-11; Jacobsen 2002, 55). For example, ethnographic research on the western Apache Tribe (USA) has shown that a retaliation killing (e.g. for murder or rape) of an adult female could result in the death of either an adult male or female (Goodwin 1942, 405).

The context in which Iron Age Dorset females can be understood as victims of warfare is problematic, because catastrophic samples from the region have been lost (see section

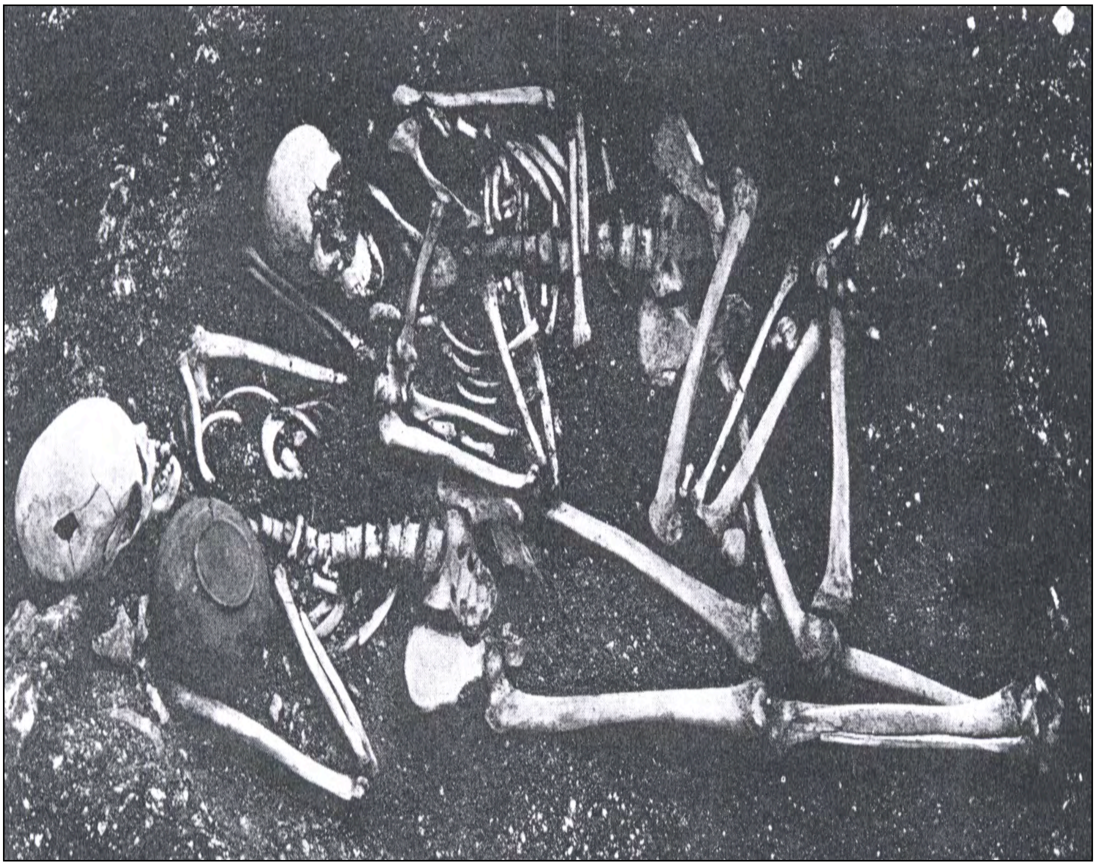
4.1.3.3) and recent research has shown that the Maiden Castle ‘war cemetery’ is not the result of a single catastrophic episode (Sharples 1991b; Bishop and Knüsel 2005). Additionally, it cannot be reliably proven to have been the setting of their death (Sharples 1991b, 125). Evidence for the ‘over kill’ of females (see Willey 1990, 93) may be present at Maiden Castle (although Carr (2002) proposes they may represent human sacrifice (Carr 2002, 64)). Wheeler (1943) states that P19 (young adult) was found thus, “the skull was propped up and the neck dislocated, apparently at the time of death” (Wheeler 1943, 353) (Figure 48a). The female did have the 3rd and 4th cervical vertebrae missing, but no peri-mortem changes were observed to the skull, ribs and remaining vertebrae.

Frenzied attacks and/or over-kill are often suggested for individuals with multiple injuries, especially when aimed at the skull (Novak 2000, 100-101). As discussed, it is unclear whether incomplete skeletons or incomplete elements (particularly facial) may represent removal of particular body parts, or severe fragmentation due to blunt force cranial trauma. For example, at the Larson Site (from the Plains of the USA) inhabited by the Arikara Tribe during 1750 to 1785 A.D., 61 individuals were recovered from the floors of houses (Bamforth 1994, 100-101). They had evidence of mutilations including decapitation, scalping, disembowelment, crushing of the skull and facial elements and removal of the hands and feet. One adolescent had their right hand removed, sustained sharp-force injuries to the torso and cut marks were observed to the right clavicle, scapula, femora and scalping marks were observed to the skull (Bamforth 1994, 101).

Wheeler (1943) suggested that female P14 (young adult) [Maiden Castle] (Figure 48b) may have been buried with her arms bound behind her back (Wheeler 1943, 353). P14 [Maiden Castle] has sharp-force injuries to the torso and blunt-force cranial trauma produced by two sharp-force injuries to the posterior aspect of the cranium and a third to the right temporal bone, which may perhaps indicate frenzied violence? The numbers of females (Table 129) with more than two sharp-force weapon injuries, or with two injuries are very low (N= 1/49, 2% respectively). The multiply injured female was a young adult [P14 Maiden Castle] and the female with two injuries was a middle-adult [P19 Maiden Castle]. Therefore, there is no clear pattern within the female sample for any particular age group to be more affected by frenzied violence.

Figure 48: Grave photographs of Iron Age females

48a Side view of the grave of P19 and P19A (Wheeler 1943, Plate LIX)
P19 has been placed in an extended position, with an upturned bowl on the right shoulder, which unfortunately obscures the cervical vertebrae. The peri-mortem blunt-force cranial trauma is visible on the right parietal bone (see Figure 42).



48b Superior view of the grave of P19 (Wheeler 1943, Plate LVIII)
The torso and head have are twisted anteriorly, so that the female is face down in the grave. The arms are bent at the elbow; the hands overlie one another and are placed at the waist (outlined).

The lack of a clear pattern within the sample is most evident when compared to other archaeological examples of catastrophic events or known inter-personal violence. This may be due to the low number of females present in the region with sharp-force weapon injuries and peri-mortem traumas. Nevertheless, the distribution and type of trauma and sharp-force injuries do have parallels to these samples, suggesting that female-directed violence did occur.

Milner et al.'s (1991) analysis of 264 individuals from Norris Farm Illinois (USA) has shown that these members of the Oneota Tribe were most likely to have been killed in small-scale attacks (Milner et al. 1991, 582-583). Forty-three individuals had evidence of peri-mortem injuries including unhealed injuries, signs of mutilation and scavenging marks from animals. The peri-mortem injuries were directed to the skull (often multiple blows), upper limbs, and trunk (Milner et al. 1991, 583-584). The distribution corresponds to what was observed in the Maiden Castle sample, where 15 of the 28 females present had peri-mortem blunt-force and sharp-force injuries to these areas. At Norris Farm, the sample is aged between 15 to over 45 years, however it is only in the 36 to 45 year age group, where adults who died violently outnumber those who did not (although it is only based on skeletal injuries). At Norris Farm, individuals with violent injuries were distributed equally between males and females (N=18 respectively) (Milner et al. 1991, 587-589), a result not observed at Maiden Castle or at the regional level (Tables 123 and 124). Milner et al. (1991) suggest that individuals with violent injuries were killed when alone or working in small groups (single-sex?) and that sporadic violence continued throughout the use of the cemetery (Milner et al. 1991, 590). Sporadic episodes of violence may account for the females who were victims of inter-personal violence at Maiden Castle, which is supported by the lack of archaeological evidence for it being a catastrophic cemetery.

Turner and Morris's (1970) analysis of 30 individuals excavated from a mass burial at Hopi, Arizona (USA), suggests that they had been victims of a massacre. The majority of the sample was adults, particularly females, who had been cannibalised or mutilated. The crania were fragmented by blunt-force trauma, with the frontal bone sustaining the majority of blows (Turner and Morris 1970, 320-323). The targeting is suggested by the authors to reflect the assailant's belief, that multiple injuries to this location were necessary to kill the victim (Turner and Morris 1970, 327). The authors suggest, based upon a legend, that females and individuals under 18 years may have been killed to prevent tension associated with the problem of distributing them between a war party (Turner and Morris 1970, 330).

The Crow Creek massacre sample (1325 A.D.), from the region of Missouri in the USA, contains the remains of 486 individuals (Willey 1990, 1, 35). The sample has an under-representation of females, but the highest numbers of females were aged from 15 to 19, 35 to 39 and 55 to 59 years (Willey 1990, 47, 50). The fracture injury recidivist data from Dorset has the highest prevalence rates for more than two injuries (N= 3/20, 15%) in the middle adult age group (35 to 50 years), which conforms to the Crow Creek data (in the present study individuals under 20 years were not classified as adults). The result supports the hypothesis that many females in the Dorset sample were victims of violence.

Many skeletons from Crow Creek displayed peri-mortem cranial fractures, however only depressed fractures were recorded, although linear fractures were present (Willey 1990, 97). Unfortunately, the Crow Creek data for depressed fractures is not separated into male and female prevalence rates. Unlike Maiden Castle, the majority of Crow Creek skulls (66.7%) have one depressed fracture with the second highest prevalence observed for two depressed fractures (19%). It may reflect cultural patterning of violence, rather than universal patterns. The focus of blows is comparable to the Iron Age female sample (Table 109), whereby the majority were observed on the parietals particularly superiorly, and "fewer on the frontals, nearly none on the occipital and none at all on the temporals" (Willey 1990, 114). The result was observed in Dorset, in which the parietal bones and frontal bone were the most affected however, unlike Crow Creek, fractures were observed to the temporal bones, zygomatic bone, occipital bone, maxillae, and mandible (Table 108). Unfortunately, determination of direction as proposed by Gurdjian et al. (1950a, b), was not undertaken at Crow Creek therefore, comparison cannot be undertaken between the two samples. The targeting of the skull in both samples may be related to the aim of the aggressor. Willey (1990) notes that historical records from the USA frequently mention the targeting of the head as a 'good' way to kill or mutilate an individual (Willey 1990, 139).

The Crow Creek sample contained examples of cut-marks to the proximal portions of the right tibia and fibula (Willey 1990, 124). Similar sharp-force weapon injuries were observed in the Maiden Castle sample [P19]. Unfortunately, at Crow Creek, it is not clear whether these elements were from the same individual and the length/depth of the cut-marks were not published (Willey 1990, 123-124). Willey (1990) interpreted these marks as indicators of post-mortem dismemberment (Willey 1990, 124). However, the marks observed at Maiden Castle do not conform to the criteria for dismemberment (Olsen and Shipman 1994).

Many females from Iron Age Dorset have fractures and sharp-force weapon injuries that conform to the pattern observed in other archaeological samples, where females are known to have been victims. The Iron Age female fracture pattern conforms to that observed in contemporary female victims of domestic violence. The data from Dorset reflects the cultural patterning of violence, with only one female exhibiting facial fractures. The result is underscored by the targeting of the face in contemporary British assaults (Walker 2001, 582-583).

4.3.3.2 Iron Age males: ante-mortem evidence for sharp-force weapon injuries

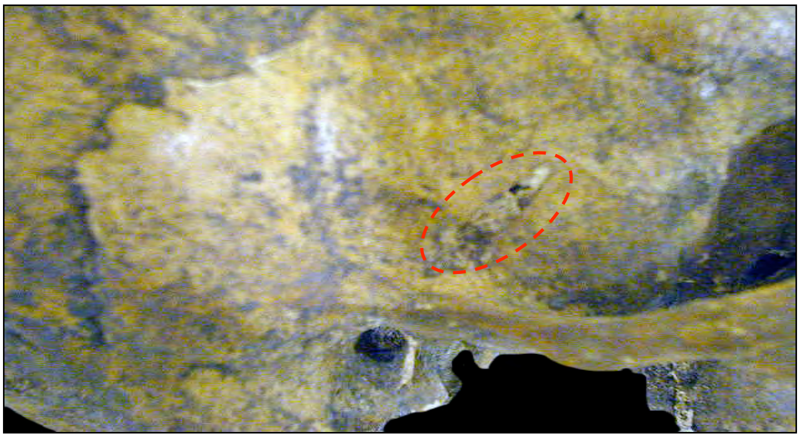
Ante-mortem evidence for sharp-force weapon injuries in comparison to the peri-mortem evidence was very low and was only observed in three males. The result is comparable to national data, in which two males had evidence of healed injuries (Boylston 2000a, 367). The remodelled lesions were observed in two males from Maiden Castle [01 and N1] and one male [285 3] from Gussage All Saints. All of the healed examples were only observed on the cranium, affecting the parietal bones (N= 2/94, 2.1%) and right temporal bone (N= 1/45, 2.2%)(Figure 63). None of the individuals has more than one injury present, and there were no indications of infection or surgical treatment. However, all males have peri-mortem sharp force weapon injuries to cranial and/or post-cranial elements. One male [285 3 Gussage All Saints] has an injury that only affects the outer table and a portion of the diploë (Figure 63a). The other cranial injuries may have been caused by a penetrating injury. Male 01 [Maiden Castle] has a remodelled lesion on the right temporal, which had penetrated both tables (Figure 63b) and N1 [Maiden Castle] has a long and deep lozenge shaped depression on the right parietal bone (Figure 63c). It appears to have channelled out the outer table and created a depression at its terminus into the diploë. The injury is without parallel in the region, and no comparable injury in available literature for the British Iron Age could be found (Boylston 2000, 367).

The absence of healed post-cranial sharp-force weapon injuries is comparable to the male sample from Towton, who were combatants in a battle during the Medieval period (Fiorato et al. 2000). From a total of 39 burials, only three individuals have healed sharp-force weapon injuries to the mandible, left parietal bone, and frontal bone (Novak 2000, 94).

Figure 63: Ante-mortem sharp-force weapon injury in Iron Age males

63a Superior right lateral view of the right parietal bone, showing the healed sharp-force weapon injury [285 3 Gussage All Saints].

The element has sustained post-mortem taphonomic damage and has been reconstructed.



63b Right lateral view, showing the healed sharp force weapon injury to the right temporal bone (defined) [01 Maiden Castle].

63c Superior view of the right parietal bone, showing the healed probable penetrating sharp-force weapon injury [N1 Maiden Castle].

The individual also displays multiple peri-mortem fractures to the cranium, which are also observable in this view.

4.3.3.3 Iron Age males: ante-mortem evidence for fractures associated with inter-personal violence

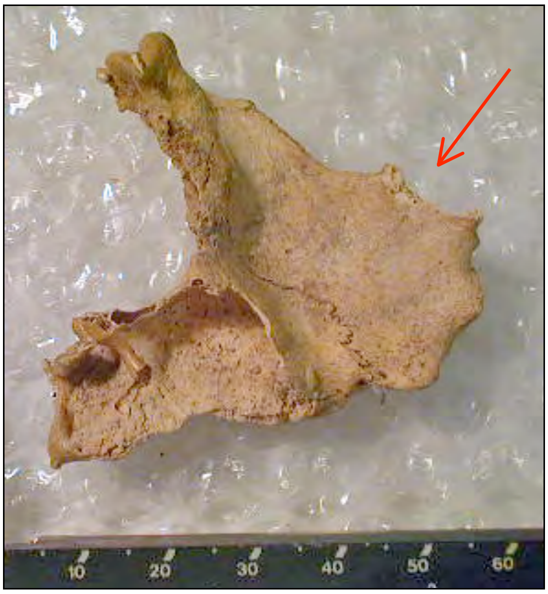
Only fractures that could be produced by violent mechanisms were included in the discussion (Table 73), as stated in section 4.3. It identified four males from Maiden Castle [P30, P20, P28 and T5] and one male from Gussage All Saints [285 3]; three of who [P30, P23 and 285 3] have peri-mortem sharp-force weapon injury. Two males have healed middle third fractures to the right humerus (Figure 16). Male P30 [Maiden Castle] has a well-healed oblique fracture, which is usually produced by a fall onto the elbow when the arm is abducted (Apley and Solomon 2000, 275). The young adult male 285 3 [Gussage All Saints] has a spiral fracture, which has healed with evidence of tissue involvement. Spiral fractures can be produced by a fall onto an out-stretched hand (Apley and Solomon 2000, 275). Both of these fracture types are produced by torsional forces, such as throwing or arm wrestling. However, these elements can be fractured by direct blows to the arm (Galloway 1999, 125; Resnick 2002e, 2817-2818).

The young adult male P20 [Maiden Castle] has the only example of a healed, un-united fracture to the temporal process of the right zygomatic bone (Figure 64). This bone is most frequently fractured by direct-blows usually in an assault context (Lovell 1997, 156). In one clinical study of facial trauma, the zygomatic bone was the most frequently fractured element and had in the majority of cases, been fractured during an assault (Scherer et al. 1989, 388-389). A clinical study by Hussain et al. (1994) found that the majority of zygomatic bone fractures were primarily caused by assaults and falls (Hussain et al. 1994, 37).

Figure 64: Ante-mortem fracture to the right zygomatic bone observed in a young adult male [P20 Maiden Castle].

64a Anterior view of the right zygomatic bone demonstrating the failure of the fracture to unite at the temporal process.

64b Posterior view of the right zygomatic bone with the un-united temporal process of the element arrowed.



A unique example of a healing distal ulna fracture was observed in a young adult male [P23 Maiden Castle] (Figure 17). The callus in this case consists of dense remodelling mixed reaction bone (Resnick and Goergen 2002, 2770-2771) and there was no evidence of rotation, angulation, over-lap and radial involvement. Isolated fractures to the ulna are usually produced by direct-force when the element is pronated. The oblique fracture type and location observed in this case, further suggests that it had been produced by a direct blow (Galloway 1999, 145; Judd 2000, 40; Judd 2004, 46-47).

Male T5 [Maiden Castle] a middle adult (Figure 18), has a well healed fracture to the olecranon process of the right ulna that has resulted in secondary osteoarthritis to the radial head and distal humeral articulation, but no evidence of radial dislocation was present. Fractures to the distal third of the left radius, and the distal third of the left fibula, which has ankylosed to the tibia were also present. The fracture affecting the right olecranon process is transverse in form and is un-united (it is unknown whether the olecranon was present as a fragment during life, as it may been lost during excavation). The olecranon is typically fractured by a direct blow or a fall upon a flexed arm, or a combination of both, with transverse fractures being produced by either mechanism (Galloway 1999, 141-142; Resnick 2002e, 2827). Isolated fractures are rare and are caused by impaction against the trochlear (Resnick 2002e, 2828). The secondary changes of, osteoarthritis, non-union and restricted movement observed in the individual, are typical of this fracture (Resnick 2002e, 2828). The Colles' fracture to the left radius was produced by a fall onto a pronated out-stretched arm (Loder and Mayhew 1988, 334-335) and is commonly fractured in males during adolescence and early adulthood (Galloway 1999, 138).

At the national level, the prevalence of ante-mortem fractures that could be produced by violent mechanisms is very low. A single radial-ulna fracture and one scapula fracture are present in un-sexed individuals (both from Yarnton, Oxfordshire) (Roberts and Cox 2003, 100) consequentially, in Britain; Dorset has the highest prevalence of ante-mortem fractures produced by violent mechanisms (an un-phased disarticulated healed ulna fracture was observed at Maiden Castle, but could not be included in the study). The result may reflect a number of socio-cultural biases, such as differences in tribal social organisation and structure (see section 4.1.3). Additional factors influencing the result of the national dataset include, the number of recoverable burials, the number of individuals excavated in other counties, the limited re-analysis and loss of samples excavated in the 19th and early 20th centuries A.D., and the lack of large-scale excavations of other hillforts in Britain.

4.3.3.4 Iron Age males: sharp-force weapon injury recidivists

The evidence for injury recidivism shows clear age differences in the number of injuries sustained by individuals, and the majority of those observed were peri-mortem (Table 80). The majority of individuals examined in the sample do not have evidence of weapon injuries. The highest prevalence without injuries was observed in middle adult males, at both the regional level (N= 15/64, 23.4%) and at the age group level (N= 15/20, 75%). Young adults had the highest prevalence of injuries at the regional and age group levels. The majority of young adult individuals with evidence for sharp-force weapon injuries had two present (N= 5/64, 7.8% at the regional level), with the second highest prevalence observed in the young adult age group for two injuries (N= 5/26, 38.5% at the regional level). In contrast, middle adult males, at the regional level had low prevalence rates for one and multiple injuries (N= 1/64, 1.5% respectively). However, at the age-group level, they had the highest prevalence of individuals with more than two injuries (N= 3/20, 15%). Older adults had the fewest number of individuals with sharp-force weapon injuries present (N= 3/64, 4.7% at the regional level and N= 3/14, 21.4% at the age group level). The recidivism, for the majority of individuals, reflects their engagement in/or exposure to a violent situation, in which they were more likely to sustain multiple injuries, and mutilations inflicted after death.

The result is comparable to the results from a Medieval catastrophic sample from Wisby (Sweden), in which many individuals sustained multiple injuries often directed at particular elements (for example the tibia) and had elements severed, for example one individual had both legs severed and another had the right foot removed (Inglemark 2001, 164-5, 171-178). However, determining injury recidivism at the individual level in the Wisby sample is impossible because an inventory is not present and the data is presented by element. If the data from whole crania are examined, it indicates that more individuals had multiple sharp-force injuries (N= 63/113, 55.7%) compared to those with not more than one injury (N= 50/113, 4.4%)(Inglemark 2001,179).

The peri- and ante-mortem sharp-force injury data (does not include projectiles) from Aymyrlyg (Siberia) again shows similarities to the Dorset data. The majority of males did not have evidence for sharp-force weapon injuries (N= 50/70, 7.1%). Young adults had the highest number of individuals of sharp-force weapon injuries (N=16/46, 34.8%) and had the highest number of individuals with more than two injuries present (N=7/46, 15.2%). The middle adult males display the same pattern as the Dorset data; with only one male having more than two injuries present (N= 1/20, 5%) and in the older adults (N= 4/4, 100%) no individuals had observable sharp-force weapon injuries (Murphy 2003, 130-231).

The data shows that a group of young and middle adult males in Dorset had a higher risk of mortality from multiple sharp-force weapon injuries. The assertion is tentatively made, because the majority of males were recidivists for only a short period before death and therefore, the recidivism informs us of their final violent encounter. The loss of catastrophic samples and the incomplete excavation of Maiden Castle and other hillforts in the region, limit our understanding of the data, as these locations may have been the preferential burial locations for individuals who had lived a violent life-way, and therefore we could be inferring from a biased sample.

4.3.3.5 Iron Age males: fracture injury recidivists

The male sample has a higher overall prevalence of fractures compared to females (Tables 72 and 123). As with the female sample, the majority of the male sample did not have any injuries present; and the highest prevalence rates were observed at the regional level in young (N= 4/64, 21.9%) and middle adults (N= 13/64, 20.3%). Unlike the female sample, the majority of age groups had individuals with a range of injuries present, from one to more than two (Table 73). The exception is older adults who did not have any individuals with two injuries. The majority of individuals sustained one or two injuries, and young adults had the highest prevalence rates at both the regional and age group level (1 injury N= 5/64, 7.8% and 2 injuries N= 4/64, 6.3%). Middle adults have the highest prevalence rates at both the regional (N= 4/64, 6.3%) and age group (N= 4/20, 20%) level for more than two injuries. These findings suggest that males had the greatest risk of episodes of violence between the ages of 20 to 45 years, which may have been related to high mortality risk during these years, as only one male with more than two injuries was an older adult (N= 1/64, 1.6%).

The pattern is also observed in the male sample from Aymyrlyg, who have a higher prevalence rates in one (N= 25/70, 35.7%) or two injuries (N= 10/70, 14.3%), compared to the rate observed in more than two injuries (N= 9/70, 12.8%). Young and middle adult males from Aymyrlyg, similarly to Dorset, had a high fracture risk during these ages (Young adult N= 24/46, 52.3% and middle adult N= 17/24, 70.8%). Whereas, in the Aymyrlyg sample only young adult males have the highest prevalence rates for more than two injuries (N= 7/46, 15.2%) (Murphy 2003, 130-231).

The elevated mortality risk of young and middle adults in Dorset is supported by the demography of the male sample (Figure 6), which peaks during these age groups. The injury recidivist pattern for elevated risk can be explained by the injury mechanism (Table 73). The majority of multiple injuries were produced by violence (N= 11/35, 31.4%), and violence and/or accident (N= 7/35, 20%). No individual was present with multiple injuries caused by accidental or unknown mechanisms. The emphasis within the results for males to have a higher risk of sustaining injuries by violence is supported by the mechanisms that produced single injuries. The majority were produced by violence and/or accident (N= 7/35, 20%), followed by violence and unknown (N= 4/35, 11.4% respectively), with accidental mechanism having the lowest prevalence (N= 1/35, 2.9%). The pattern was also observed in the Aymyrlyg sample, in which the majority of all observable single fractures were produced by violence (N= 12/39, 30.8%) and, violence and/or accident (N= 6/39, 15.4%). The sample differed from the Dorset data for multiple injuries (N= 17/39, 43.6%). Only at Aymyrlyg one individual had sustained multiple fractures through accidental mechanisms (N= 1/39, 2.5%), five individuals had fractures caused solely by violence (N= 5/39, 12.8%) and 11 (N= 11/39, 28.2%) had fractures produced by violent and/or accidental mechanisms (Murphy 2003, 130-231).

The dominance of the Iron Age male recidivism data by violent mechanisms is related to the high prevalence of peri-mortem fractures in the sample, the majority of which were produced by violent, and violence and/or accidental mechanisms (Table 73); again reflecting the bias introduced by the Maiden Castle sample. It reflects the role of risk-taking behaviour and male propensity for violence (Wilson and Daly 1985; Sabo 1999, 2). Even when competing masculinities are present in a community, more dominant males may make others engage in violence, even if they are unwilling (Large 1997, 25).

4.3.3.6 Iron Age male aggressors: concepts of masculinity and violence

" With his shield suffering violence, he would submit to no one.
It was the love of honour that sustained him"
(Extract from a Brittonic source, Koch and Carey 2003, 322).

Without recognising the role that gender plays in the life-ways of individuals and consequentially their health-statuses, "we will have an impoverished and often mechanistic view of human lives" (Conkey 1993, 48). By recognising that a multiplicity of masculinities may have been present in Durotrigian society, the emphasis upon the 'warrior' status may be deconstructed to acknowledge that individuals may have had different levels of engagement and exposure to violence, in that a scale of involvement could have been present. It may have been possible, through social constructions of male identities and the acknowledgement that ageing transformed masculinities and the ability of individuals, to be active participants in violence.

The level of violence, aggression, and warfare is unknown within the British Iron Age, especially within the earlier Iron Age. The material culture indicates that tribes manufactured weaponry and their ideological frameworks contain aspects of violence (James, forthcoming). Kristiansen's (1999) perspective on Iron Age violence is more immoderate, as he suggests "warfare was an integrated aspect of daily life" (Kristiansen 1999, 182). If James' (forthcoming) suggestion for interpretations of the Iron Age to include "the *expectation* that many people were actively harsh and brutal to others" (James forthcoming. Emphasis in original text) is accepted, then we must acknowledge that some males with evidence for sharp-force injuries and blunt-force traumas were active participants in violence. A view that is in opposition to the alternative paradigm put forward for the British Iron Age (e.g. Hill 1996), in which aggression and war did not form major elements in society, and violence did not play a role in the daily lives of the various communities.

Many clinical studies of male health have emphasised the cumulative role of social factors in the male life course (WHO 2001, 23). Young males can adopt localized, culturally specific signifiers and discourses of masculinity (Whitehead and Barrett 2001, 20). Males can use these to demonstrate differences between themselves and females (Connell 2001, 32), "though women make boys out of babies it is men who make men out of boys" (Greer 2000, 374). A male's concept of masculinity may be related to aggression and violent acts, as it has been demonstrated that all forms of violence relate to "an internally repetitive distinction of identity and difference" (Halbmayer 2001, 66). It is particularly evident in societies that contain a warrior class, as suggested for the Durotrigians (see section 4.1.3), and is attested in the primary sources on continental Celtic peoples, "[the Gauls] consider it disgraceful for a father to be seen with his sons in public until … they can sustain military duties" (Diodorus Siculus *Bibliotheka Historike* 5.18 cited in Koch and Carey 1997, 22). Anthropological work has shown that when a warrior tradition exists in a society, younger individuals can be socialised to become aggressive, and are encouraged to see the tradition as an ideal of violence and aggression (Ember and Ember 1994, 625-634; Large 1997, 29). As Gibson (1990) states, “being a warrior is not an occupation but a male identity” (Gibson 1990, 96). Ember and Ember (1994) note that aggression is the “intervening variable between war and interpersonal violence” (Ember and Ember 1994, 624), reflecting the need of that society to have “unambivalent” warriors (Ember and Ember 1994, 643). Therefore, the multiple injuries sustained by some individuals and targeting of particular areas of the body, may reflect the skill of ‘professional’ warriors and their efficiency at inter-personal violence (see Jacobsen 2002). Such behaviour could replicate the social belief that their response was the most appropriate (Schröder and Schmidt 2001, 5). Identifying individuals who were ‘warriors’ in the archaeological record is highly problematic, as warfare is usually reflected in a limited number of individuals (Milner 1995, 237). There is also debate over the extent to which warfare can be recognised from weaponry (Carman and Harding 1999, 247), and how war is distinguished from other violent practices (Ferguson 1997, 326).

Many concepts of masculinity encourage involvement in risk-taking and violent behaviour, “anyone can play a masculine role, and it appears that heightened violence potential is associated with the masculine role” (Bowker 1998, 7). Clinical and social science research has shown that such behaviour can be linked to biological differences between the sexes, as males are more likely to engage in violent activities which entail a high risk of injury and mortality, especially if they are related to status and social attention (Pinker 2002, 345). Courtenay’s (2002, 2003) review of male health in USA, has shown that the male incidence of fighting is two to four times higher than that of females; with males considering physical aggression to be an appropriate response to a situation of possible conflict, and that males frequently underestimate the risks of physically dangerous situations (Courtenay 2002, 303; 2003, 8).

Anthropological studies have shown that young males use violence as a means of accruing wealth, prestige and status, even when there is no opportunity for land to be taken (Russell 1972, 295; Maschner and Reedy-Maschner 1998, 22; Thorpe 2003, 147). It is supported by Knauft's (1987) research, which demonstrates that in societies where male status distinctions are emphasised, a high level of violence is usually present (Knauft 1987, 479). Studies have shown that these distinctions of status and material wealth can be achieved by intra-tribal acts of aggression, such as participation in public duels. These acts can be socially advantageous, because they stress fearlessness and aggression, and above all mark out individuals who willing to engage in violent actions (Halbmayer 2001, 66-67). Therefore, despite creating a high risk of mortality and injury, the behaviour can be reviewed as "highly adaptive" (Courtenay 2003, 9).

A comparable social situation has been hypothesised for Iron Age Britain; such as a clientage system and the development of a warrior class (Sharples 1991a, 84-87; Haselgrove 1994, 3; Gwilt and Haselgrove 1997, 7). Kristiansen (1999) suggests that a warrior class developed during the Iron Age, which included dependent associates, and expression via material goods and weaponry (Kristiansen 1999, 176-177). A warrior class may have promoted the use of violence and aggression to fulfil particular concepts of masculinity. Haas's (1990) analysis of the evolution of tribal polities, suggests that tribal warfare is dominated by small, intermittent raids into other territories to acquire goods, destroy an enemy's resources, and to abduct individuals (Haas 1990, 177).

The findings of these studies are similar to the observations of Celtic males in the primary sources (the role of bias is acknowledged). Athenaeus stated that they often engaged in mock-fights, which frequently escalated into episodes of inter-personal violence (*Deipnosophistae* 4.40 cited in Koch and Carey 2003, 10). Other primary texts record violent barbarian raids into European Roman territory (Elton 1997, 45-47). Tacitus noted that British tribes were "distracted between warring factions of rival chiefs" (*Agricola* 12), but this may have been a response to greater Roman Imperial actions in Gaul, and the consequence of earlier Roman invasion. Chapman's (1992) discussion of Celtic peoples and violence concludes that inter-tribal violence may have formed a part of their social framework of organisation, with warfare only occurring at certain times of the year (Chapman 1992, 180-181). Chapman (1992) connects such behaviour to the acquisition of social status, "what mattered, perhaps, was *to be seen to be brave*. Once that had been achieved, there was no need to hang around to get killed" (Chapman 1992, 181. Emphasis in original text).

The context in which the sharp-force injuries and blunt-force traumas were sustained is complex, especially as no individuals are from catastrophic contexts, and the phasing of burials at Maiden Castle has been questioned (Sharples 1991b). The situation is compounded by the nature of the evidence as Vencl (1984) states, "the identifications of causes and pretexts for fighting and wars is inaccessible through archaeology" (Vencl 1984, 119). The repetitive targeting of specific areas of the body and accuracy with which the injuries were delivered to cause death, suggests that they were not undertaken by in-experienced individuals who had a limited knowledge of weaponry.

Haas (1990) suggests that males aged 18 to 35 years may have a higher risk of death when tribal warfare is present (Haas 1990, 178), a pattern observed in modern clinical data, in which the majority of 15 to 24 year olds dying are male (Courtenay 2003, 13). Haas's (1990) suggested mortality peak does correspond to the demography of the present sample, most notably, to the age of injury recidivists, those with sharp-force weapon injuries, and individuals with blunt-force traumas. The male data suggests that some individuals may have engaged in episodes of violence, perhaps influenced by their masculinity or concepts promoted by socio-cultural frameworks, in order to improve themselves socially and materially. Their scale of involvement may have ranged from participation in duels, small-scale raiding parties, or larger organised acts of warfare. As only the mechanism of fracture could be identified, we cannot rule out that some of these individuals were killed during the Roman invasion, especially as conquest of the territory was recorded as being more difficult compared to other areas in southern Britain (Sharples 1991a, 86-87).

In the Iron Age, determining male engagement in violence has been very problematic, despite employing an ecological model of violence, as no research has been undertaken to examine the archaeological evidence for this engagement. The perception of violence in the Iron Age still rests upon the stereotypes and images portrayed in the primary sources. Unlike feminist research, which has tested the archaeological record to identify female participation in violence, the same has not been undertaken for males, perhaps because it is more of an implicit assumption. Therefore, the understanding of the palaeopathological evidence remains incomplete, even when anthropological research is used as, "we … cannot assume that similar instances of violence in different cultures have the exact same constitution – the same history, the same meaning, the same social function and effect" (Cameron and Frazer 1994, 169).

4.3.3.7 Iron Age male victims

"Sharp my spear, bright in battle; I am gearing to guard the ford,
though I may not escape; goodbye"
(Extract from a Brittonic source, Koch and Carey 2003, 390).

The WHO's (2002) report on world violence and health, found that males accounted for three-quarters of homicide victims, the majority of whom were aged from 15 to 29 years, and that males had a higher risk of becoming victims (WHO 2002,6). The peak in adolescent and young adulthood is supported by other studies of clinical data, for example Wilson and Daly’s (1985) study, that found the majority of homicide victims were between the ages of 20 to 30 years, a pattern also observed in ages of the perpetrators (Wilson and Daly 1985, 62). In the present sample, this peak was observed in the ages of sharp-force and fracture injury recidivists (Tables 72, 73 and 80). The greater involvement of 20 to 30 year olds in violence results from the involvement of peer groups in violent acts, behaviour which increases an individual’s risk of becoming a victim (WHO 2002, 9).

There are no clinical models for male directed violence, even though husband beating does exist (Kimmel 2004, 283-286). The lack of a male domestic violence model may result from researchers believing it to be “ineffectual and harmless behavior” (Burbank 1990, 253). Courtenay’s (2002, 2003) study of male health in USA, found that nearly one-half of the male population has been assaulted by another individual, compared to only a quarter of the female population (Courtenay 2002, 303; 2003, 5).

Even though males are more likely to be victims of violence, more research is needed to identify male non-participants in assault contexts (Courtenay 2002, 303). Therefore, in order to assess the data recorded in the present study; comparisons were made with archaeological contexts in which males were victims of violence, and to clinical data on assault.

A British example of an Iron Age massacre was found at Cadbury Castle (Somerset). The human remains (mostly disarticulated) were from catastrophic contexts at the hillfort, which also contained native and Roman weaponry, or had evidence of burning (Barrett et al. 2000, 105-115). Unfortunately, the human bone report (Forbes 2000) is limited and analysis of peri-mortem blunt- force traumas and sharp-force injuries is not present, therefore the data may not be wholly reflective of the evidence. The report notes that many body parts were present however, how these became to be disarticulated (taphonomically or by secondary processing) is not demonstrated (Barrett et al. 2000, 111). Sharp-force weapon injuries were present to the cranium and upper leg (Barrett et al. 2000, 111), and violent blows and cut-marks to elements were noted (Forbes 2000, 118). Despite the limited data, similar injuries were observed in the present study, particularly at Maiden Castle (Tables 76 to 80) (Figures 59-64).

The Iron Age sample from Bredon Hill (Gloucestershire), was recovered during excavation of the hillfort and was found near to the entrance-way (Hencken 1938, 54). Analysis of the sample found that the majority of individuals were males aged 20 to 35 years (young adults) (Hencken 1938, 54-55), a demographic result observed in the present study (Figure 6). The human remains had evidence for multiple sharp-force weapon injuries that exceeded those necessary to kill an individual. Hencken (1938) notes that the remains were in a "wild confusion" (Hencken 1938, 55), with many decapitated individuals and others represented by severed limbs or torsos, "two human trunks were found with but one arm and forearm between them, and neither legs nor head" (Hencken 1938, 55). Similar evidence has not been observed in the Dorset sample, however not all hillforts in the region have been excavated and samples of this kind may lay undiscovered. The sample from Bredon Hill emphasises the attritional nature of the cemetery from Maiden Castle, which may include individuals killed in a catastrophic event.

Williamson et al.'s (2003) sample of the human remains from the 18th century (A.D.) from Ohio (USA), were individuals killed in a documented ambush by Native Americans (Williamson et al. 2003). Their analysis found that the majority of crania (N= 9/12, 75%) had more than one sharp-force lesion present, and the injuries were focused upon the parietal bones and occipital bone (Williamson et al. 2003, 113-117). The injury patterning is similar to the present study, particularly the evidence for targeting specific areas of the body. The authors suggest that multiple peri-mortem injuries could be a “common occurrence” in small or large-scale massacres (Williamson et al. 2003, 119, 121). Another example of an 18th century (A.D.) massacre by Native Americans is the Fort William Henry sample from New York (USA). The sample consists of five male individuals, who had existing injuries and did not leave the fort with the retreating army (Baker and Liston 1996, 29). Their injuries are very similar to those observed in the present study, as there are multiple sharp-force weapon injuries to the torso, especially to the ribs, thoracolumbar spine, and pelvis. The Fort William Henry sample had peri-mortem blunt-force cranial injuries, particularly to the frontal bone, and defensive cuts to the ulna (Baker and Liston 1996, 34-40). Comparable sharp-force weapon injuries were observed in a middle adult from Maiden Castle [P27] (Figure 58).

Robb’s (1997) biocultural analysis of Iron Age (7th to 5th centuries A.D.) samples from Pontecagno (Italy) observed numerous healed fractures in males. The affected elements were the metacarpals and metatarsals, ribs, clavicle, thoracic vertebrae and femur, in addition to the distal thirds of the forearm, and one Colles’ fracture (Robb 1997, 113, 120-123). Robb (1997) noted that the male sample had the highest prevalence rates for fractures, which he interpreted as males having “prescribed violent behaviour”, in which they had a higher risk of fracture compared to females, as their gender role included participation in warfare or inter-personal violence (Robb 1997, 137-138). The male sample from Dorset has ante- and peri-mortem fractures affecting the same elements (Tables 54, 55, 58 to 60) and similarly to the Pontecagno sample, they have the highest fractures prevalence rates. Robb’s (1997) proposed connection between fractures and male gender roles corresponds to the hypothesised warrior-class in Iron Age Dorset (e.g. Sharples 1991b).

Ostendorf Smith's (1997) analysis of the osteological indicators for warfare in the western Tennessee Valley (USA) during the Archaic period (6000 to 1000 B.C.) identified 10 males with peri-mortem injuries that conformed to those sustained during an episode of conflict. These injuries consisted of embedded projectile points, cut-marks to the torso consisting of multiple stabbing injuries, and blunt-force trauma (Ostendorf Smith 1997, 242, 245, 250). The embedded weapons were projectile points located in the anterior and posterior aspects of the thoracic spine (Ostendorf Smith 1997, 250). These injuries are comparable to those observed in the Dorset male sample, particularly the peri- and ante-mortem examples of embedded weaponry, and the sharp-force injuries to the torso (Tables 77 and 79).

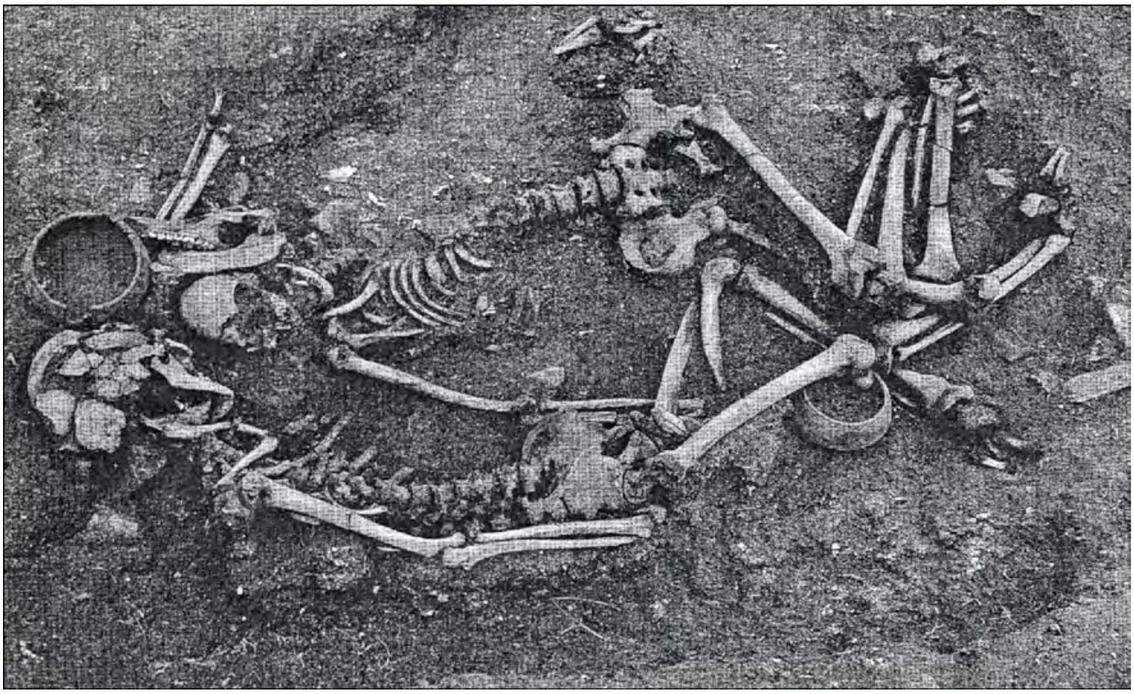
Excavation of the A.D. 9 battle between the German and Roman armies at Kalkriese (Germany), has provided a large catastrophic sample of both armies recovered from five pits, surface scatter and mass burial pits (the majority of individuals and elements are male). The remains have been subject to extensive human and faunal taphonomic action, such as burial, excarnation, display and exposure (Schlüter 1999, 136; Wilbers-Rost 1999; Wells 2004, 54, 188-198).

Examination of the human remains has shown that sharp-force weapon 'slashes' were sustained to the cranium, upper limbs, ribs/spine and lower limbs, but the majority of the injuries were penetrating. Other injuries included, punctures, amputation, decapitation, blunt-force fracturing secondary to sharp-force weapon injuries, and fractures to the upper limb (Wells 2004, 178-182). The Iron Age males from Dorset have comparable injuries, particularly the males from Maiden Castle (e.g. Figures 58, 61, 62).

At Maiden Castle, a number of males with peri-mortem sharp-force weapon and blunt-force injuries were inhumed together. The double male inhumations include, P24 and P25 who partially over-lie each other and have sharp-force weapon injuries (Figure 65a) and, P22 and P23 who have sharp-force weapon injuries and blunt-force traumas (Figure 65b) (Wheeler 1943, 345-354). These individuals do not have evidence of secondary burial processing or excarnation, therefore it is very probable that they may have been killed during the same episode of violence.

Figure 65: Grave photographs of Iron Age males from Maiden Castle

65a Grave photograph of P24 and P25 (after Sharples 1991b, 121 Plate 94).

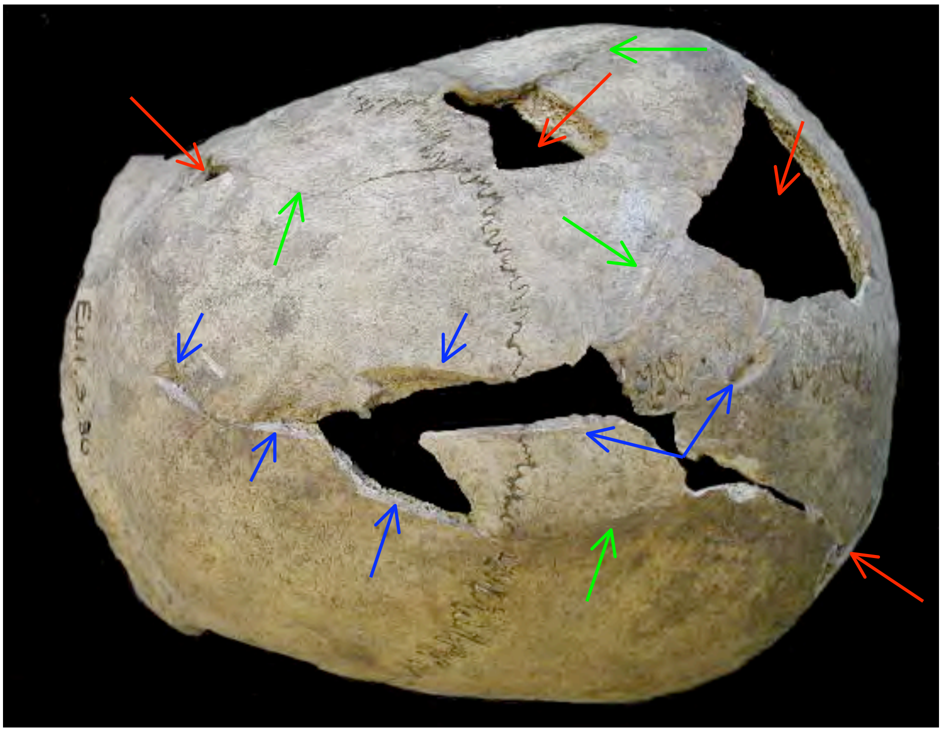


65b Grave photograph of P22 and P23 (after Wheeler 1943, Plate LX).

As discussed in section 4.3.2.6, multiple sharp-force injuries and blunt-force traumas have been suggested by many authors to reflect frenzied attacks and/or overkill, particularly when these are focused to the skull (Novak 2000, 100-101). It should be noted that multiple injuries are commonly observed in massacre contexts (e.g. Bamforth 1994). A number of males from Maiden Castle have multiple injuries that are suggestive of frenzied attacks/overkill. For example, T16 (middle adult) has peri-mortem sharp-force injuries and blunt-force trauma to the cranium, sharp-force weapon injuries to the forearms and fingers, and multiple sharp-force injuries and blunt-force traumas to the torso (Figures 52a, 57c-d and 59d) and P9 (middle adult) who has multiple sharp-force weapon injuries and blunt-force trauma to the cranium (Figure 66).

Figure 66: Example of peri-mortem sharp-force weapon injuries and blunt-force cranial traumas in a middle adult male [P9 Maiden Castle].

66a Superior view of the cranium, showing the impact areas of blunt-force traumas (arrowed in red), the multiple sharp-force weapon injuries (arrowed in blue), and associated multiple fractures (arrowed in green).



66b Left lateral view of the posterior portion of the left parietal bone, showing a deep linear sharp-force weapon injury (arrowed blue) that has resulted in the creation of a wastage flake (arrowed green), which is now missing.

The parallels between the Dorset dataset and other archaeological samples, demonstrates that the male sample has evidence for victims of violence. The presence of victims of violence may relate to concepts of masculinity and male life-ways, highlighting those who may have been active participants in acts of aggression (including more organised acts, such as raiding or battles against the Romans). The evidence from the male sample demonstrates that acts of aggression did occur in the daily lives of the inhabitants of Dorset, which were set within a wider framework of cultural change during the mid and late Iron Age. By integrating concepts of masculinities and anthropological data, male life-ways can be understood in more sensitive and realistic ways, especially as information on life-ways, life course and status remain poorly under-researched.

4.3.4 Violence in Romano-British Dorset

"History tells us that the Gauls too had their hour of military glory; but since that time a life of ease has made them unwarlike: their valour perished with their freedom. The same has happened to those Britons who were conquered" (Tacitus *Agricola* 11).

The evidence for violence, particularly sharp-force weapon injuries, is lacking in Romano-British Dorset. The result is in marked contrast to the rest of Britain (Roberts and Cox 2002, 158), but may reflect the nature of Romanization in Dorset, in addition to the loss of many Romano-British burials from Dorchester, and the incomplete excavation of many cemeteries. The results do not mean that sharp-force injuries were not sustained in Roman Dorset, but rather that the osseous markers of such trauma were not observed. *Pax Romana* (peace through Roman rule) did reduce violence in the Empire, but it did not eradicate acts of violence, as it had the power to re-define acts of aggression (i.e. 'legitimate' acts of warfare such as raiding were relabelled as brigandage) and tolerated acts of violence in the family (James 2003b). Evidence for inter-personal violence was observed in males and females, although to a lesser degree compared to the Iron Age, and cultural patterning was observed, marked by an increase in facial fractures, particularly to the nasal bones of both sexes.

Determining scales of violence, using an ecological model (Figure 41) for the Romano-British period is very problematic, as the primary sources focus on the initial period of invasion and conquest, particularly upon the Iceni rebellion (e.g. Tacitus *Annals*). The situation is further compounded by the complex nature of society at this time (e.g. Noy 2000; Whittaker 2004, 199-213), particularly the makeup of communities outside London, and the military centres (e.g. York), which have greater evidence of migration. James' (2003b) review of violence in the Roman Empire highlights several key points that have exacerbated the situation. The concept of violence is more readily considered at frontiers (e.g. Hadrian's Wall), with central areas viewed as peaceful, and in academic research studies of violence are peripheral (James 2003b).

4.3.4.1 Romano-British female evidence for inter-personal violence

"What sense of shame can be found in a woman wearing a helmet, who shuns femininity and loves brute force? (In spite of it all, though, she'd hate to become a man)"
(Juvenal *Satire* 6. 252-4).

The evidence for inter-personal violence in the Romano-British female sample is very low compared to the Iron Age (Tables 113-116). No peri-mortem fractures or sharp-force weapon injuries were observed. The decrease in the number of fractured elements in the female sample was found to be statistically significant (Table 118). The injury recidivism data supports this pattern, as only one injury was produced by a violent mechanism, namely a nasal bone fracture [1114 Alington Avenue] (Table 125). Other fractures that have a less secure association with violence were observed in the distal third of a left ulna (N= 1/44, 2.3%) [1178 Alington Avenue] and in two metacarpals (N= 2/392, 0.5%) [908 Tolpuddle

Ball and 848 Alington Avenue]. The distal third of an ulna is most frequently fractured when the element is pronated and the individual is attempting to shield their body from blunt-force injuries (Galloway 1999, 145). The adult female 848 [Alington Avenue], sustained a complete fracture to the mid third of a 4th metacarpal, and the middle adult female 908 [Tolpuddle Ball] sustained an oblique fracture to the distal third of a 5th metacarpal. The 5th metacarpal is one of the most fractured hand elements, and comparison to clinical data showed that these fractures, were located in the most frequently fractured segments (Galloway 1999, 152). Hands are frequently injured in manual occupations (Galloway 1999, 152), but can also be fractured in attempts to ward off attack (Roberts 1997, 133).

Rib fractures (N= 7/530, 0.2%) were observed in three individuals [3 and 800 Poundbury Camp and 143 Poundbury Pipeline]. One female [3 Poundbury Camp] had four healed distal third rib fractures and evidence for a malignant neoplasm. Female 800 [Poundbury Camp] has an isolated mid third rib fracture and healed tibial plateau fracture. Female 143 [Poundbury Pipeline] had an isolated rib fracture to the mid third of the shaft. Only in two rib fractures recorded in female 3 [Poundbury Camp] could the fracture type be identified, which was transverse. Transverse fractures are commonly observed in a clinical context, and are typically produced by direct-blows to the torso (Galloway 1999, 107). Other causes of rib fractures include accidents and falls (Galloway 1999, 107), which may have been the case in the female who also has a healed tibial plateau fracture [800 Poundbury Camp].

The only example of a Colles' fracture was observed in older female 996 [Poundbury Camp] (Figure 67). Colles' fractures are produced by axial compression combined with bending, typically caused by falling onto an out-stretched hand (Resnick 2002e, 2832). The context in which the fracture was sustained may not have been accidental (as often suggested for the fracture type), because “there is no difference in the injury configuration no matter if the injury was caused by an intentional push or an accidental fall” (Judd 2004, 46-47).

Figure 67: Healed Colles’ fracture in an older adult female [996 Poundbury Camp]

67a Anterior-posterior and medio-lateral radiograph of the left radius, the Colles’ fracture is arrowed.

67b Medial view of the left radius showing deformation of the distal third (arrowed) due to the Colles’ fracture.

None of the individuals described above had associated cranio-facial injuries and in the only individual [800 Poundbury Camp] with multiple injuries (excepting one female [3 Poundbury Camp] who has multiple rib fractures), the rib fractures were associated with a limb fracture typically caused by a fall. Therefore, the evidence indicates that only a minority of females sustained fractures that could have been produced by violent mechanisms. The assumption that those (typically) associated with falls were sustained in a benign context is questioned, as they may have been sustained in an episode of inter-personal violence (e.g. 3 Poundbury Camp).

The absence of cranial trauma and the single example of nasal fractures is not entirely representative of female trauma during the Romano-British period in Dorset. The result does not represent the true prevalence rate from Poundbury Camp, because not all individuals could be included in the study. Walker's (pers.comm.) analysis of the sample recorded two more females with ante-mortem nasal fractures and another two females with ante-mortem depressed fractures located on the parietal bones. A similar prevalence was not observed in other cemeteries included in the sample (N.b. Poundbury Camp does contain other unique examples of pathology (and mortuary practice), suggesting that it may not be reflective of the region).

The Poundbury Camp data observed by Walker (pers.comm.), is included in the discussion, because its absence would result in conclusions that are not truly reflective of female-directed violence during the period. The female prevalence of ante-mortem nasal fractures is higher than observed for the Iron Age (Table 113, 116), suggesting that fracture patterns may have been influenced by cultural changes. Contemporary clinical data has shown that the majority of nasal fractures are sustained during assaults (Scherer et al. 1989, 389), particularly in unarmed episodes (Wladis et al. 1999, 733-734). Domestic violence is the most common context for female directed trauma (Greene et al. 1999, 290), in which the nose is the second most common part of the body to be fractured (Spedding et al. 1999, 401). Walker (1997) concludes that the involvement of the nasal bones is a result of their fragility and facial targeting in Western societies (Walker 1997, 160 and 162). Jurmain's (1999) observation that the weapon used to inflict the trauma may have influenced injury location is recognised (Jurmain 1999, 226), as the females may have been hit in the face with a blunt instrument.

Overall, from the Iron Age to the Romano-British period, the statistically significant decrease in the number of fractured elements in the Romano-British period indicates that the prevalence of female-directed violence declined under Roman control. The result may be indicative of the development of *Durnovaria* and the way in which Romanization operated in Dorset. A perspective reinforced by females from other Romano-British urban cemeteries with violent-related injuries (not including decapitation). In order to compare the results of the present study with national data, skull trauma and sharp-force weapon injuries have been used, because data regarding fracture location, type and mechanism for post-cranial fractures was not provided (especially for forearm fractures). At Cannington, a late Romano-British cemetery from Somerset, a young adult female [78] has fractures to the nasal bones and possibly as a result of the same episode, ante-mortem tooth and enamel loss (Brothwell et al. 2000, 208) and another female [98] has a "frontal swelling on [left] L side; probably old trauma" (Rahtz et al. 2000, 464). At Colchester (Essex), healed depressed fractures were observed in three females, which were located on the frontal bone, left parietal bone and occipital bone. None were associated with isolated ulna fractures (Pinter-Bellows 1995, 76) (see section 2.4.10). At Cirencester (Cotswolds), only one depressed fracture was observed in the female sample, and another female had evidence of a healed sharp-force weapon injury to the right parietal bone (Wells 1982, 169, 171), neither of which were observed in the Dorset sample. At Trentholme Drive (York), a female skull has a healed "injury" present and another female has a healed "defect in left parietal [which] may be due to injury" (Warwick 1968, 143, 144). Nationally (previously mentioned sites and Dorset data excluded), three females had fractures to the frontal bone and parietal bones, three had fractures to the face, one sustained a mandibular fracture, and three have evidence of sharp-force weapon injuries (Roberts and Cox 2003, 153, 158). Despite national evidence for inter-personal violence being low (especially compared to males, see Roberts and Cox 2003, 153-158), Dorset does (on present evidence) have the lowest number of females observed (Sample N =1, including Walker data N= 5).

In the Roman period, female engagement with/exposure to violence operated on many levels; unfortunately, the primary sources focus upon the Mediterranean and therefore, may reflect social practices that may not have been widespread within Britain. However, as females from the Mediterranean have been identified at Poundbury Camp (Richards et al. 1998), their use may not be entirely inappropriate (see section 1.6.9.2).

The most famous examples are female gladiators from the Mediterranean, who are recorded in primary texts from 61 B.C. to the early 3rd century A.D. (Leftkowitz and Fant 1992, 214-215), and one possible female gladiator cremation burial has been (speculatively) suggested at Great Dover Street (London) (MacKinder 2000). More textual evidence exists on violence within families and between partners in the Roman period, but derives from Italy and Mediterranean areas of the Empire. Within a family, the power to give physical punishments was most frequently associated with the male head of the household. The majority of recorded episodes of violence describe the disciplining of children and slaves (of both sexes), although female slave owners reportedly had their slaves beaten (see Juvenal's satire below) (Shelton 1998, 174; Saller 2001, 87, 90). The medical practitioner Galen noted that it was very common for slaves to be repetitively punched, kicked, and often blinded (Bradley 1994, 28).

Female directed violence in partnerships is attested in the Roman period, as spousal abuse was not illegal (Shelton 1998, 48). The most frequently cited causes for spousal acts of aggression in the primary sources are adultery and drinking (Evans 1991, 11). Female slaves had a greater risk of physical violence, because they were subject to whippings by their owners, typically to reveal secrets about their mistresses (Saller 1991, 159). Juvenal satires the behaviour, “some women pay their beaters an annual stipend. ‘Hit him!’ she says, and smears her face or chats with her friends” (*The Satires* 6. 480-481). Clark (2001) goes so far as to state “most English terms are in any case quite inadequate to encompass all acts of physical violence within the Roman family” (Clark 2001, 127).

In the Provinces, individuals who had committed crimes could be beaten at the order of Roman officials (Saller 1991, 155-156). Violence was undertaken using a variety of weapons, such as spiked whips, clubs, and professional torturers could be hired (Saller 1991, 151, 160). Saller (1991) notes, “Romans regularly and legitimately inflicted on their fellow men corporal punishments that maimed and even killed” (Saller 1991, 151).

The most well known example of spousal abuse was described by St Augustine in his mother’s biography. The attitudes described in the text relate to a Christian North African community towards the end of the Roman Empire (Shelton 1998, 48) and is used as an example of the context in which women were victims of spousal aggression. The term aggression is used, because the account does not directly state that St Augustine’s mother was beaten (Clark 2001, 115). In the biography, St Augustine includes a passage, “many women, whose husbands were far more gentle than her own, bore the disfiguring marks of blows even on their faces” (*Confessions* 9.9.19 cited in Clark 2001, 114). Importantly, the passage implies that these women most frequently sustained blows to their bodies, rather than their faces. A pattern observed in many modern clinical studies (e.g. Greene et al. 1999; Kyria et al. 1999) and emphasises the role of cultural patterning, as Walker (1997) found that modern perpetrators of spousal abuse target the face (Walker 1997, 160).

The presence of females with injuries suggestive of inter-personal violence in Dorset (Table 126) is lower than observed in many cemeteries within Britain. The absence of sharp-force weapon injuries does not mean that females did not sustain these injuries, but that they are ‘invisible’ to us. Importantly, the cultural patterning of violence changes in the Romano-British period, suggesting the influence of Romanization (law and citizenship) and a more culturally diverse population (e.g. marriages between native women and men from elsewhere in the Empire). The most fundamental change for females is a lack of peri-mortem injuries and evidence for ‘frenzied attacks’, again perhaps reflecting cultural changes, and a low mortality risk from violent episodes during this period.

4.4 Diet: nutritional status and health

> "The ordinary man should adopt the following regimen. During the winter, he should eat as much as possible, drink as little as possible … such a diet will keep the body warm and dry" (Hippocratic Writings, *A Regimen for Health* I).

This section discusses the evidence for diet through time, and combines the osteological data (metabolic and dental disease) with bioarchaeological data derived from archaeological sites in Dorset and secondary evidence for diet from primary sources. Very little stable isotope work has been conducted on the populations of Dorset from the Iron Age and Romano-British period. Recent work conducted by Jay (pers.comm.) on Iron Age populations in Hampshire, Cornwall and East Lothian (Scotland), showed that all populations ate a similar diet, suggesting that the results can be tentatively used for Dorset (Jay pers.comm.). A small sample of Iron Age and Romano-British individuals from Poundbury Camp have been investigated using stable isotopes (Richards et al. 1998) however, it is unclear the extent to which the results are reflective of that cemetery population and the region.

The lack of stable isotope studies limits how the osseous indicators of diet can be understood, a situation complicated by the lack of evidence for nutritional deficiencies. Studies of dietary change following colonisation has been intensively investigated in the Americas, using osseous indicators and stable isotope data and have shown that significant changes can take place. For example, the Spanish colonisation of California from 1769-1823 A.D. resulted in contact with the Chumash Tribe whose very diverse food-ways included marine and terrestrial resources. After contact, the varieties of exploited food-ways significantly narrowed and became European, with the focus upon terrestrial resources such as wheat, barley, beef and beans (Larsen 1994, 133-135). This type of intense and collaborative research is still required in Britain, if our understanding of Romanization is to be better understood.

4.4.1 Introduction

The influence of gender has been observed to affect diet and access to adequate nutrition. Food collection, preparation, and consumption can all be imbued with cultural significance (Sørensen 2000, 99-100), and anthropological research has shown that this is often expressed in gendered terms/differences (McElroy and Townsend 1996, 224-225). Food taboos most frequently affect females, and are commonly connected to life course stages (McElroy and Townsend 1996, 225). For example, widows of the Saniyo-Hiyowe community of Papua New Guinea, risk being killed by their deceased husband's family if they breaks food taboos. Whereas a man from the same community who commits food taboos only experiences ridicule from his peers (McElroy and Townsend 1996, 224). The WHO's (date not provided) research of age and gender differences in nutrition, found that females had the highest risk of nutritional deficiencies due to their life-ways, low social status (in many countries), and food restrictions. These differences affect the quality and quantity of food allocated to them, in addition to the role of taboos (http://www.who.int/docstore/peh/archives/women/9411nut.pdf). The extent to which food taboos are actually practiced is questioned by many working in nutritional anthropology (Quandt 1996).

The most important point raised by the clinical and anthropological research, is the belief that when a household has sufficient food, all members will receive enough nourishment (http://www.who.int/docstore/peh/archives/women/9411nut.pdf). Rousham's (1999) examination of food allocation in South Asia found that nutritional allocation varied considerably. In north India only the most nutritious food was disproportionately given to sons, whereas in southern India boys aged five to seven years were at significantly greater risk of malnutrition compared to girls. In Nepal, differences in food distribution were only practised among adults (Rousham 1999, 41). Rousham (1999) concluded that a universal male preference does not exist, because differential practices are governed by other factors such as birth order, sex composition of the children in the household, parental education, and socio-economic status (Rousham 1999, 42).

Cohen and Bennett's (2002) examination of skeletal evidence for sex-related differences in nutrition intake, concludes that data interpretation is very problematic, and suggest a better assessment of sex-related differences in the quality and quantity of diets can be gained by examining patterns over periods of cultural change (Cohen and Bennett 2002, 304). For example in Florida (USA) pre-contact females had a higher rate of dental caries but after European contact, differences in male/female prevalence rates were not observed (Larsen et al. 2002, 421).

4.4.2 Iron Age

Our knowledge of Celtic eating behaviour derived from the primary sources will be biased in terms of date (most were written in the 1st century B.C. and 1st century A.D.) and the political and social motivations in their writing (Champion 1985; Webster 1996). Athenaeus wrote "they eat only small amounts of bread, but large quantities of meat, either boiled, roasted, or cooked on spits … those who live near rivers, the Mediterranean, or Atlantic also eat fish" (*Deipnosophistae* 4.36 cited in Koch and Carey 2003, 10). It is not clear whether 'they' refers to the whole community or to male individuals only. In the primary sources, there are only rare references to the 'invisible' members of the community, such as children, females and the elderly (see Moore and Scott 1997). Gendered critiques of ethnographic practice have shown that many are biased towards male activities and social behaviour (Conkey 1993, 41-43). Other primary sources and research on eating practices are dominated by feasting and its relationship to power (Arnold 1999). Differential food practices may have been present during feasts, however their impact upon long-term nutritional status would have been slight, because they would have been used as tools of agency and identity in specific social and cultural settings (Arnold 1999).

Data observed in Iron Age bioarchaeology indicates a paucity of marine resources recovered from settlement sites, despite the employment of sieving strategies (Buckland-Wright 1987, 129; Hamilton-Dyer 1999, 196). Analysis of marine molluscs shows that they were consumed, but their small number suggests that they did not significantly contribute to the diet (Wyles 1997). The lack of bioarchaeological data may be explained by communities eating marine resources at source, or at ephemeral seasonal settlements on the coast (e.g. seaweed). The small contribution of marine resources to the diet is supported by stable isotope work. Jay's (pers.comm.) analysis of individuals from Hampshire, Cornwall, and

East Lothian (Scotland) found very low amounts of marine resources, even when individuals were from coastal sites (Jay pers.comm.). Richards et al.'s (1998) analysis of 13 Iron Age individuals (7 females and 6 males) from Poundbury Camp, demonstrated that their diet was terrestrially based (protein from plants and animals), with little to no consumption of marine foods, and no differences were observed between males and females (Richards et al. 1998, 1248-1251).

Social divisions in Celtic communities are stressed in terms of status, often based on age, rather than gender or sex (Diodorus Siculus *Histories* 5.27-32 cited in Koch and Carey 2003, 10-14). This conclusion has been recently tested using stable isotope analysis at the Iron Age cemetery of Wetwang Slack (Yorkshire), which has clearly defined ranked burials (chariots versus ditch burials). The results demonstrate that no dietary differences were observed between the different status groups (Jay 2004, 33), suggesting that status was not expressed through access to food resources. The results do not rule out differential practices employed at certain social events, such as feasting (see above). It is considered that attempts to understand Celtic food practices from the primary sources would be biased and are not entered into, as only generalisations could be made regarding the relationship between diet and social practices, particularly in the light of new scientific research.

Bioarchaeological evidence for diet shows that a range of domesticates were kept for meat, particularly sheep/goat, cattle, and domestic fowls such as geese, ducks, and chickens (Harcourt 1979, 155; Reilly 1997, 270). Analysis of the faunal remains indicates that cattle and sheep/goat were primarily kept for meat (Reilly 1997, 273), which may have been salted/cured for long-term storage (Wood 2000, 100-105). The faunal remains show that cattle and sheep/goat herds were also kept for secondary products such as wool, milk, and fat extraction (Hamilton-Dyer 1999, 197,199). This is attested by pottery residue analysis at

Maiden Castle (contexts not stated), which found that the majority of samples contained dairy fats (Copley et al. 2004, 25). Wild resources were also exploited including marine molluscs, such as periwinkle, oyster, mussel, and limpet. Freshwater fish included dace, and wild game such as deer (red/roe), hare, mallard, wood pigeon, crane, and heron were also exploited (Harcourt 1979, 155; Wyles 1997, 274). A wide range of cereals were recovered, and include hulled barley, rye, emmer/spelt, and oats (Jones 1981, 108; Hinton 1999, 203-207).

4.4.2.1 Evidence for nutritional status in the Iron Age: non-specific metabolic disease

The evidence for metabolic disease was dominated by remodelling cribra orbitalia and porotic hyperostosis, indicating that individuals were recovering from iron deficiency sustained during non-adulthood (Stuart-Macadam 1985, 392, 395). The use of these changes to assess dietary deficiencies is applied with caution, because clinical and palaeopathological studies show that it is rarely produced solely by iron deficiencies, and the changes observed may only reflect a minor aspect this process (Stuart-Macadam 1992b, 166; 1992c, 44-45; Wapler et al. 2004). Iron is absorbed into the body's system through natural foods and water, but iron absorption can be compromised by levels of vitamin C. This vitamin is a chelating agent of iron and any deficiency affects the amount of iron taken to the mucosal cells in the gut (Wadsworth 1992, 72-73, 83). Other foods, such as nuts, cheese and wheat germ can act as iron absorption inhibitors due to their high phosphate levels. Foods containing high phosphate levels usually contain large quantities of phytates. These are commonly found in cereals, which have hemaglutinins that inhibit dietary iron absorption. The deleterious effect can be solved by cooking, although there is a high degree of variation in cooking practices between communities, families, and households (Wadsworth 1992, 85).

Iron Age females, compared to males, had a higher overall prevalence of cribra orbitalia and porotic hyperostosis displaying porosity with coalescence of the foramina (Tables 11, 16, 89, 92). The majority of changes were healed or mixed, and in contrast to the Romano-British period, active changes were observed (Tables 89, 92). In the Iron Age, only four orbits had evidence of active long-term changes (right N= 2/47, 4.2% and left N= 2/46, 4.3%) and active lesions were observed in two orbits for porosity only changes (right N= 1/47, 2.1% and left N= 1/46, 2.1%). The highest prevalence rates of healed lesions were observed for right and left orbits displaying porosity with coalescence of the foramina (right N= 9/47, 19.1% and left N= 7/46, 15.2%). The parietal bones were the most affected by porotic hyperostosis (Table 92), and no porosity with coalescence of the foramina was observed. The highest prevalence rates were observed in healed porosity only changes in the parietal bones (N= 13/95, 13.7%) and occipital bone (N= 8/48, 16.7%). Active lesions were observed for all cranial bones with porosity only changes (e.g. frontal bone N= 1/47, 2.1%), however the majority of the responses were healed.

Iron Age male individuals had similar results to females for cribra orbitalia in a number of respects (Table 11), but the difference between the sexes was found to be statistically significant (Table 12). The majority of observed lesions were healed, and the same number of orbits (N= 4) had mixed or active lesions present for porosity only changes. Active lesions were only observed for porosity with coalescence of the foramina, with the left orbit being more affected (left N= 3/47, 6.4%, right N= 2/46, 4.3%). The highest prevalence rates were observed for right (N= 9/46, 19.6%) and left (N= 10/47, 21.3%) orbits with healed barely discernible changes, followed by both orbits with porosity with coalescence of the foramina (right N= 7/46, 15.2%, left N= 5/47, 10.6%).

The majority of the changes observed in porotic hyperostosis (section 3.6.3) as with cribra orbitalia were healed, and the most observed changes were barely discernible and porosity only. Porotic hyperostosis (Table 16) was observed to affect the frontal bone, parietal bones, and occipital bone. The parietal bones were the most affected, and had the highest prevalence rates for healed barely discernible changes (N= 14/96, 14.6%) and porosity only (N= 6/47, 12.8%). As in the female sample, no active or mixed lesions were observed for any element displaying barely discernible changes.

In the present study, Iron Age females had a higher prevalence of cribra orbitalia and porotic hyperostosis (Tables (Tables 11, 16, 89, 92). In the Iron Age, the difference in the number of male and female cranial bones displaying porotic hyperostosis was found to be statistically significant (Table 17). Differences between males and females are observed in other palaeopathological studies (El-Najjar et al. 1976; Higgins et al. 2002, 172). Stuart-Macadam's (1985) review of porotic hyperostosis noted that in modern clinical studies, the highest rates were observed in females and non-adults, even when males have a higher risk of developing anaemia from parasitic infestation (amongst other causes) (Stuart-Macadam 1985, 395). Of note, is Stuart-Macadam's (1985) observation that in archaeological populations the difference between male and female prevalence rates is not statistically significant or small (Stuart-Macadam 1985, 395). The result is in contrast to Larsen (1999) and Blom et al.'s (2005, 163) findings, and may result from the publication of new studies and Larsen's (1999) observation that this result is not recorded in all populations (Larsen 1999, 39). These comments emphasize the multifactorial origin of this osseous response, and Stuart-Macadam's (1992b) assertion that it represents adaptation to the environment (Stuart-Macadam 1992c, 44).

The changes may have developed by food-ways (which is most simply defined by Camp (1996, 300) as the relationship between food and culture), such as excessive alcohol consumption (see Arnold 1999) and red meats; Jay's (pers.comm.) stable isotope analysis found that Iron Age diets contained large amounts of animal proteins (Jay pers.comm.). The cattle assemblages from Dorset were kept for meat (Harcourt 1979, 155; Reilly 1997, 270), and primary sources suggest that meat was salted for future consumption (Wood 2000, 100-105). The bioarchaeological evidence shows that the Iron Age diet included iron inhibiting phytates, derived from hulled barley, rye, emmer/spelt, and oats (Jones 1981, 108; Hinton 1999, 203-207).

The changes may also indicate an adaptive biological response, resulting from the enhanced immune response of females to infectious diseases, in which they are less likely to develop an infection and have lower prevalence rates (Ortner 2003, 116-118). The combination of a natural immune advantage and the body's adaptive response to infection by withholding iron (Weinberg 1992, 109) could explain the higher prevalence in females. However, this defence mechanism can be compromised by the menopause, during which females can absorb excessive iron causing cardiac dysfunction (Weinberg 1992, 127). It should be noted that the hypothesis that anaemia acts as an adaptive mechanism is not conclusively proven. Vyas and Chandra (1984) suggest that anaemia impairs the immune system, inhibiting the body's ability to fight disease; whereas Murray and Murray (1977) propose that anaemia improves immunity from disease (cited in Kent 1992, 24). Kent (1992) highlights the important point that these findings may not apply to very extreme cases of anaemia (caused by parasitic infection/bleeding) which inhibit the body's ability to fulfil basic metabolic functions (Kent 1992, 24).

In conclusion it is agreed with Stuart-Macadam (1992c) that porotic hyperostosis on it's own "does not indicate a diet that is low in iron or bioavailable iron and so cannot be called upon to provide information about the dietary status of a population" (Stuart-Macadam 1992c, 44). Therefore, the presence of cribra orbitalia and porotic hyperostosis in the Iron Age reflects the complex inter-play of life-way, diet, and environment.

4.4.2.2 Evidence for Iron Age dental health

Dental changes in both sexes were dominated by wear and calculus but abscesses were also observed, and were related to caries or ante-mortem tooth loss (Tables 29, 100). Smith's (1984) study of molar wear in the Maiden Castle and Poundbury Camp samples indicated that these sites conformed to patterns of wear normally observed in agricultural communities. Agrarian communities are characterised by a limited pattern of wear and oblique wear planes, which Smith (1984) suggests is related to a reduction in food toughness, and the use of grinding stones and pottery in food production (Smith 1984, 49-54). Quern stones excavated from Gussage All Saints were made of greensand, grit, and ferruginous sandstone (Buckley 1979, 93-97), which are effective abrasive agents. The amount and cause of wear may have been a factor in ante-mortem tooth loss. Loss of the occlusal surface causes increased dental eruption (Hillson 2002, 23). The sockets move superiorly, exposing more of the tooth until a small portion remains that becomes unstable and can be lost. Subsequent remodelling of the remaining dental positions can move the dental roots closer to the buccal surface of the alveolar bone, leading to further instability (Hillson 2002, 23).

Differences between males and females were most evident for ante-mortem tooth loss and were found to be statistically significant in the Iron Age (Table 30). The majority of male results have a prevalence rate below 30%, whereas the majority of female results have a prevalence rate of over 45% (Tables 36, 100). This is supported by national results, where more females than males were affected (Roberts and Cox 2003, 102).

Caries is a multifactorial disease, which is reliant upon host resistance, hygiene, pathogenic agent, environment and diet (Goodman and Martin 2002, 45). Population based dental studies have shown that agricultural populations have a higher prevalence of carious lesions compared to hunter-gatherers. In contrast, other studies have found that hunter-gatherers have a higher prevalence, because they consume more cariogenic foods (Larsen 1999, 68, 71). Turner's (1979) study of agricultural populations found that the prevalence of caries ranged from 2% to 25%, with an average of 10% (Turner 1979 cited in Goodman and Martin 2002, 46). The aggregated Iron Age adult prevalence rate was 5.7% (Tables 29, 100), which falls within the range found by Turner (1979), indicating that the dental health results corroborate the agrarian basis of Iron Age life-ways. The Iron Age sample differed from the global pattern in which females have a higher caries prevalence compared to males (Larsen 1999, 72). In the present study, the difference in the number of male and female teeth with evidence for a carious lesion was found to be statistically significant (Table 33). The difference in the prevalence of caries suggests that males and females may have had different food practices, an outcome not seen the stable isotope results (Jay pers.comm.; Richards et al. 1998).

Bioarchaeological evidence suggests that in the Iron Age, sugar was derived from natural sources such as carbohydrates and fruits. Honey was also available, as pasturage provided flowering grasslands that could be exploited by bees. Wild sources of honey may have been collected, as well as those produced in hives and 'bee-gardens' (Wilson 1991, 275-276; Kenward 2005). If hives were used, this would have provided a regular source of honey and an accessible source of sugar for food. The starch and sugar contained in carbohydrates has a low cariogenicity if they do not stick to the dentition; but if the food contains starch and sugar a pH depression in plaque fluid is produced, which increases the risk of developing carious lesions (Hillson 1998, 276-278).

Caries in the adult population may have been produced secondary to dental wear. The coarse diet produced wear that exposed the tooth pulp, making the tooth more susceptible to carious infection (Moore and Corbett 1973, 151). Associated with caries is the formation of abscesses, the most chronic example was observed in an older adult male (Gussage All Saints 204 8) who had evidence of an active infection at the time of death. This infection, resulting from abscesses, was particularly severe as remodelling woven bone on the right maxilla was present (Figure 11). The male had extensive dental wear, ante-mortem tooth loss and carious lesions in 11 of the 19 remaining teeth. The presence of chronic periapical abscesses indicates that the male had a low-grade pyogenic infection. These are different from acute abscesses in which pus collects locally in a cavity within the tissue (or through bone trabeculae or, vascular channels in the lingual and buccal alveolar bone), following the path of least resistance, and discharging when a free surface is reached. Acute abscesses are not visible on a radiograph and are extremely difficult to identify on dry bone. Low-grade pyogenic infections form chronic abscesses, in which osteoclastic activity forms an osseous sinus, enabling the pus to be discharged onto the skin or oral muscosa (Dias and Tayles 1997, 550-551).

The consumption of dairy products formed an important part of Iron Age diets, which can act as a protective buffer against caries. Milk and other products contain casein protein, and the consistency of dairy products often covers the tooth crown, preventing food adhering to the surface and decaying. The effectiveness of proteins as buffers is supported by palaeo-

Inuit dentitions, which have a low prevalance of caries, because the majority of their diet contained proteins and fats (Hillson 1998, 279).

Individuals with extensive ante-mortem tooth loss were observed, and is exemplified by a young adult female from Poundbury Camp [1402], who had lost 19 teeth ante-mortem, eight post-mortem, and only had three remaining mandibular teeth. The extensive tooth loss would have created difficulty in the consumption and processing of food, and may have impaired her with regard to nutrition and energy (Scott and Turner 2000, 248). The individual's food may have had to be prepared differently or she may have been limited to the consumption of soft foods such as pottage.

In conclusion, the somewhat limited evidence for diet correlates with the bioarchaeological data for an agrarian based economy. Despite the results indicating limited access to sugary food, the statistical tests show that consumption and access may have been influenced by gender roles. No individual displayed long-term nutritional deficiencies, which may indicate that age and gender differences may have been expressed using other social mechanisms (as supported by stable isotopic evidence). The evidence does not mean that food taboos were not employed at particular social events, such as feasts.

4.4.3 Romano-British Period

In recent years, Romano-British food-ways have been investigated using a more bioarchaeological approach, which has resulted in a detailed understanding of differences through time and within locales, and has demonstrated the wealth of information that can arise from this type of study (Dobney 2001). The numerous bioarchaeological studies of Romano-British settlements in Britain have shown that a wide variety of imported foods were eaten (e.g. pomegranates), in addition to foodstuffs grown in gardens, allotments or market gardens (Perring and Brigham 2000, 153).

A recent faunal and pottery analysis from Dragonby (Lincolnshire) using a post-Colonial approach has critiqued Romano-centric interpretations of bioarchaeological material (Hawkes 2001). Hawkes' (2001) analysis has shown that Roman material culture and foods were used in the same way as native material, and we should not assume that the presence of Roman material equates to the adoption of a Roman life-way (Hawkes 2001, 97-102). This is supported by other faunal analyses that have shown Romano-British assemblages are most similar to north-western European Iron Age samples compared to southern Mediterranean ones and, only the emphasis of diet changed not the species exploited (King 1999; Dobney 2001, 37). A hypothesis recently supported by the translation of the writing tablets from Vindolanda, suggesting that ethnic food-ways were practiced even in the army (http://www.vindolanda.csad.ox.ac.uk). These findings challenge the use of primary sources and Mediterranean evidence to understand food-ways in Britain. Consequentially, only information pertaining to Dorset will be used.

The bioarchaeological evidence from Dorset (excavated from settlement sites) consists of plant remains, faunal assemblages, and mollusca. The data show that *Durnovaria* was set in a semi-urban rural environment, consisting of gardens, farmyards, and pasture (Allen

1993b, 71-72). This evidence supports the hypothesis that individuals were actively engaged in growing food, although some foodstuffs such as figs were probably imported. The range of plant remains recovered, indicates that a wide variety of cereals and fruits were consumed. Evidence from grain driers includes cereals, predominantly, wheat, barley, and oats. Fruit remains included plums, cherries, blackberries, figs, grape, elderberries, and pear/apple (Bryant 1990, 41; Ede 1993). Additional evidence for food included hazelnuts, cabbage, pea/bean, and celtic bean (Ede 1993; Letts 1997). Faunal remains found in the region include both domestic and wild sources. The wild meat sources consist of roe deer, hare, goose, teal, wrasse, woodcock, dove and duck/mallard (Hamilton-Dyer 1993; Maltby 1993). The domesticated sources consist of sheep/goat, pigs, horse, fowl, and cattle (Peck 1993; Reilly 1997; Hamliton-Dyer 1999). Analysis of butchery patterns and ageing data indicates that animals were being kept for milk, eggs, meat, and other secondary products such as horn and marrow (Maltby 1993; Peck 1993; Hamliton-Dyer 1999). The marine mollusc assemblages could have been obtained locally, and contained periwinkles, oysters, cockles, mussels, scallops, limpets, and whelks (Allen 1993a; Wyles 1997). The evidence for fish increases, and was obtained from the local coast or rivers and included, eel, conger, salmon, gadfam, bass, sea-bream, mullet, flat-fish, chub, and plaice (Allen 1993a; Hamilton-Dyer 1993, 1999).

Limited stable isotope work exists for diet during the Roman period in Britain, and the studies are very small and localised (e.g. Richards et al. 1998). Therefore, our understanding of the intricacies of dietary practices remains poorly understood. This is in contrast to a recent study by Prowse et al. (2005) whose examination of the cemetery from Isola Sacra (Rome) demonstrated that non-adults consumed a diet deficient in terrestrial plants and meat, whereas adults had a higher consumption of luxury foodstuffs such as marine resources and olive oil. Differences between males and females at Isola Sacra were also observed, as females consumed a greater proportion of terrestrial plants, whereas males consumed more marine resources. There is also some evidence to suggest that individuals who consumed a less herbivorous diet were healthier (Prowse et al. 2005). Richards et al.'s (1998) stable isotope examination of 27 Romano-British males and females from Poundbury Camp provides some insight into dietary differences in Dorset. Individuals from mausoleums and lead coffin burials consumed more marine resources, and those buried in wooden coffins had more complex stable isotope results, showing very low marine resources (in some individuals none was found), and a greater consumption of terrestrial plants and animals (Richards et al. 1998, 1250).

4.4.3.1 Evidence for nutritional status in the Romano-British period: non-specific metabolic disease

As in the Iron Age, no adults with evidence of specific metabolic disease were observed. However, national data has shown that the prevalence of metabolic diseases increases, and for the first time rickets, osteomalacia, and osteoporosis have been identified, the majority of which were observed in females (Roberts and Cox 2003, 143). It is should be noted that Molleson (1993) suggests that 23 females and 8 males from Poundbury Camp have osteoporosis (Molleson 1993, 194).

Metabolic disease was represented by cribra orbitalia and porotic hyperostosis, all of which were healed or had mixed reactions (Tables 13, 18, 90, 93), indicating that individuals had recovered from non-adulthood iron deficiency (amongst other factors, see section 4.4.2.1 for discussion). The male and female Romano-British sample differs from the Iron Age for both cribra orbitalia and porotic hyperostosis in three aspects. No active lesions were observed, males have greater variability in lesion type for porotic hyperostosis and lastly, more male elements are affected (Tables 13, 18, 90, 93). Males have a higher prevalence of orbits displaying healed barely discernible changes (right N= 11/80, 13.8%, left N= 13/79, 16.5%) and healed reactions, for example porosity only changes to the right orbit (N = 8/80 10% for healed reactions. See Table 13). Males have a lower prevalence of mixed reaction porosity only and, porosity with coalescence of the foramina without thickening changes (Table 13). Overall in the male sample, more left orbits displayed changes. In the Romano-British sample, the difference between the sexes for the number of orbits displaying cribra orbitalia was statistically significant (Table 14), and also between the number of Iron Age and Romano-British male orbits affected (Table 15).

The male sample had more elements affected by porotic hyperostosis, no active lesions were observed, and the most frequently observed reaction was porosity only (Table 18). The occipital bone displayed the most variation, with only one bone displaying a mixed reaction coalescing foramina with increased thickness (N= 1/76, 1.3%). The parietal bones were the most frequently affected elements, and had the highest prevalence for healed barely discernible changes (N= 6/155, 3.9%).

The majority of females with cribra orbitalia displayed healed lesions, particularly for porosity only changes (right N= 6/44, 13.6%, left N= 4/46, 8.7%) (Table 90). The female sample had a higher prevalence of mixed lesions displaying porosity only and porosity with coalescence of the foramina without thickening (Table 90). For example in the Romano-British period, for porosity only the right orbit had a prevalence rate of 4.5% (N= 2/44) compared to 1.3% (N= 1/80) in males, and a statistically significant result was obtained for the difference between the number of female and male orbits displaying cribra orbitalia (Table 14). Porotic hyperostosis displayed greater female prevalence (Tables 18, 90), but the difference between the number of male and female cranial elements affected was not statistically significant (Table 19). In both sexes, the majority of observed lesions were healed, with the highest prevalence observed in the female parietal bones for porosity only changes (N= 8/84, 9.5%). The parietal bones were the most frequently affected elements, particularly for healed porosity only changes (male N= 14/155, 9% and female N= 8/84, 9.5%). In both sexes, the frontal bone was the least affected element with only two bones displaying healed porosity only changes (Tables 18, 93).

In this present study, males had a higher prevalence rate of cribra orbitalia and porotic hyperostosis (Tables 14, 16, 90, 93). However, only the difference in the number of male and female orbits displaying cribra orbitalia was found to be statistically significant (Tables 14, 19). The result was not found for the Iron Age, (Tables 12, 17) but has been observed in other archaeological populations (El-Najjar et al. 1976; Walker 1985; Stuart-Macadam 1991) and appears to be population specific (e.g. Larsen 1999, 39). As this response is multifactorial in origin, the results may reflect the effects of Romanization or changes to male life-ways, and/or causative factors outside Britain, for example disease exposure in the Mediterranean. The greater prevalence in males may, as suggested above, indicate a combination of the processes associated with Romanization, for example greater population mobility, exposure to disease or weaning processes elsewhere in the Empire, specific male life-ways (e.g. soldiery), and biological responses to colonisation.

The Dorset data for cribra orbitalia reflects a national result (Dorset data excluded) in which more males than females are affected (state of healing not provided) (Roberts and Cox 2003, 141). The extent to which the national result is influenced by the greater number of males in this period is unclear, but it may be a contributing factor. An increase in the prevalence of cribra orbitalia and porotic hyperostosis has been observed in post-Contact samples from the USA (Larsen 1994; Steckel and Rose 2002, 572). At the Georgia Blight

(Florida), the prevalence rate of these reactions increases with colonisation/contact, and are considered to reflect the contamination of water sources, dietary shifts, and changes within settlements (Larsen et al. 2002, 422-424).

Romano-British food-ways may have contributed to the development of these responses by the consumption of iron inhibiting phytates. The introduction of wheat marks a change from Iron Age cereals such as rye and emmer/spelt (Jones 1981; Hinton 1999, 203-207). The dominant role of cereals in the Romano-British diet is supported by stable isotope results from Poundbury Camp, particularly in a young adult female [1225] whose protein sources were predominantly plant based (this individual grew up in the Mediterranean) (Richards et al. 1998, 1250). Hawkes' (2001) research has shown that Iron Age food-ways may not have considerably altered with Romanization, raising the possibility that many individuals continued to consume large quantities of meat. A stable isotope result found in a middle adult male [40 Poundbury Camp] who had consumed a large proportion of animal protein (Richards et al. 1998, 1250). Evidence for the eating of animal protein in the Romano-British period is supported by the faunal evidence, which shows a shift from sheep to cattle and an increase in the consumption of fowl and pig meat (Maltby 1993; Reilly 1997; Allen 2002). Importantly in Roman Dorset, there is an increase in marine consumption, demonstrated by the increase in fish and mollusc remains (see section 4.4.3). The stable isotope study at Poundbury Camp has shown that this may have been a social status response to cultural change. Individuals inhumed in mausolea and lead coffins had the highest levels of marine protein, whereas only a small minority of individuals buried in wooden coffins had marine protein present (Richards et al. 1998, 1250). The pattern may represent continuity of Iron Age food-ways, or limited access to marine resources. Contact studies from the USA have shown that women are more likely to continue native food-ways and agricultural practices, despite having greater contact with European settlers (Levy and Claassen 1992, 111). A young adult female [235 Poundbury Camp] from the Mediterranean buried in a wooden coffin, had none or a small amount of marine protein in her diet, suggesting that despite migration, her socio-economic status (possibly a slave?) or cultural food-way dictated the levels of marine resources consumed.

In conclusion, porotic hyperostosis, as shown by Stuart-Macadam (1992c) does not indicate a diet low in iron. However, in combination with cribra orbitalia, the results may reflect an adaptive biological response to disease, parasitic infection, and the role of female enhanced immunity (see sections 4.2.1 and 4.4.2).

4.4.3.2 Romano-British dental health

The present study demonstrates that dental health does change in the Romano-British period. The most striking change was an increase in carious lesions, particularly in the female maxillary dentition (N= 361/410, 88% compared to N= 48/917, 5.2% in males). The rise in carious lesions is related to the increase in abscesses, for which males had the highest prevalence, especially in the maxilla (N= 40/917, 4.4%). Continuity from the Iron Age exists, as the highest prevalence rates were observed for occlusal wear, calculus, and ante-mortem tooth loss (Tables 36, 101).

The prevalence of calculus was different between the maxillary and mandibular dentition, and between the number of males and females affected, which was statistically significant result (Table 39). For females (Table 101), there is a slight decrease in prevalence from the Iron Age (e.g. a difference of 4.4% for the maxillary dentition), and a large difference between the maxillary (N= 267/410, 65.1%) and the mandibular dentitions (N= 78/459, 17.1%) was found. This difference may be a biased result, because many of the loose teeth may have been mandibular (N= 14/36, 38.9%). In males, only the maxillary teeth show a decrease in prevalence from the Iron Age (a decrease of 3.6%), whereas the mandibular dentition has an increase of 27.1% (Tables 29, 36). The result may have been caused by the lower ante-mortem and post-mortem loss prevalence rates observed in the mandibular dentition, and the presence of loose teeth with calculus (Table 36). Roberts and Cox's (2003) national study also observed an increase in the number of individuals affected with calculus (Roberts and Cox 2003, 131). These results show that Dorset reflects wider food-way changes, suggesting greater variability in available foodstuffs, and the consumption of a high protein diet (Roberts and Cox 2003, 131).

The Romano-British increase in carious lesions corresponds to national data (Roberts and Cox 2003, 131-137) and bears similarities to Price's (1939) study of non-Western dentitions (Eskimos, Africans, and Native Americans). Price (1939) found an increase in caries subsequent to the introduction of Western diets (cited in McElroy and Townsend 1996, 195). Moore and Corbett's (1973) study of carious lesions in Iron Age and Romano-British populations (samples not named), concluded that dental location and lesion position did not change over time, although compared to later Anglo-Saxon populations, the prevalence of caries was higher in both populations (Moore and Corbett 1973, 150-151).

The increased prevalence rate of female caries is 81.6%, but is restricted to the maxillary dentition (Table 101). The female mandibular rates differ temporally (Tables 100, 101), with a decrease of 0.2% in the Romano-British period. Differences between the mandibular and maxillary dentitions are observed in the Romano-British male sample, as there is a decrease of 0.2% in the maxilla, and an increase of 0.7% in the mandible (Table 36). As caries is a multifactorial disease (Goodman and Martin 2002) the increase during the Romano-British period, suggests that several of its causes may have altered with the incorporation of Britain into the Roman Empire. Foremost, the bioarchaeological evidence has shown that the environment did change during this period (see section 1.6.14), and that new foodstuffs were introduced into the diet. During the Iron Age, products from the Roman Empire and Gaul were imported into Dorset, but their dispersal was probably limited, and after Gaul was incorporated into the Roman Empire, trade fell-off (Cunliffe 1993, 202, 208). The temporal shift suggests that complete incorporation into the Empire was necessary for dental health to change. The incorporation may have enabled more individuals to access new foodstuffs, and take-up new food-ways i.e. fewer dairy products. Roberts and Cox (2003) suggest that the rise may be related to an increase in carbohydrates and sucrose in the diet, e.g. preserved fruits (Roberts and Cox 2003, 134-135). However, status differences (as demonstrated by the stable isotope results from Poundbury Camp), and the practice of native or other cultural food-ways would have influenced the consumption of imported foodstuffs.

The Romano-British increase in ante-mortem tooth loss displays differences between the sexes, with the male sample appearing to have a slightly higher prevalence rate (combined 40.2%) compared to females (combined 37%) (Tables 36, 101), but this was not statistically significant (Table 37). This result has been observed in Freeth's (1999) analysis of three Romano-British populations (cited in Roberts and Cox 2003, 135) and in the national results published in Roberts and Cox (2003, 135). The result is the reverse of the Iron Age data, in which females had a higher prevalence (Tables 29, 100), and suggests that factors other than caries were responsible for the ante-mortem tooth loss. The loss of teeth could have been caused by cultural practices such as poor dental hygiene, or the processing of animal skins (Merbs 1983, 129-133, 145, 154). The female prevalence rates for periodontal disease decrease in the Romano-British period, and the difference in the number of female maxillae and mandibles affected was found to be statistically significant (Table 107). As with the evidence for caries, there is a small increase in the male sample (Table 36), a pattern reported in clinical dental studies (Hillson 1998, 267). The male increase was most clear in the mandible (a rise of 5.7%). The result could reflect greater access by males to Mediterranean foodstuffs, which contain more carbohydrate and sucrose (Roberts and Cox 2003, 134-135). Hillson (1998) suggests that these differences could result from changes (or greater variation) in hygiene practices, dental treatment, and the "plaque-encouraging nature of the diet" (Hillson 1998, 267). These factors did alter during the Romano-British period, but it should be noted that the evidence is from the Mediterranean, and therefore the extent to which oral hygiene and dental treatment were practiced in Britain is unknown, as are the continuation of native practices.

Hygiene practices are suggested from the appearance of toilet sets during the Romano-British period (Jackson 2000, 120) or by toilet items such as tweezers e.g. Greyhound Yard (Henig and Woodward 1993, 118-119). Other organic materials such as wood or quills could have been used to clean the teeth (Jackson 2000, 120). Primary texts on dental cleaning include the use of abrasives such as jeweller's stone polish or, a paste of honey and the ash of burnt dog's teeth (Jackson 2000, 120). Dental treatments, particularly extractions, are included in the medical treatises from this period, although Celsus notes that extraction was often practiced after the failure of other treatments (*De Medicina*, 6.9.5). Loose teeth were often held in place by gold wire, or if extraction was needed, specialised tools such as dental forceps were used (these instruments have found in Roman Europe) (Jackson 2000, 119). Dental fillings and crowns were described in the primary sources (medical and social) (Jackson 2000, 120). A unique example of Roman dental surgery was discovered in France (Chantambre, Essonne). A 30 year old male (inhumed in the 2nd century A.D.) had an iron implant at the location of the right maxillary 2nd pre-molar, and the surrounding bone shows extensive re-modelling around the implant (Murail and Girard 2000, 110). It is possible that the implant was crowned with wood, ivory or bone.

The dental results provide a limited, but important indicator of dietary change, showing Dorset's incorporation into the Roman Empire and the greater use of Roman/ized foodstuffs and food-ways. Stable isotope analysis to look at mobility have shown that many Dorset inhabitants had moved from Mediterranean areas of the Empire (Richards et al. 1998), therefore the dental evidence may reflect food-ways and hygiene practices that were specific to a location, culture/community (i.e. the Army), or availability of resources (e.g. orthodontics).

4.5 The relationships between the living environment, life-way, and health

This discussion presents the remaining evidence for health from the Iron Age to the end of the Romano-British period. It focuses upon fractures caused by accidental mechanisms, specific infectious disease, and the occurrence of new pathologies. These are themed according to agrarian life-ways, settlement, and community.

4.5.1 Agrarian life-ways

Farming is an occupation that involves many different tasks which are located within a specific local environment, and in the United States it has been designated as the second most dangerous occupation, accounting for the death of 22.7% individuals per 100,000 workers (www.occupationalhazards.com/articles/12199). The British Health and Safety Executive's (BHSE 2003) data for the years 2001-2002, shows that fatal accidents were highest for mixed farming (N= 28/41) and considerably lower for arable and cattle farming (N= 2/41) (BHSE 2003, 4). In agricultural societies, the whole community is involved in sustaining the settlement, consequentially labour and occupational risk is usually designated along gender and age divisions (Sørensen 2000, 109-112). It is important to address these aspects in past communities, because these divisions expose individuals to different causes of mortality and environmental risk (Henshall Momsen 2003, 90). Anthropological and clinical studies have highlighted gender inequities in health, occupation, and mortality risk. Studies of rural developing communities found that women had a disproportionate amount of risk, and the division between environmental and occupational health was highly permeable (Sims and Butter 2000).

Evidence for fractures caused by accidental mechanisms in the Iron Age and Romano-British periods will be discussed to determine the extent to which the results corroborate the evidence for engagement in agrarian or rural activities. In order to address the role of the agricultural life-way upon fracture mechanism and to minimise bias, peri-mortem fractures are excluded from this discussion. This was implemented because the majority of individuals with peri-mortem fractures were from Maiden Castle and two other sites in Dorset, supporting the assumption that the Maiden Castle data would skew interpretation. Unfortunately, no fracture study specific to Iron Age agricultural communities could be found, and the majority of available data were derived from 'ritual' sites, such as Danebury (Hampshire) and may represent ritualised acts (Craig et al. 2005) or a specific life-way, such as engagement with violence.

4.5.1.1 Iron Age: males and females

Fractures produced by accidental mechanisms were observed in both males and females, the majority of which consists of osteochondritis dissecans. In females, the lesion was observed on the humerus, femur, and tarsals, and six elements were affected, with the highest prevalence observed in the right humerus (N= 1/43, 2.3%)(Tables 113, 114). Males, had five elements affected, and fractures were observed on the humerus, femur, and tibia. The highest percentage was observed in the left tibia (N= 1/54, 1.9%)(Tables 58, 59, 60). All long bone lesions were observed on the distal articular surface, apart from those affecting the tarsals, e.g. in a navicular, a healed lesion was observed on the articular surface of the talar facet (T26 a middle adult female [Maiden Castle]). Osteochondritis dissecans is suggested to be the "eventual result" of a fracture produced by shearing, rotatory, or tangentially aligned impaction forces (Resnick and Goergen 2002, 2690). The affected elements correspond to those commonly observed clinically (Resnick and Goergen 2002, 2692), although unlike the clinical studies, no sex predilection was observed in the present study. The repetitive tasks involved in farming may have lead to the formation of these fractures (such as lifting) and unfortunately, no comparison data were available. Nationally, osteochondritis dissecans has a low prevalence, for example none are reported from east Yorkshire (Stead 1991).

Fractures to the long bones caused by accidental mechanisms were only observed to the femora, tibiae, and fibulae in both sexes, and the clavicles in males (Tables 58, 59, 60, 113, 114). The fracture types observed were oblique (tibiae and fibula), complete (clavicles, male only), and transverse (fibulae) (Tables 59, 114). Oblique and transverse fracture types are produced by low energy forces resulting from bending (transverse), compression, or torsion mechanisms (Resnick 2002e, 2817). In the female sample, oblique fractures were observed to the left fibula and tibia, affecting the proximal third of the fibula and the distal third of the tibia (Table 113). These fractures were observed in one middle adult [P36 Maiden Castle], both have resulted in overlap, the fibula has anterior angulation of the fractured segment, and a slight degree of rotation was seen in the tibia.

The male sample has a higher fracture prevalence rate compared to females. The clavicle was the most frequently affected element, particularly to the left side (N= 3/4, 75%). The four clavicle fractures affected the proximal and distal thirds, with the latter segment sustaining the majority of fractures (N= 3/4, 75%). The result is in contrast to clinical findings, where the majority of fractures are located at mid third (Apley and Solomon 2000, 270). Two of the fractured clavicles displayed deformity (Table 68), which is an expected finding, because the manual reduction of clavicle fractures is very hard or impossible (Apley and Solomon 2000, 270-271). For example, a middle adult [T10 Maiden Castle] has a healed fracture to the proximal third of the right clavicle, which has resulted in shortening and posterior angulation of the affected segment. Fractures at the fibula affected the proximal third and distal articular surface (N= 1 respectively), the fractures were transverse in type

(Table 58). The fracture to the distal third of the left fibula [T5 Maiden Castle] has resulted in ankylosis to the anterior-lateral aspect of the distal third of the tibia.

In females, fractures to the vertebrae were only produced by compression forces (Table 113) and in the male sample (Table 58), one avulsion fracture and a single compression fracture were observed in the thoracic vertebrae, and in the lumbar vertebrae, four compression fractures and avulsion fractures were observed. The thoracic avulsion fracture affected the spinous process of the 1st thoracic vertebra [T4 Maiden Castle] and conformed to a clay-shoveler's fracture type (Pathria 2002, 2975). These are produced by the spinous process being avulsed by the overlying ligaments and tendons, typically by a direct blow to the back of the neck, or hyperextension causing crushing (Galloway 1999, 93-94; Pathria 2002, 2975) and are suggestive of occupation (Roberts and Manchester 1999, 78).

The remainder of the avulsion fractures observed in both sexes conform to those sustained during adulthood (Maat and Mastwijk 2000, 148). An older adult male [387 6 Gussage All Saints] (Figure 72) has a healed 'Y' shaped compression fracture to the portion of the 2nd lumbar centrum, and a healed avulsion fracture to the superior margin of the anterior aspect of the 3rd lumbar vertebra, suggesting that the two were produced by compression and flexion forces (Galloway 1999, 96). These are frequently produced by indirect forces caused by extreme movement of the body, or impact directed to other regions of the body (e.g. legs) (Galloway 1999, 95).

Figure 72: Vertebral fractures in an Iron Age older adult male [387 6 Gussage All Saints]

72a Inferior view of the 2nd lumbar vertebra, showing the healed 'Y' shaped compression fracture to the right side of the centrum.

72b Anterior view of the 2nd lumbar vertebra, showing the compression fracture to the right side of the centrum (marked).

72c Superior view of the 3rd lumbar vertebra, showing anterior avulsion of the superior margin.

Judd and Roberts' (1999) fracture analysis of the rural Medieval sample from Raunds Furnells (Northamptonshire), found that the most fractured elements were the clavicle and fibula, followed by the radius and ulna (their study did not include osteochondritis dissecans) (Judd and Roberts 1999, 233). In the Iron Age male sample, the clavicle and fibula were the most frequently fractured elements, and in the Iron Age female sample only the fibula was fractured. The Colles' fractures observed in the male and female samples, although not discussed here, may have been caused accidentally whilst engaged in farming activities. Judd and Roberts' (1999) study found that the distal third of the diaphysis was the most frequently fractured, and the most common fracture type was oblique (Judd and Roberts 1999, 233). In the present study, the transverse fracture type predominated in males (humerus and fibula) and females (radius, humerus and fibula), and in both sexes, the distal third was the least affected segment. Although similar elements are fractured, the rural samples differ on all other points. This most probably results from differences in farming technology, and the gender predominately responsible for agriculture.

A clinical study of modern agricultural fractures in Dorset (based on a sample of MNI 49) found that the majority of affected individuals were males, particularly between the ages of 15 to 29 years (Rowe and Cliff 1982, 120). This result is comparable to the present study, in which the majority of individuals with accidental fractures were males. In the clinical study, fractures (not produced by machinery) were caused by large animals and construction work, which resulted in fractures to the ribs, hands and feet and a finger amputation was also observed (Rowe and Cliff 1982, 121). Although these mechanisms were present in Iron Age Dorset, no amputations were observed (but may have been missed during recovery), and fractures to the hands and feet were only observed in the female sample (N= 5 elements affected). Fractures to the extremities are frequently observed in manual occupations (Rowe and Cliff 1982, 123), and in the present study, it is unusual that the prevalence is very low and only observed in females, suggesting that some activities were associated with a one gender. Unfortunately, this result may not represent a real pattern, but be a consequence of variations in excavation and recovery practices.

Other clinical studies of agricultural communities found that males were more frequently hurt, and those working with cattle had a statistically significant higher risk of trauma (Busch et al. 1986; Brison and Pickett 1992; Pratt et al. 1992; Temes et al. 1997). This is supported by Pratt et al.'s (1992) study, which found females to be less frequently hurt, as they undertook fewer riskier tasks on the farm, or were safer workers. However, when females did experience accidents, the severity, distribution, and bodily location were not different to males (Pratt et al. 1992, 647). In the present study, the difference between the number of males and females affected by fractures was not found to be statistically significant (Table 61).

Jones' (1990) study of fractures in an Amish community (who do not use contemporary agricultural technology) is based upon cases that were clinically observed. Many families and communities only seek medical assistance when absolutely necessary, and usually rely upon folk practitioners (Hostetler 1993, 322-326); therefore the study may not reflect the true incidence or prevalence rate. Jones' (1990) study found that horse and buggy accidents had the highest proportion of recorded fractures (the discussion excludes those caused by collision with cars), with other fractures produced by falls, horse-drawn agricultural equipment, and sports. Individuals aged 34 months to 75 years had fractures (type not given) to the occipital bone, humerus, femur, tibia, fibula, and ribs (Jones 1990, 900-901). In the present study, ante-mortem fractures to the humerus, fibula, and ribs were observed in males, and in females the humerus, tibia, fibula, and ribs were fractured ante-mortem. Therefore, these fractures may have been produced by mechanisms similar to the Amish, as horse and carts (also chariots) were used as transport in the Iron Age (McGrail 1997, 276).

Fractures produced by horses and cattle, are very common in contemporary rural and farming communities, and the remains of both animals have been found in Iron Age Dorset (Hamilton-Dyer 1999). Fracture mechanisms that are applicable to the past include, falling from a horse, kicking by cows, accidents in animal-drawn vehicles, and other falls (Busch et al. 1986; Brison and Pickett 1992; Pratt et al. 1992; Temes et al. 1997). Cogbill and Busch's (1985) study of agricultural trauma found that those hurt by animals sustained the most serious trauma to the torso (Cogbill and Busch 1985, 207). In the clinical literature, the details of the trauma varied considerably between researchers, which corresponded to the method of data collection, for example hospital admission versus interviews. In these clinical studies, the majority of trauma was sustained to the upper limbs, followed by the lower limbs, skull, and torso. The trauma produced were dominated by fractures, and amputations (soft-tissues excluded). The fractures were most frequently multiple in form, particularly to the tibia-fibula, and radius-ulna. Radiating fractures and blunt-force trauma were observed to the skull, and dental fractures were recorded (Busch et al. 1986, 559; Brison and Pickett 1992, 629; Pratt et al. 1992, 644; Temes et al. 1997, 493).

In the present study, both males and females had fractures to the limbs and torso (ribs and vertebrae), but only one middle adult female [P36 Maiden Castle] has healed oblique fractures to the distal third of the left tibia and the proximal third of the left fibula (Figure 73). The fracturing of both elements demonstrates that a severe force had been sustained by the lower leg, however as the fracture type is oblique it suggests that the force was indirect, and probably produced by a fall (Resnick 2002e, 2884). Only the female sample contained two examples of depressed fractures, and the male sample contained one example of a healed zygomatic bone fracture, however, these were most probably produced by violent episodes. No dental fractures were observed although it is possible that the affected teeth were lost ante-mortem due to instability or, the fracture has been disguised by wear. The injury recidivist data of both sexes, demonstrates that the majority of single injuries were produced by accidental or, accidental and/or violent mechanisms (Tables 73, 124). Only the male sample has the highest number of individuals (N= 7/35, 20%) presenting with single and multiple injuries caused by violent and/or accidental mechanisms. Nationally, only one radial-ulna fracture was observed (Roberts and Cox 2003, 99-100). Ubelaker and Pap's (1998) study of a Hungarian Iron Age sample, also found a very low prevalence of trauma, as only three fractured elements were recorded.

Figure 73: Ante-mortem fractures to the left tibia and fibula in a middle adult Iron Age female [P36 Maiden Castle].

Figure 73a Anterior view of the left tibia and fibula, the healed fractures are arrowed.

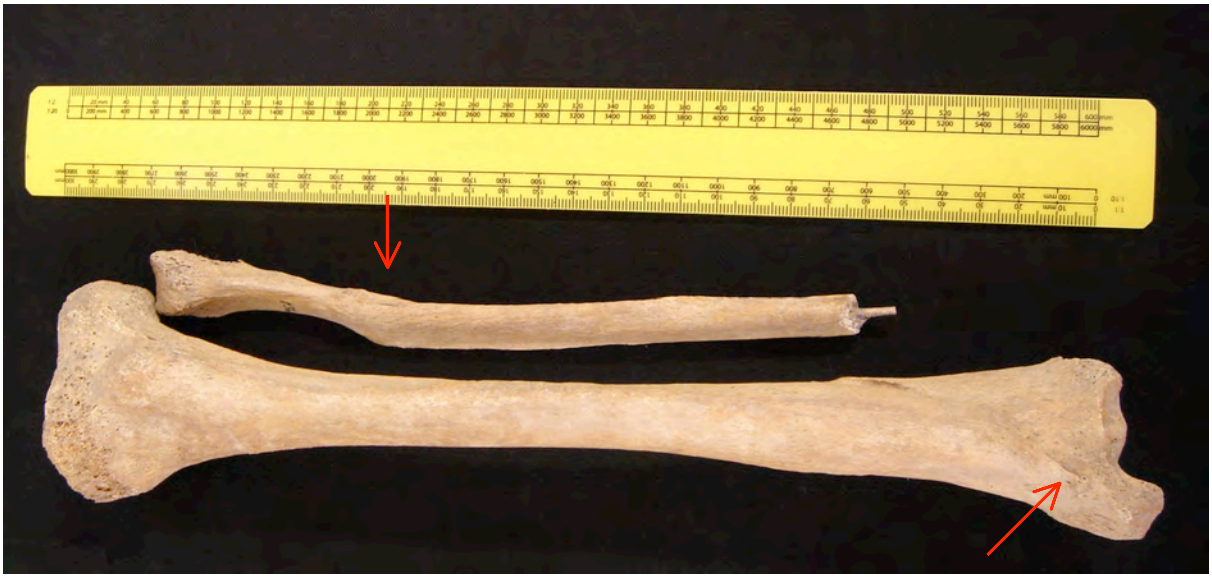


Figure 73b Anterior aspect of the left tibia showing the healed oblique fracture to the distal third.

Figure 73c Antero-lateral aspect of the left fibula showing the healed fracture to the proximal third.

In conclusion, the results of the present study are similar to clinical and archaeological studies of rural and agricultural trauma, however it does deviate from Judd and Roberts' (1999) study for element affected, fracture type, and location. It is highly probable that many of the isolated fibula, rib, hand and foot fractures were a result of agrarian tasks, and the fracture injury recidivist data may better reflect participation in farming, whether the fractures were directly caused by animal husbandry, or during the creation of secondary products.

4.5.1.2 Romano-British: males and females

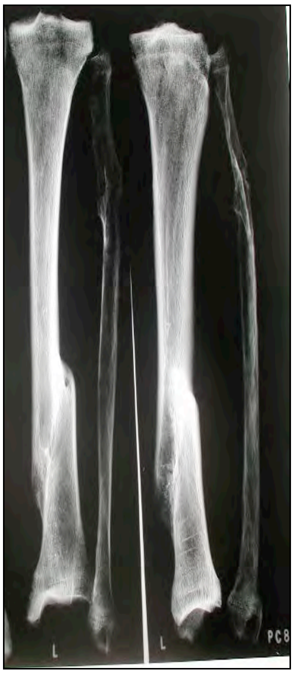
Fractures produced by accidental mechanisms were observed in both sexes in the Romano-British period, however unlike the Iron Age, the majority of observed fractures were oblique and complete, and the middle and distal thirds of the element were the most frequently fractured (Tables 63-65, 115-117). Oblique fractures are produced by compression, bending and torsion mechanisms through moderate energy loading (Resnick and Goergen 2002, 2712). In females (Table 115), three oblique fractures were observed to a rib, a left tibia, and one metacarpal. Seven complete fractures were observed to the left nasal bone, three ribs, one left ulna, one metacarpal, and phalanx. The most fractured segment was the distal third and the most fractured elements were the rib and left tibia. In males, 19 oblique fractures were observed in the axial (e.g. rib) and appendicular skeleton (e.g. four left tibiae and five left fibulae) (Table 65). Thirteen complete fractures were observed to the axial (e.g. right frontal bone and nasal bones) and appendicular skeleton (e.g. left humerus and two metacarpals) (Table 65). The most fractured segment was the middle third, and the most fractured elements were the rib and fibula (Tables 63-65).

Fractures produced by accidental mechanisms were observed in both sexes, however the Colles' fracture observed in the female sample may have been produced by fall whilst undertaking agrarian activities (Tables 116-117). As stated in section 4.5.1.1, osteochondritis dissecans is the "eventual result" of a fracture produced by shearing, rotatory or tangentially aligned impaction forces (Resnick and Goergen 2002, 2690). The majority of fractures were observed in males, and were located on the distal articular surface of a left humerus and right femur, and the proximal articular surface of one phalanx (Table 65). In females, osteochondritis dissecans was only observed on the distal articular surface of a right tibia [581 Poundbury Camp] (Table 117). These elements are typically affected by osteochondritis dissecans; for example in the humerus, they are often associated with throwing (Resnick 2002e, 2705) and in the femur, they can be produced by shearing forces, direct blows, and ligament avulsions (Resnick and Goergen 2002, 2695).

In males (Tables 63-65), a number of accidental fractures were observed to the long bones. Unlike the Iron Age, no clavicle fractures were recorded (a healed fracture in a left clavicle could not be included [Crown Building] see Appendix 1). For example, at Poundbury Camp, two males [847 and 6] have tibial-fibular fractures (Table 64, Figure 74). The involvement of both elements indicates that a severe force was sustained by the lower leg, however the fracture type in both cases is oblique, suggesting that the force was indirect, most probably caused by a fall (Resnick 2002e, 2884).

Figure 74: Tibial-fibular fractures in Romano-British males

74a Antero-posterior and medio-lateral radiograph of the left tibia and fibula [847 Poundbury Camp].



74b Posterior view of the left tibia and fibula [847 Poundbury Camp].

74c Antero-posterior radiograph of the left tibia and fibula [6 Poundbury Camp].

74d Anterior view of the left tibia and fibula [6 Poundbury Camp].

A young adult male from Alington Avenue [577] has a healed fracture to the medial epicondyle of the left humerus (Figure 19). These are rare fractures and are produced by an avulsion mechanism, typically during adolescence. The medial epicondyle is more frequently affected, due to the individual falling onto the elbow, onto an extended forearm or abrupt valgus strain (Galloway 1999, 132). A middle adult male [516 Poundbury Camp] has a surgical neck fracture to the right femur (Figure 75). The presence of a dysplastic acetabulum can predispose an individual to a surgical neck fracture but unfortunately in this male, the element is broken post-mortem and it was not possible to diagnose dysplasia. The fracture type could not be established, but may be subcapital, transcervical, adducted or abducted in form (Galloway 1999, 175). Fractures in this region of the femur are influenced by the underlying trabeculae bone morphology (e.g. Ward's triangle), they are produced by high-energy trauma in younger adults, but in older adults they are produced by falls or indirectly by muscle contraction (Galloway 1999, 175). The fracture is very well healed, and there is no evidence of atrophy or necrosis, secondary changes that are frequently associated with this fracture location (Apley and Solomon 2000, 320-321).

Figure 75: A surgical neck fracture to the right femur of a Romano-British middle adult male [516 Poundbury Camp].

75a Anterior view of the healed surgical neck fracture to the right femur.

76b Posterior view of the healed surgical neck fracture to the right femur.

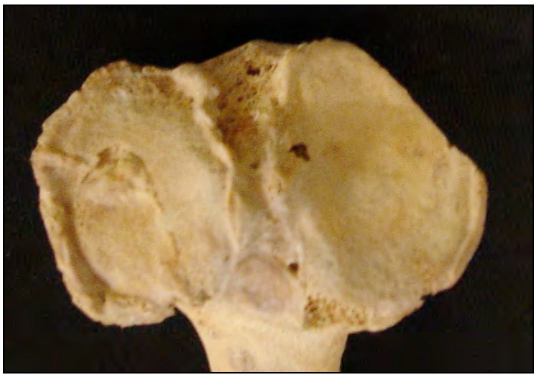
A young adult male [1400 Maiden Castle Road] has a healed depressed tibial plateau fracture to the left lateral condyle, which has healed with little displacement (Figure 76a). These fractures are caused falls from a height (Apley and Solomon 2000, 327) and a higher percentage of tibias are fractured in individuals who purposefully jump from a height (The et al. 2003, 484), and it is possible that it could have been sustained during agrarian activities (e.g. jumping from a cart).

In females, accidental fractures were observed to the tibiae, tarsals, and a phalanx (Tables 114, 115). The forearm and metacarpal fractures, although considered in this present study to have been produced by violent mechanisms, may have been caused by accidental events. The left tibia sustained the majority of fractures produced by accidental mechanisms. A middle adult female [117 Maiden Castle Road] has an oblique fracture to the medial plateau of the proximal articular surface (Figure 76b). An older adult female [800 Poundbury Camp] (Figure 76c) also has a healed tibial plateau fracture to the lateral condyle of the left tibia, which conforms to a depression fracture (Apley and Solomon 2000, 327). These fractures are most frequently caused by medial or laterally directed forces, or axial compressive loading, and it is possible for both forces to act in combination. They are produced by abduction of the tibia, whilst the plateau is under compression from the femur (Galloway 1999, 189), and are caused by falls from a height (Apley and Solomon 2000, 327).

Figure 76: Romano-British tibial plateau fractures

76a Superior view of the left tibial plateau, showing the healed depressed fracture to the lateral condyle. Observed in a young adult male [1400 Maiden Castle Road].

76b Anterior view of the proximal third of the left tibia, showing the healed oblique fracture observed in a middle adult female [117 Maiden Castle Road].



76c Superior view of the left tibial plateau, showing the healed depressed fracture to the lateral condyle, observed in an older adult female [800 Poundbury Camp].

A middle adult female [143 Poundbury Pipeline] sustained severe trauma to the left ankle joint (see section 3.20.4.1) (Figure 32), the fracture mechanism is highly complex as it is most frequently dictated by the nature of the ankle joint. The majority result from the body's weight being forced onto the foot, which is placed on the ground, whilst the body rotates upon the fixed ankle joint (Galloway 1999, 198). Unfortunately, due to extensive secondary osteoarthritic change and the inability to radiograph the elements, the fracture type affecting the medial malleolus could not be determined, but the types usually observed are avulsion or transverse (Galloway 1999, 198). These are produced by abduction and adduction forces, frequently combined with rotation or vertical compression, and are produced by a fall, or a fall from a height (Apley and Solomon 2000, 335-336). Compression fractures to the talus are commonly associated with this type of ankle trauma (Galloway 1999, 200), and its involvement stresses the force of the trauma.

Molleson's (1993) assessment of the fractures observed at Poundbury Camp concluded that males were predominantly involved in agricultural or construction activities (Molleson 1993, 199). This conclusion was not reached by comparing the sample to other agrarian populations. When the results of this study were compared to the medieval rural sample from Raunds Furnells (England), several disparities were observed. Foremost, no fractures to the clavicle were observed to either sex (see Crown Building, Appendix 1), which may result from variations in agricultural practices e.g. differences in plough technology. Both male samples had fractures to the femur, tibia, and fibula, with the fibula being the most fractured long bone (Judd and Roberts 1999, 233). Iron Age females had fewer long bone fractures compared to Raunds Furnells, and no fibula fractures were observed (Judd and Roberts 1999, 233). Judd and Roberts (1999) found that the distal third of the diaphysis was the most frequently fractured, and the most common fracture type was oblique (Judd and

Roberts 1999, 233). In Romano-British males, the middle third was the most affected segment, and the most common fracture type was oblique (Tables 63-65). In Romano-British females, the distal third was the most affected segment, and the most common fracture types were complete and oblique (Tables 115-117). Similarly to Raunds Furnells (Judd and Roberts 1999), one female was present with concurrent trauma to the lower limb [143 Poundbury Pipeline]. The similarity in fracture type and affected segment, demonstrates that rural life-ways in the archaeological past may be analogous, due to equivalent tasks and animals kept. The greater similarity between the Romano-British and Medieval samples may reflect the development of farming technology in Britain as part of Romanization. The comparison demonstrates that despite the region having an urban centre, the majority of individuals have a rural fracture pattern (see Larsen 1999, 117).

Only three females conformed to an injury recidivist model (Table 125), two females had multiple injuries caused by violence and/or accident, and the majority of single injuries were produced by violence and/or accident (Table 126). The pattern was observed in the male sample (Table 74), in which six males presented with single injuries, and five presented with multiple injuries caused by violence and/or accident (Table 75). These data may support the proposed agrarian life-ways of many adults from Roman Dorset, as the result is comparable to the late Romano-British sample from Cannington (Somerset), in which the majority of individuals sustained single fractures, and only two males had more than two fractures present caused by violent mechanisms (Rahtz et al. 2000, 456-502). Many contemporary rural individuals sustain multiple fractures from animal husbandry, and animal-drawn vehicle accidents (Rowe and Cliff 1982, 121; Cogbill and Busch 1985, 207).

As shown in section 1.6.3, cattle, sheep/goats, and pigs continued to form part of the agrarian economy in the Roman period. Modern clinical studies have shown that after machinery, animals are the second causative factor in farming accidents (Pratt et al. 1992, 642), and fractures are the third most frequent result of farm-related injuries on dairy farms (Brison and Pickett 1992, 629). Pratt et al.'s (1992) data demonstrates that the hand (21%) and leg (20%) were the most affected areas (Pratt et al. 1992, 644). In the present study's Romano-British sample, the leg was the most frequently fractured part of the skeleton (Tables 63, 115), suggesting that many of these fractures may have been caused by animal husbandry (in addition to falls). Interestingly, at the national level (excluding sites in the present study) more arm elements (N= 102) are fractured compared to leg elements (N= 74) (Roberts and Cox 2003, 154-157). This most probably results from the urban setting of many sites used by Roberts and Cox (2003) and therefore, individuals who lived in these locales would have had a different fracture pattern, as Judd and Roberts (1999) amongst others, have demonstrated (Larsen 1999, 117). Pratt et al.'s (1992) agricultural trauma study found that fewer females sustained fractures, but the type, location, and severity did not considerably differ from males (Pratt et al. 1992, 647). To a certain extent, this result was observed in the present study, as both sexes sustained tibial plateau fractures (Figure 76). Importantly, these fractures are only observed in the Romano-British sample; and may represent a mechanism specific to Roman technology, or developments in the agrarian economy. Busch et al.'s (1986) analysis of blunt bovine and equine trauma, found that the most frequent orthopaedic trauma were tibial-fibula fractures (Busch et al. 1986, 559), two such fractures were observed in the male sample (Table 64) (during the Romano-British period, donkeys and mules were introduced into Britain, see section 1.6.3). A study of trauma produced by animals in Sweden, found that the most acute trauma was experienced by individuals with fractures caused by cattle (Björnstig et al. 1991, cited in Roberts and Manchester 2005, 103).

The healed cranial fractures recorded in Romano-British males (Figure 68), although highly suggestive of inter-personal violence, may have been caused by large animals, or falls from horses (Temes et al. 1997). Cogbill and Busch's (1985) assessment of agricultural trauma found that animal kicks most frequently resulted in facial and leg fractures (Cogbill and Busch 1985, 207). Other fractures, observed in both sexes, which may be related to agricultural accidents, are those to the metacarpals and phalanges (Tables 63, 115). Although the number of elements affected is less than four, these fractures may have been produced by agricultural accidents. A modern clinical study from Dorset, found that the hands and fingers were the most affected elements, which Rowe and Cliff (1982) believe to result from the manual nature of agricultural work (Rowe and Cliff 1982, 123).

As discussed above, the national data (Roberts and Cox 2003, 154-157) may be biased by cemeteries from urban centres. The late Romano-British population from Cannington (Somerset) (Brothwell et al. 2000) is from a rural location, and during this period had comparable life-ways to individuals in Dorset. The Cannington population also display accidental fractures, which are associated with agrarian life-ways. Males have fractures to the clavicle, tibia, fibula, radius, ulna, metacarpal, and phalanx. Females have fractures to the clavicle and ulna (fracture type and segment was not always stated in the publication). More males have sustained fractures compared to females, and one male [144] has fractures to the tibia and fibula (Rahtz et al. 2000, 456-502). The female sample from Cannington differs from the present study and Raunds Furnells sample (Judd and Roberts 1999, as no females have leg fractures, and their fractures are more suggestive of inter-personal violence (e.g. to the frontal bone and nasal boness) (Rahtz et al. 2000, 456-502).

In conclusion, the evidence for accidental fractures shows significant temporal differences, reflecting changes in the local and wider environments, which is supported by the statistical significance of the data (Tables 67, 118). For example, tibial plateau fractures are only observed in the Romano-British period, suggesting that they were caused by factors specific to that time. The Romano-British sample conforms to archaeological and clinical trauma data from rural populations, reflecting the agrarian aspect of the Romano-British economy, and the employment of many individuals on villa estates and farms in the region, supporting the limited textual evidence for “estate names” in Dorset (Birley 1979, 139).

4.5.2 Community and settlement

This section focuses upon tuberculosis and neoplastic change. Discussion of the evidence will focus upon two themes, community in terms of variability and resources, and settlement, with regard to changing domestic structures and local environment.

4.5.2.1 Tuberculosis

The presence of tuberculosis in the Iron Age population (Table 26, Figure 10) represents the earliest identification of this disease in Britain (Mays and Taylor 2003), although in earlier archaeological periods, as well as during the Iron Age, it may remain un-/misdiagnosed, or the individual may have died before a recognisable osseous response could be initiated. The tubercular infection in a middle adult male from Tarrant Hinton [AB 2] caused extensive destruction to three lumbar vertebrae. The spine is a common site of involvement, particularly the lumbar vertebrae, due to haematogenous spread from the source infection in the lung (Resnick 2002b, 2525). Biomolecular analysis of the vertebra and ribs was unable to distinguish between *Mycobacterium bovis* and *Mycobacterium tuberculosis* (Mays and Taylor 2003, 193). The presence of osseous lesions in this individual does not mean that they died of the infection (Roberts and Buikstra 2003, 7), particularly as the lesions are remodelling. The osseous changes may indicate re-activation of non-adult or young adult infection from a primary focus in the lung, re-infection from an air-borne source of tubercle bacilli, or the consumption of infected meat and/or dairy products (Resnick 2002b, 2525; Roberts and Buikstra 2003, 19, 74-82). The infection indicates that they had prolonged contact with the source of the infection, and that many others in their community may have been infected, but did not show any signs of the disease (Resnick 2002b, 2524-2525; Roberts and Buikstra 2003, 7,9).

Roberts (2002b) identifies risk factors and socio-cultural causes that may be recognized in past populations, and those applicable to Iron Age Dorset are animals, poor hygiene, occupation, and travel/migration (Roberts 2002b, 32). Diet is not discussed, as there is no firm evidence to suggest that diets were inadequate during this period. In the Iron Age cattle, and sheep played dominant roles in the agrarian economy, and evidence suggests that dairy products formed a significant part of a community’s diet (see sections 1.5.5 and 4.4.2). Tuberculosis may have been transmitted due to animal husbandry, such as ‘mucking out’ (sic) and milking or, the use of dung as fuel (Roberts and Buikstra 2003, 76-81). The role of animal husbandry in the transmission of infectious diseases is supported by faunal remains from Dragonby (Lincolnshire) that have evidence for brucellosis (Brothwell 1981, 246). Transmission may have occurred due to exposure from wild animals, as badgers and deer are known carriers of the disease (Roberts and Buikstra 2003, 79-82), and have been identified in Dorset during this period (Harcourt 1979). Examination of Iron Age material culture has shown that bones, sinew, hide and fleece were all processed to make objects and utensils. All of these animal products are potential vectors of tuberculosis, even after extensive processing (Roberts and Buikstra 2003, 119).

Transmission may have occurred due to local environmental conditions, via dwellings and their level of sanitation, as construction design can manufacture microenvironments that aid respiratory pathogen transmission (Chen 1988). Reconstruction of roundhouses has shown that if the fuel sources do not adequately burn, particulates can be produced causing irritation to the lungs. Such an atmosphere causes coughing and thus, can spread the disease via droplet infection. In roundhouses, members of the community may have been in close proximity to one another whilst working or sleeping, and such a polluted atmosphere may have been suitable for spreading the disease. Chen’s (1988) study of longhouses in Sarawak

(Malaysia) found that lengthy social contact increased the likelihood of contracting tuberculosis (Chen 1988 cited in Roberts and Buikstra 2003, 60), as droplet infection and transmission takes a long time, especially when households are crowded (Elender et al. 1998 cited in Roberts and Buikstra 2003, 60).

The levels of sanitation and the cleanliness in roundhouses (Figure 77) and seasonal dwellings are poorly understood, because we lack bioarchaeological data concerning vectors of disease such as flies. Early excavations did not recover or adequately store material, and flooring levels from this period rarely survive. Those preserved in waterlogged conditions comprise a very small dataset (none have been found in Dorset) and are not complete enough to use as an indicator (Keeley 1987, 172-173; Georgi pers.comm.). This situation is further compounded by our lack of knowledge concerning residency and occupancy length during this period (Haselgrove 1994, 1). Analogous examples of Iron Age dwellings that have been intensively analysed using bioarchaeological data are the early Medieval Norse dwellings in Iceland and Greenland, where permafrost layers have preserved the interior environments (Georgi pers.comm.). Insect samples recovered from flooring deposits included human body and hair lice and analysis of these samples showed that sheep fleeces and wool were processed in these areas (Buckland et al. 1993, 516-517). Flooring consisted of hay, twigs, dried seaweed and woodchips, which were frequently changed. These materials are absorbent materials and during decomposition may have provided extra warmth (Buckland et al. 1993, 519-520).

Figure 77: Example of a reconstructed Iron Age roundhouse (Chiltern Open Air Museum)

77a View of a reconstructed roundhouse, showing the conical roof design, with wattle and daub walls.

77b An inside view of the conical roof, showing the lack of ventilation at the apex.

77c An example of wall construction, showing the wattle and daub technique. The floor in this reconstruction was made from compacted stone and soil.

Travel and migration may have aided the transmission of tuberculosis during the Iron Age. In Dorset, the port at Hengistbury Head had trading networks within Britain and mainland Europe (section 1.5.5), and may have provided the opportunity for people to come into contact with infected individuals from other communities. Stable isotope assessment of migration in Iron Age Britain is very limited, and available data suggest that the analysed individuals were local to their place of burial (Richards et al. 1998; Budd et al. 2003; Montgomery et al. 2005), however there is no evidence to suggest that individuals did not undertake extensive travel during prehistory.

As previously discussed, our understanding of Iron Age medical knowledge is very poor. It is not known how individuals with tuberculosis and its physical manifestations were treated. A review of palaeobotanical evidence for plants with medicinal properties from Iron Age contexts only identified a sample of charred opium poppy seeds from a structured/ritualised deposit (Birbeck 1999, 33). Despite the numerous interpretations of these deposits (see Hill 1995b), the presence of the charred seed may show that communities were aware of the poppy's analgesic properties (Mann 2000, 190), as it's seeds have been identified from the Neolithic period onwards in the British Isles, as well as in Iron Age dwellings (Miller et al. 1998; Healy and Harding 2003). The seeds do not provide direct evidence for the plant's cultivation, as they can survive within the soil for a long time, and when the soil is disturbed and aerated, they will grow abundantly (Hinton 1999, 207).

The presence of tuberculosis in Iron Age Dorset, offers a tantalising insight into infectious disease during this period, particularly because it is the only case of a specific infection in the sample. The affected male [AB 2 Tarrant Hinton] was not differentiated in terms of funerary treatment, and this limited evidence suggests that they were not stigmatised within their community. The identification of tuberculosis suggests that it may have been more virulent within the community, and could have originated from travel/migration, animal husbandry, or the consumption/handling of infected animal products.

In the Romano-British period, two females [1128 and 223 Poundbury Camp] displayed remodelling and healed tubercular lesions (Tables 98, 99, Figures 26, 27). An adult female with a healed tubercular infection that had resulted in Potts' disease from Poundbury Camp [1201 Poundbury Camp] was not selected for recording in the present study (Molleson 1993, 188 Plate 61c). Additional individuals from Alington Avenue [1088 and 960] were reported to have tubercular changes, but were not available for inclusion in the present study (see Appendix 1 and section 3.18). It is tentatively proposed that the young adult female with changes conforming to hypertrophic osteoarthropathy [2.22 Fordington Old Vicarage], may display a response to a chronic pulmonary disease produced by an infection (Table 135, Figure 40). Mays and Taylor's (2002) review of hypertrophic osteoarthropathy suggest that before the introduction of antibiotics, the majority of cases were a response to tuberculosis, rather than cancer (see Ortner 2003, 354 for contrary information). Their ancient DNA study of two Medieval individuals suffering from the disease, found that one individual tested positive for *Mycobacterium tuberculosis* (Mays and Taylor 2002).

The middle adult female [1128 Poundbury Camp] has suffered destruction of the 4th and 5th lumbar vertebrae, and the anterior aspect of the sacral vertebrae (Table 98). This is a frequent site of infection, and the presence of remodelling sclerotic bone on the anterior aspect of the sacrum indicates extension of the infection (Resnick 2002b, 2527-2528) (Figure 26). Diagnosis of a tubercular infection to the right hip has been tentatively made in an older adult female [223 Poundbury Camp] (Figure 27), as it possible that it may have been caused by necrosis, and/or non-union after a fracture (Sevitt 1981, 189-213). Tuberculosis typically affects the femur during non-adulthood by haematogenous spread, although it can affect adults up to the age of 40 years old (Ortner 2003, 229, 236). The isolated infection of the surgical neck, with maintenance of the proximal articular area for weight bearing, is not uncommon (Ortner 2003, 237). There was no evidence of atrophy in the right leg, but it is not known whether limb shortening had occurred, because the left femur could not measured due to post-mortem taphonomic damage. Accounts of tubercular infections in early twentieth century European children, describe how they adapted to the infection. Outwardly, the children appeared healthy, but adopted "attitudes of self-protection" as they would stand with the hip flexed, abducted, and externally rotated (Fraser 1914, 210). Therefore, we cannot presume that the female was excluded by their community, or needed extra care and assistance (Roberts 1999, 2000c).

The increased number of individuals with tubercular lesions during the Romano-British period suggests that the infection was more widespread, perhaps due to Britain's incorporation into the Roman Empire, which would have expanded population size and density, and increased migration. Roberts (2002b) identification of risk factors associated with tuberculosis which are applicable to the Romano-British period are animals, poor hygiene, occupation, travel/migration, and ethnicity (Roberts 2002b, 32). Diet is not discussed as no individual displayed a specific metabolic disease.

During the Romano-British period, the agricultural economy expanded, and mules and donkeys were introduced into Britain (see section 1.6.3). Therefore, as discussed above, individuals may have become infected with tuberculosis because of their agrarian occupations, or during the manufacture of secondary animal products (Roberts and Buikstra 2003, 74-81, 119). Roman medical treatments for tuberculosis may have continued to expose sufferers to the mycobacterial disease. Milk cures (often taken at resorts) were popular (Pease 1940, 388), and the Hippocratic writings state, "it is good for patients liable to consumption if they have not too high a fever. It should be given in cases with prolonged low fever, where the patient is abnormally wasted" (Hippocratic writings, *Aphormisms* V). The extent to which these were practiced in Dorset is unknown, as medical treatment varied considerably within the Empire (Baker 2001; 2002a; 2002b). However, as individuals from the Mediterranean have been identified in Dorset, it is not unreasonable to suggest that these treatments could have been employed.

Determining hygiene levels in Romano-British households is highly problematic, especially as the majority of evidence is site specific often with military connections, and from an urban area (e.g. York and London). Dobney et al.'s (1999) review of the environmental evidence pertaining to Roman Britain found that some samples indicate clean and dry areas, but we should not presume that they were clean, because very little has actually been excavated (Dobney et al. 1999, 18-20). Dorchester was the only urban area in Dorset during this period; it was considerably smaller than other urban centres in Britain, and did not have a permanent military presence. Therefore, such evidence is tentatively applied to Dorset. The environmental indicator group from York proposes that areas of decomposing organic material existed created by food, faecal material, and other domestic waste. However, it is not clear whether this unsanitary picture of Roman living is specific to Roman military sites, or from excavation and sampling strategies (Hall and Kenward 1995, 393). Such evidence is cautiously accepted, because no study has presented a sufficient body of data. In urban areas there are a lack of closed contexts, which could result in the mixing of outdoor and indoor conditions; and the flora from urban centres are formed by natural dispersion and plants which are useful to humans (Kenward 1975, 1985; Hall 1988, 93-94). At 1 Poultry in London, timber buildings and their environs were preserved, and bioarchaeological data retrieved from the excavation demonstrated that the yards contained dumps of household rubbish, and the houses hosted black rats and house mice (Rowsome 2000, 30, 34-35). A similar assessment was made at Greyhound Yard, where cesspits, wells, and waste-pits were identified (Woodward 1993, 363).

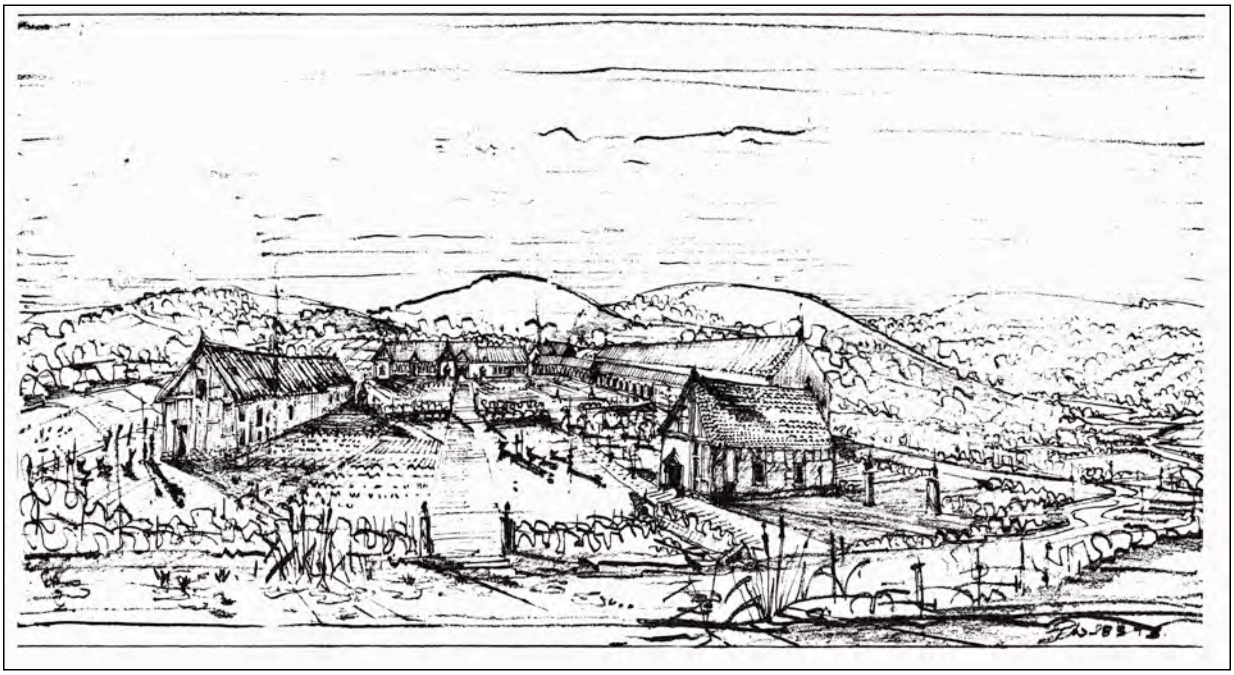
A range of housing has been excavated in the region (see section 1.6.2) and as today, conditions may have been dwelling-specific and dependent upon status/occupation (e.g. slave). In Dorchester (Figure 78), private bathhouses and plumbed houses have been identified, showing that many homes may have had a high level of sanitation (e.g. Colliton Park, Dorchester). In the surrounding countryside, roundhouses may have continued in use, as well as villa estates, containing high and low status housing and a variety of microenvironments (e.g. Halstock Villa) (Field 1965; Groube and Bowden 1982, 48; Woodward 1993, 365-6). As in the Iron Age, transmission of tuberculosis within dwellings may have resulted from lengthy contact with infected individuals. Variation in microenvironments existed, due to the range of dwellings constructed during this period, which could have promoted respiratory pathogen transmission (Chen 1988; Elender et al. 1998; Roberts and Buikstra 2003, 60).

Figure 78: Romano-British dwellings in Dorset

79a View of the reconstructed townhouse at Colliton Park, Dorchester

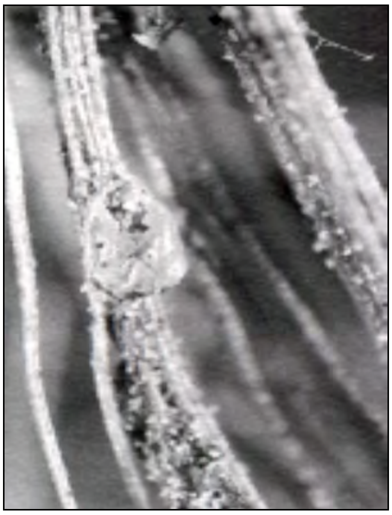
78b View of the bathhouse (arrowed) and partial reconstruction of the townhouse at Colliton Park, Dorchester.

78c Reconstruction of Halstock Villa (Lucas 1993, 150, Figure 60).



Our understanding of personal hygiene in Dorset has been enhanced by the examination of preserved internal and external parasites from the gypsum packing of burials from Poundbury Camp (Jones 1993) (Figure 79). One older adult male [513] had 5350 ova per gram of whipworm (*Trichuris trichuris*) and roundworm (*Ascaris lumbaricoides*) eggs recovered from their pelvic region, but the level is not deemed harmful to health (Jones 1993, 197-8), and the older adult male only displayed healing porotic hyperostosis. One non-adult had numerous head lice (*Pediculosis capitis*) still attached to their hair (Farwell and Molleson 1993, 178). Reinhard (1992) suggests this type of evidence indicates that the community had poor personal hygiene, and lived in cramped conditions suitable for the transmission of infectious diseases (Reinhard 1992, 238). This suggestion is tentatively accepted, because it is based upon a small sample from the region, and may indicate a more complex interaction of factors, such as occupation, status (e.g. slave), socio-economic resources, and ancient standards of cleanliness and sanitation.

Figure 79: Spent head lice cases preserved in a gypsum burial Poundbury Camp [376 young adult male].



(after Farwell and Molleson 1993, 147 Plate 49).

Unfortunately, due to a lack of bioarchaeological data, determining the role of sanitation in the transmission of tuberculosis is poorly understood in this period. It is further complicated by the probable non-adult development of the disease in these individuals, which may have occurred elsewhere in Britain or the Empire, and may not reflect conditions in Dorset.

Occupation has been identified as a prime factor in the transmission and contraction of tuberculosis. Based on clinical data, the three most frequently affected occupations are unskilled labourers, workers in a particulate-laden environments, and prisoners (Roberts and Buikstra 2003, 69). Prisons were used by the Romans (Adkins and Adkins 1998, 353), but their role in the transmission of tuberculosis in Roman Britain remains speculative, especially because state imprisonment was relatively short, and large households often contained private prisons for slaves (Adkins and Adkins 1998, 353). Slaves may have had a higher risk of contracting tuberculosis, because they formed the majority of the workforce (skilled and un-skilled), although by the 4th century A.D. their use as unskilled labour is proposed to have become unprofitable (Adkins and Adkins 1998, 342). During the Romano-British period, the agrarian economy expanded, especially with the development of the villa economy (Leech 1976; Millett 1997, 67-74). Branigan's (1976) assessment of villas in southwest England concluded that despite many being high-status homes, the material culture, faunal remains, and architecture suggest that some were working-farms, often associated with iron smelting, and the shale industry (Branigan 1976, 132-136). The involvement of many individuals in agriculture is supported by the fracture pattern analysis (see section 4.5.1.2), and exposure may have increased/widened from the Iron Age, due to expansion of the agricultural economy and increasing population. In the Roman period, many primary authors recorded tubercular infections in animals (Roberts and Buikstra 2003, 117) and improving husbandry knowledge in Dorset, could have resulted in the slaughtering of infected animals, but it is possible that the disease was transmitted before slaughter. Agricultural tasks and the manufacture of products are recorded in the Roman primary sources. The manufacture of cloth and processing of wool is dominant in the literature, and is particularly associated with women (Dixon 2001, 120-121). For example, female slaves often worked with animals or their secondary products; “at times when the woman cannot do any agricultural work in the open … she is to occupy herself with wool-work … she must make sure that the kitchens, the cowsheds, and not least the pens, are properly cleaned” (Columella *De Re Rustica* 12. 3 cited in Gardner and Wiedemann 1991, 81-82).

Travel and migration are important factors in the transmission of tuberculosis, particularly for populations who are in transition, with travel to new ‘locales’ and cultures increasing or introducing new methods of exposure (Roberts and Buikstra 2003, 64, 68). The import of slaves from different parts of the Empire, as well as within Britain, may have increased the risk of tuberculosis within households, “nowadays our huge households are inter-national. They include every alien religion- or none at all” (Tacitus *Annals* XIV.44).

Alland (1966) suggests that if cultural practices change in a small number of individuals, new routes of transmission can be formed which can affect the wider community (Alland 1966, 48). Therefore, the forced or ‘natural’ migration of individuals may have created new modes of transmission. This may have occurred in Dorset, both in a response to greater contact with the Roman Empire before the Claudian invasion, and with increasing cultural interaction during the Romano-British period (e.g. the use of public baths).

In the Romano-British period, travel and migration can be more reliably established, using textual sources and biomolecular data. The Roman state depended upon the travel of many individuals, primarily military personnel, civil servants, couriers and envoys, and the Imperial family. Beyond this, travel was undertaken by merchants, farmers, tourists, and pilgrims (Adkins and Adkins 1998, 169; Whittaker 2004). Birley (1979) notes that practically all regions of the Empire are attested in inscriptions, particularly Germany and Italy, but observes that by 200 A.D., an individual’s origin is rarely stated (Birley 1979, 18-19). Noy’s (2000) analysis of the “epigraphic habit” and newcomers to Rome has implications for our understanding of the inscriptions in Britain. Noy (2000) raises three important points, the Romanization of men's names after Army conscription, whether people or their commemorators who believed (wanted) themselves to be Roman would reveal their ethnic identity, and that "people could still be considered 'foreign' by themselves and others, if their attachment to another place … seemed greater" (Noy 2000, xii, 10). The majority of British primary evidence derives from inscriptions, predominantly from the army, for example the numerous letters from Vindolanda. Many of these were written by Batavians and their families from the lower Rhine (Germany), demonstrating that the army had introduced literacy within a short space of occupation (Bowman and Thomas 1994; Miles 2000). Many high-ranking officials are included in (amongst others) inscriptions, tombstones and altars, for example Sextus Julius Severus was governor of Britain (130-133/4 A.D.), but previously had been governor of Moesia Inferior (northern Greece/Macedonia) (de la Bédoyère 1999, 229). Women born elsewhere in the Empire are recorded in Britain, such as Diodora a priestess from the Levant (Watts 2005, 41), and others from Germany, Sardinia, and France (de la Bédoyère 1999, 266-267).

More secure evidence for migration is based upon stable isotope data, the identification of females from the Mediterranean at Poundbury Camp (Richards et al. 1998) has been discussed, but data from elsewhere in Britain supports the inscription evidence for migration from all areas of the Empire. Budd et al.'s (2003) stable isotope study of six Romano-British samples provides a more insightful understanding into the makeup of communities during this time, and may provide parallels for Dorset. Budd et al. (2003) showed that results could be site specific for example, rural or periphery locations may show little population movement. Analysis of two individuals from Mangotsfield (Somerset) (mid 3rd century A.D.), were local to that area (Budd et al. 2003, 134), whereas four burials from an urban cemetery in Winchester (mid 4th century A.D.) were from the western Mediterranean and North African coast (Budd et al. 2003, 134). The available biomolecular evidence provides a skewed view of Romano-British communities, as the majority of samples containing migrants are from urban areas, which are often more frequently excavated.

The presence of tuberculosis in the Roman Empire reflects the agrarian economy upon which the Roman state relied, and the inter-connection of countries that enabled many individuals to travel great distances. The role of client-kingdoms or states should also be considered, as they were allied with the Roman Empire and provided troops, but remained outside its direct control. It should be noted that individuals outside the Empire could also volunteer for the Army (Elton 1997, 134-135). Evidence for individuals with tuberculosis in other Roman provinces is sparse compared to Britain; no cases have been reported from the Netherlands, Germany, Israel, Greece, Portugal, Serbia and Turkey, although "absence of evidence is not evidence of absence" (Roberts and Buikstra 2003, 150, 156, 171-172, 176, 178-179, 181). In Italy, tuberculosis has been identified from the Neolithic period, and cases have been identified from the Iron Age and Roman periods (Roberts and Buikstra 2003, 173-174). In France, four individuals with tuberculosis, from the late Roman Period (4th to 5th centuries A.D.) have been identified. One male with spinal changes dating to the 4th century A.D. has been recorded from Egypt, and two cases have been observed in Spain, both confirmed by aDNA testing (Roberts and Buikstra 2003, 170, 165-166, 179). Due to the nature of the Empire, tuberculosis could have been spread more easily and may have been more prevalent than the osteological data indicates. A hypothesis supported by the observation in primary Roman texts, that tuberculosis was a very commonly occurring disease (Roberts and Buikstra 2003, 215).

In England, individuals with tubercular lesions have been found in southern and eastern counties, from both rural and urban cemeteries (Roberts and Buikstra 2003, 132). Two probable cases of tuberculosis to the shoulder joint (not included in Roberts and Buikstra 2003) are reported from the Eastern cemetery in London (Conheeney 2000, 283, 287). Roberts and Buikstra's (2003) study found that nine samples have evidence of tubercular infection, and four of the nine sites are from Dorset. Their study does include the Tolpuddle Ball cemetery dating to the late Romano-British period (see Appendix 1), and an example of Potts' disease in an older adult female from Queensford Mill (Roberts and Buikstra 2003, 134), which could not be included in the sample (the collections at the British Museum of Natural History were closed). The high number of sites from Dorset may relate the long history of excavations carried out in Dorset, and that many of the sites from the region have a large sample size e.g. Poundbury Camp (Farwell and Molleson 1993), which increases the chance of finding the disease. Two of the four cemetery sites served *Durnovaria* and surrounding hinterland, suggesting that transmission factors and environmental conditions had not considerably altered since the Iron Age. Tuberculosis may have established itself in the urban centre because of migration (from within the region, Britain, and the Empire), the possible unsanitary environment in parts of *Durnovaria*, and the reliance of many individuals upon imported dairy and other animal products that may have been infected.

Durnovaria as the only urban centre in the region would have created new and often exclusive modes of disease transmission. The town contained a large public bathhouse, which could have exposed many people to infectious diseases. Bathing was very popular in the Roman Empire, because many believed that it played a preventative role in healthcare, and often formed part of an individual's daily routine (Fagan 2001, 87-88). It was a recommended cure for fever and wasting diseases, both symptoms were noted by Graeco-

Roman medical writers to be associated with tuberculosis (Meinecke 1927, 382-383, 390; Pease 1940, 387). The bathhouse may have been a hub for medical treatment, as private doctors often rented rooms to practice in (Jackson 2000, 11); nevertheless, the type of medicine practiced in Dorset may not have been truly ‘Roman’ in form (see Baker 2001; 2002a; 2002b).

In Roman Dorset, the transmission of tuberculosis between newcomers and natives (and vice versa) may have been caused by a number of factors, such as the settlement of army veterans in the local community, the importation of slaves, or the establishment of a large working population in *Durnovaria*. The town would have created a larger, and perhaps more static community than ever previously seen, who lived in more densely settled dwellings which were close to areas of waste disposal, all factors which promote the spread of tuberculosis.

4.5.2.2 Biology and environmental risk? Neoplastic changes

Neoplasms are suggested to result from environmental, and/or genetic/biological causes (Ricci et al. 1995; Resnick 2002c, 2190; Ortner 2003, 503-504). By examining the data using a medical ecology approach, potential environmental causes can be considered, and the available bioarchaeological evidence assessed.

The majority of benign and malignant neoplastic changes were observed in the Romano-British period, this result correlated with national data, in which the number of individuals with congenital and neoplastic diseases increases (Roberts and Cox 2003, 163). Benign osteochondromas were observed in both periods, but only four individuals displayed changes.

In the Iron Age, benign osteochondromas were recorded in the tibiae of a young adult Iron Age female [1364 Poundbury Camp] (Table 130, Figure 36). In the Romano-British period, a young adult female [104 Poundbury Pipeline], a middle adult male [791 Alington Avenue], and an older adult male [Crown Building] (Table 81) have benign osteochondromas in the post-cranial skeleton. These benign neoplasms are produced by growth, which are unlikely to be influenced by environmental conditions (Ortner 1981, 733; Resnick et al. 2002b, 3871, 3881).

In the present study, malignant neoplasms were only observed in two individuals from the Romano-British period, although nationally meningiomas have been identified in two Iron Age females from Yorkshire and Kent (Roberts and Cox 2003, 93). In Dorset, an additional case of meningioma was reported in a Romano-British middle adult male [789] from Alington Avenue (Waldron 2002, 153) unfortunately, the skull was not present in the archive, and the case could not be included in this present study (Appendix 1). The low prevalence rate recorded in this present study is biased by the inability to radiograph all available elements, incomplete archives, and the low number of older individuals present. The result does correlate to the palaeopathological literature, which observes that they are rarely seen (Ortner 2003, 504; Roberts and Manchester 2005, 257).

The two individuals with malignant neoplasms are from Poundbury Camp, and both display destructive lesions that conform to the palaeopathological and clinical criteria for multiple myeloma, and osteolytic metastatic changes (Resnick 2002c,d; Ortner 2003, 376-382, 532-535). An older adult female [3 Poundbury Camp] (Table 132, Figure 38) has multiple destructive lesions to the skull, vertebrae, sternum, pelvis, and femora, which conforms to the clinical criteria for multiple myeloma (Resnick 2002c, 2215). This female also has four rib fractures, two of which are in the process of healing. It is possible that due to the physical side effects of this disease, they could have been caused by a fall (Resnick 2002c, 2189). Multiple myeloma is a common disease, accounting for 1% of all malignant changes, and 10% to 15% of those affecting the haematological system (Resnick 2002c, 2189). The changes observed in the female [3 Poundbury Camp] reflect the insidious nature of the disease, as it can remain asymptomatic for many years (Resnick 2002c, 2189).

Osteolytic metastatic changes were observed in a middle adult male [955 Poundbury Camp] who has destructive lesions throughout the axial and appendicular skeleton. In the skull, the majority penetrate both the endo- and ecto-surfaces, and in the remaining post-cranial elements, the division between the medullary cavity and cortex has been destroyed (Table 82, Figure 24).

Determining the presence of pollutants in the Romano-British period is problematic, as very little data is available on environmental pollution. The most recent data from 1 Poultry and Walbrook in London, show that people were living in close proximity to industries such as potteries, forges, tanneries, and cloth making (Perring and Brigham 2000, 141-142; Rowsome 2000, 34). This would have exposed some individuals to air pollutants, rotting animal parts, heavy metals, and dust. The health repercussions for urban dwellers was recognised by Roman medicine, as they were considered to be particularly fragile people (Foucault 1990, 102-103), although the concept of public health did not exist at this time (Nutton 2000, 72). As discussed above (section 4.5.2.3), the environmental conditions of *Durnovaria*, although bearing some similarities (e.g. Greyhound Yard) to other urban areas in Roman Britain, do not appear to have adversely affected health-statuses. Palaeopathological evidence for rickets, a disease associated with urbanism and poor living conditions (Roberts and Manchester 2005, 238) was recognised during the Roman period, Soranus describes "a bow-legged" condition of infants in Rome (Jackson 2000, 38), and Galen noted several deformities of rickets, such as being bow-legged (Mays 2003, 147). A diagnosis of rickets has been suggested for two non-adults from Poundbury Camp based upon "slightly bowed tibiae" (Molleson 1993, 179). In the present study, two infants from this cemetery (not those identified by Molleson (1993)) displayed changes suggestive of active rickets (Ortner and Mays 1998; Lewis 2000, 50-51; Mays 2003). Mays (2003) suggests that in rural samples, infantile rickets resulted from sick children being confined in dark and smoke filled homes (Mays 2003, 150). These factors may have been present in Roman Dorset, but do not necessarily mean that the urban environment was polluted. No examples of remodelled rickets were observed, although if the case was mild then the evidence may have been obliterated by skeletal remodelling (Roberts and Manchester 2005, 240). Molleson (1993) reports that two adult females (not included in the present study) [126 and 213 Poundbury Camp] display changes suggestive of osteomalacia (Molleson 1993, 184), but the changes are within normal variation for the population and were not caused by metabolic disease.

It is concluded that the palaeopathological data does not provide overwhelming or definitive evidence for an un-healthy living environment in Dorset. The limited examples of metabolic disease are restricted to non-adults from Poundbury Camp, data that is atypical of the region. Additionally, it cannot be proven that the disease resulted solely from factors in Dorset, rather than from migration, culturally specific care (e.g. swaddling), and conditions outside Britain.

Molleson's (1993) discussion of the evidence for lead accumulation in the Poundbury Camp sample, based upon samples of ribs from nearly 400 individuals, concluded that lead was ingested throughout life by all status groups, and that males had the highest rates (Molleson 1993, 185-186). A more recent assessment was undertaken on ribs from 49 Iron Age and Romano-British burials from Alington Avenue (Eldridge 2002). The Iron Age samples, apart from one male [1138] had normal results, and their average result (data not provided) was lower than the Romano-British period (Eldridge 2002, 157). The Romano-British samples showed that similar lead levels were obtained from rib and soil samples (from the stomach region), which could indicate an increase in dietary intake, or show the movement of lead within the grave context. Importantly, Eldridge's (2002) results show that high lead intake was not endemic, as high lead levels were only identified in two adult burials [female 1114 and male 277], suggesting that these individuals had a higher rate of exposure compared to the rest of the sample (Eldridge 2002, 157).

Despite the analysis of human bone samples from Poundbury Camp and individuals from the cemeteries at Cirencester (Cotswolds) (Waldron and Wells 1979; Waldron 1982), no study has securely ascertained why there is an increase in the lead levels of Romano-British samples (Eldridge 2002, 157). Aufderheide et al. (1992) studied the lead levels of 20 Italian populations, dating from the Iron Age to the Medieval period, found that the levels of lead increased to a peak during Imperial Rome, and once the mines had been depleted, the levels declined (Aufderheide et al. 1992, cited in Aufderheide and Rodríguez-Martín 1998, 319). A temporal change in lead accumulation has also been identified in Britain, suggesting that the Romano-British period saw a rise in industrial activity and pollution levels. The concentrations found in samples of Romano-British dental enamel are similar to those associated with industrial pollution today (Budd et al. 1998; Budd et al. 2004).

A recent assessment of ancient metallurgical activity may supply a possible answer to why Roman populations from Europe have such high concentrations. Marshall's (2003) analysis of soil cores found that between 120 to 350 A.D., lead levels were "relatively high", and noted that peat deposits from Britain, Germany, the Netherlands and Sweden, and ice cores from Iceland, all show an increase in lead levels during this 230 year period (Marshall 2003, 15). Marshall (2003) proposes that this was caused by the expansion of a European wide lead smelting industry, which caused local, regional, and hemispheric pollution (Marshall 2003, 15).

Eldridge (2002) suggests that the elevated lead levels observed in some individuals may have been caused by their socio-economic status enabling them to own pewter-ware, purchase lead-based makeup or medicines, and consume food preserved in reduced wine preservative (Eldridge 2002, 158). Skilled occupations, for example coffin makers, miners, and metalworkers would have increased exposure.

Geochemical evidence for environmental pollution was found at Dartmoor (Cornwall), caused by tin mining during the late Romano-British period (Thorndycraft et al. 2003). Gale's (2003) analysis of wood-based industrial fuels, and their impact upon lowland Britain (which includes Dorset), found that woodlands were extensively used during the Romano-

British period for lead/tin and iron working, pottery manufacture, salterns, and limeburning, resulting in landscape clearance and greater land management (Gale 2003, 38-44).

The bioarchaeological evidence from Dorset and Roman Britain demonstrates that factors related to the development of neoplasms were present. Nevertheless, the available evidence for pollution and local environmental conditions are poorly understood, and within Dorset, there is a paucity of data with which to assess the human evidence.

4.5.3 Treatment: the osteological evidence

> "A wise man ought to realize that health is his most valuable possession and learn how to treat his illnesses by his own judgement" (Hippocratic Writings *A Regime for Health* 9).

As shown in section 2.9.3, considerable debate exists concerning the definition of health and disease. Research in the field of medical anthropology has shown that these are culturally defined, and significant differences between the sexes will exist (Miles 1992; Brown et al 1996, 183-185; Strathern and Stewart 1999; Good 2003). Treatment can be understood as a mechanism by which an individual attempts to stabilise or balance their health, and so intra-individual differences will exist. These arise from personal experience, the socio-cultural framework in which sickness, personal illness, and poor health are understood, and most importantly of all, how these are differentiated and communicated by families and communities (Miles 1992; Fábrega 1999; Moerman 2002; Good 2003). The concept of treatment is subjective, as it includes curing and healing, and is set within numerous systems of medicine (Strathern and Stewart 1999, 7-16; Good 2003, 27). How medicine, curing and healing are understood, are made all the more complex because of variations between individuals, communities and generations; in addition to temporal and spatial differences as, “people are pragmatic and will use anything that seems to work” (Strathern and Stewart 1999, 64).

The identification of care and treatment in past individuals can be reconstructed from many different sources for example, medical texts, surgical instruments, prosthetic limbs, and osseous examples of surgery. However, the analysis and theory of care and treatment can be highly variable, because they are approached from a variety of academic backgrounds, for example medical history, palaeopathology, and medical anthropology. Considerable variation exists in the type of questions asked of the same data set, i.e. can compassion be identified? (e.g. Dettwyler 1991). In human osteology, more theoretical approaches combining funerary and palaeopathological data have also been undertaken, for example upon the late Romano-British sample from Lankhills (Winchester), which examined health as an aspect of social identity (Gowland 2003).

In order to provide a focused assessment of the evidence for treatment and the types of treatment used in Iron Age and Roman Dorset, two areas of osseous change are focused upon. Treatment for trauma is discussed using evidence for secondary changes, such as the presence of osteoarthritis, overlap, infection, deformity, and lack of union (see Roberts 1991; Grauer and Roberts 1996). Where specific osseous changes could be identified (tuberculosis, amputation, neoplasms, and congenital anomalies), how these diseases were treated and/or how their sufferers may have been perceived will be explored.

4.5.3.1 Fractures

Radiographic analysis of fractures could only be undertaken in a small sub-sample of individuals, therefore wherever possible, the guidance for the macroscopic recording of fractures published by Roberts (2000a, 347) was followed (see section 2.4.8.1). In order to assess treatment, the following data are excluded from the discussion, secondary changes produced by the fracture location and/or type, and elements (e.g. clavicle) where accurate reduction is not possible.

In Iron Age Europe, securely identified medical instruments have been excavated, for example at München-Obermenzing (Germany), probes, retractors, and a trephining saw were recovered from a grave (James 2002, 63). In contrast, no such graves have been identified in Britain, and treatment has not been discussed from an osteological perspective. Carr (2002) has assessed possible methods of treatment, and the evidence for healing during the Iron Age such as shamanism, divination, and human sacrifice (Carr 2002). However, the amount of evidence cited from Britain is small and open to numerous other interpretations, for example the hundred (or more) skeletons recovered from a ditch at Spettisbury Rings may not, as Carr (2002) suggests, represent sacrificed individuals (Carr 2002, 64). It is considered that the osteological data collected for the present study provides the most secure evidence for treatment during this period.

Sex differences in treatment could not be statistically investigated, as the sample sizes were too small; however, as no individuals had evidence for infection associated with a fracture, it suggests that disparities in treatment did not exist. The lack of complications after sharp-force weapon injuries, suggests that the communities were skilled in wound treatment.

The small sample of individuals with healed fractures (Tables 68-71, 119-122), results from the type of fractures observed, and their location for example, ulna fractures are rarely displaced (Apley and Solomon 2000, 284). In order to increase the sample size, and because medical anthropology has shown that treatment can be subject to considerable temporal variation, as well as sex differences (Miles 1992; Strathern and Stewart 1999; Moerman 2002), metacarpal fractures are included in the discussion. In contrast, Grauer and Roberts (1996) suggest that people are less likely to seek treatment for hand/foot fractures (Grauer and Roberts 1996, 533), and it is accepted that this may have been true during the Iron Age and Romano-British period.

In the Iron Age, humeral fractures were observed in a young adult male [285 3 Gussage All Saints] and an older adult male [P30 Maiden Castle] (Table 69, Figure 16). The right humerus of the young adult male [285 3 Gussage All Saints] does not display any rotation or angulation, which may suggest that the fracture had been splinted and that the arm acted as a natural weight, enabling the fragments to be drawn back into alignment (Apley and Solomon 2000, 276). Further evidence to suggest that the fracture had been splinted is based upon the small degree of shortening. Roberts (1991a) suggests that a small degree of shortening indicates that the element had been well reduced and splinted in the correct position (Roberts 1991a, 232).

The humeral fracture observed in the older adult male [P30 Maiden Castle] displays 100% apposition, and slight medial angulation of the distal segment, although it is within modern clinical standards of acceptable reduction (30°) (Klenerman 1969). The evidence may indicate that the fracture had been splinted and/or reduced, as clinical studies have shown that distraction of the fracture site occurs due to the arm not being supported by a sling (Chiu et al. 1997, 949). The fractured element shows a very small amount of shortening and good alignment, which may indicate treatment (see above) (Roberts 1991a, 232).

The healed tibial-fibula fracture in an Iron Age middle adult female [P36 Maiden Castle] provides evidence for treatment (Table 120, Figure 73). The small amount of shortening in the tibia and good alignment, with only slight lateral angulation of the fibula, suggests that the elements were reduced and the leg splinted (Roberts 1991a, 232-233).

The type of splints employed during the Iron Age is unknown, and as Roberts (1991a) notes, because the majority of fractures observed are healed, there is no reason for splints to be recovered from burial contexts (Roberts 1991a, 227). Ethnographic studies of Australian Aborigines show that a wide variety of materials can be used. Many communities used bark tied with vegetable string or sinew, sticks tied with animal skins, and one community used grass, leaves, and clay to make a plaster cast (Webb 1995, 198, 200). Huber and Anderson's (1996) medical anthropology study of bonesetters in a Mexican community, found that in order to make a diagnosis, the fracture site is inspected and palpated, and the bonesetter often feels the uninjured side to compare (Huber and Anderson 1996, 29). Subsequent to reduction, the treatment is often similar to that observed amongst Aborigines, in that resin is put onto a thick cloth, which is wrapped around the limb, and then the limb is splinted with reeds (Huber and Anderson 1996, 32). Oyebola's (1980) study of Yoruba bonesetters in Nigeria, found that the fracture is deemed set when the site of union is felt to be larger than the adjacent portions of the bone, and notes that no anaesthetics or analgesics are used throughout the entire procedure (Oyebola 1980, 314).

In the Iron Age male sample, several instances of healed sharp-force weapon trauma to the cranium were observed (Table 79, Figure 64), and none displayed any secondary changes, such as infection. The lack of secondary changes to such severe injuries, suggests that treatment, such as poultices, was given (Bartram 1998, 189-190). Honey was available during the Iron Age, and could have been employed for its antiseptic properties (Molan 1998), or pollen may have been used to prevent debilitation (Linskens and Jorde 1997, 81). It is naïve to assume that pharmaceutical knowledge was poor during this period, especially as recent research on primates has shown that they practice self-medication (Huffman 1997). Excavations at Hengistbury Head provided evidence for chamomile (Darvill 1995, 164; Gale 2003, 131), which can be used as a relaxant and to cure inflammation (Bartram 1998, 106), and opium poppy seeds could have been used as an analgesic (Mann 2000, 190) (see section 4.5.2.1).

Primary evidence for surgical treatment in Iron Age Britain is trepanation. None of the cases identified by Roberts and McKinley's (2003) are from Dorset. During the course of the present study, an example of a drilled trepanation was identified on a disarticulated fragment [5458] recovered from a soil layer (Sharples 1991c, M6:F6), but it was not identified in the original report. This fragment is triangular in shape, and is most probably derived from the anterior aspect of a parietal bone (Figure 51). The fragment appears to have been produced by blunt force trauma, and on the shortest side, there is an even semi-circular notch (13 mm). The margins of the notch are very sharp and in cross-section show bevelling, and at right angles to the notch, a small linear fracture is present. These changes suggest that it had been drilled, which is the most frequent type of trepanation during the Iron Age (Roberts and McKinley 2003, 63). The presence of bevelling and a linear fracture, indicate that it had been an ante-mortem event (or one undertaken when the bone was still collagen fresh), perhaps in an attempt to treat blunt-force cranial trauma, or as part of secondary burial ritual (Roberts and McKinley 2003, 65-66).

In the Roman period, our understanding of treatment is more reliable due to the survival of medical texts, instruments, and inscriptions (Porter 1997, 69-80; Jackson 2000). Nevertheless, the practice of medicine in Britain during the Roman period has received little attention, although particular focus has been paid to the military aspect, because this has provided the largest body of data (Baker 2001, 2002b). It has been hypothesised that civilians had access to military medical facilities in Britain (Allason-Jones 1999, 143-144), however in Dorset, there was no permanent military base and therefore, this aspect lies outside the discussion. Medical anthropology has shown that in any society a plethora of medical systems can co-exist at any one time (Strathern and Stewart 1999, 16), a trend noted by Celsus "they also say that the methods of practice differ according to the nature of the localities, and that one method is required in Rome … another in Gaul" (Celsus *De Medicina* I.30). In the Roman Empire, this situation was further complicated by variations in philosophical and medical training (Jackson 2000, 48-49). There is no reason to assume that traditional practices did not continue, especially as Fábrega (1999) notes that in more complex societies, primary, specialist healers and more formal medical practitioners can be present, albeit competing (Fábrega 1999, 194, 197). Due to the highly complex nature of medical treatment in Britain at this time, information from the primary medical texts will be used, but it is acknowledged that the application may be speculative.

Romano-British period did not display any sex differences in the treatment of observable fractures. The sample was too small for the data to be statistically tested for significance, which was compounded by sex differences in elements affected.

In the Romano-British male sample (Table 71), three individuals had tibial fractures present, but only in one male was the fibula not affected. A young adult male [1137 Alington Avenue] sustained a well-healed transverse fracture to the distal third segment (Table 71, Figure 80). The lack of shortening may be a consequence of the fracture type, which makes it relatively stable (Apley and Solomon 2000, 332-333). However, this evidence does not discount the possibility of reduction, as the fibula can distract the element and cause non-union (Apley and Solomon 2000, 334). As the element could not be radiographed, a differential diagnosis of non-adult infection is suggested.

Figure 80: A healed tibia fracture in a young adult male [1137 Alington Avenue].

**80a Anterior view of tibiae.
The diaphysis of the left tibia is
distal third. The location
of the fracture is marked.**

**80b Anterior view of the tibiae distal
thirds. The location of the fracture is at the
marked.**

The two males with tibial-fibula fractures at different segments (contre-coup) have the most poorly reduced fractures in the whole sample (Table 71, Figure 74). A middle adult male [6 Poundbury Camp] has more shortening than the Iron Age sample (Tables 69, 120). Neither element shows rotation, and both elements display poor apposition, but are well aligned in comparison to the other male [847 Poundbury Camp] (Table 71, Figure 74). This adult male [847 Poundbury Camp] has fractured the left elements (Table 71, Figure 74). The poor apposition observed in both individuals may have affected their gait. The evidence from the affected elements does not discount treatment having taken place, but may indicate that it was inadequate, and/or that the male had begun weight-bearing too soon (Oyebola 1980, 318).

Three males [210 and 835 Alington Avenue, and 1.114b Fordington Old Vicarage] have healed isolated fibula fractures (Table 71, Figure 81). The state of healing observed in all three suggests that treatment may have occurred, with the tibia aiding treatment by acting as a natural splint.

Figure 81: Example of an isolated ante-mortem fibula fracture observed in Romano-British males [1.114b Fordington Old Vicarage].

81a Anterior view of the fibulae, showing the healed oblique fracture to the proximal third of the left element.

81b Medial view of the left fibula, showing the healed oblique fracture to the proximal third.

Metacarpal fractures were observed in five individuals (3 males and 2 females) and a range of healing was noted, all but one [210 Alington Avenue] was well aligned (Table 71, 122, Figure 82). Shortening was observed in two individuals, one middle adult male [1032 Alington Avenue] and a younger adult male [1137 Alington Avenue], but could not be compared to the opposite side. Overlap was observed in two individuals [Frampton; 1032 Alington Avenue] (Table 71) and suggests that reduction had either been unsuccessful, or perhaps the hand had been used too soon as healing takes 2 to 3 weeks (Apley and Solomon 2000, 295). Reduction may not been attempted, as the healer (or affected male) may not have deemed the amount of displacement worthy of reduction.

Figure 82: Examples of ante-mortem metacarpal fractures from the Romano-British period.

82a Superior view of the right and left 5th metacarpals, with the right showing evidence of a well healed fracture [1032 Alington Avenue].

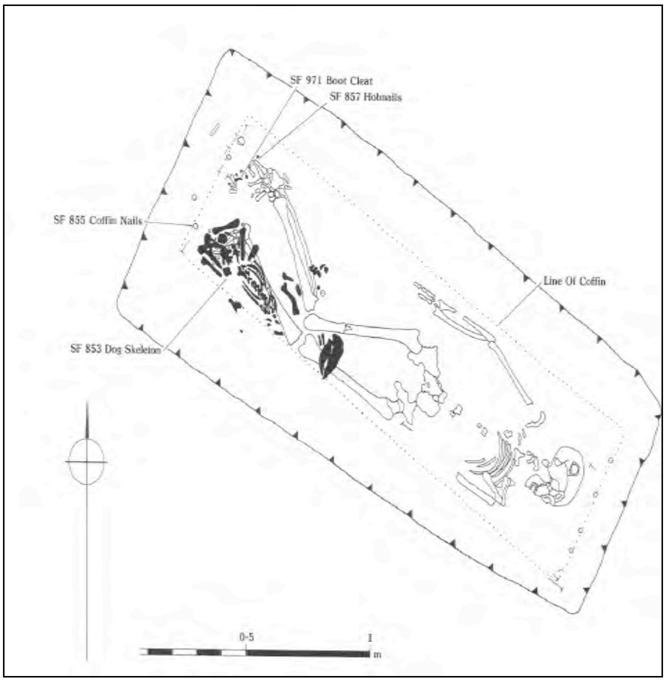
82b Medial view of a healed oblique fracture to the left 5th metacarpal [908 Tolpuddle bypass].

Serious traumatic episodes that would have required treatment were observed in three individuals. Tibial plateau fractures observed in one male [1400 Maiden Castle Road] and two females [117 Maiden Castle Road and 800 Poundbury Camp] (Figure 76), and a surgical neck fracture was observed in a middle adult male [516 Poundbury Camp] (Figure 75). Treatment may have included stabilising of the joint, splinting of the knee, and careful management. For example, in tibial plateau fractures, if movement is not initiated then the normal range of bending can be lost, which may lead to disability or impairment (Apley and Solomon 2000, 328). The treatment of fractures during the Roman period is detailed in many of the treatises, and relied upon levers, metal examples of which have been found in medical kits (Jackson 2000, 117). Various treatments were available for fractures, for example wrapping the fracture site with boiled lard (Shelton 1998, 87). The Hippocratic writings on fractures are incredibly detailed, especially concerning reduction. For example, if both leg bones were broken, the elements were reduced using wooden mechanisms or pulled apart by two individuals. Initially, no splints were recommended, instead the bandaged limb was rested upon a pillow with a median longitudinal depression. Every third day, when bandage was dressed, the fracture site was extended. On the seventh, ninth or eleventh day, a splint was applied to the limb, and it was expected that by the fortieth day the fracture would have healed (Hippocratic Writings *Fractures* I-18).

The evidence for treatment (based upon fractures), suggests that for some individuals the level of treatment declined during the Romano-British period, particularly for tibial-fibula fractures. Unfortunately, because the sample size is small, whether this is a ‘real’ change cannot be fully grasped, particularly as Dorset (and Britain) have evidence for complex surgical procedures (Farwell and Molleson 1993, 153). It is considered that the examples of poorly treated fractures may indicate that individuals had used the limb before adequate healing had occurred. They could represent treatment given when practitioners were not available (e.g. during travel) or by people with limited experience. The role of status does not appear to be a factor in these examples, as the middle adult male [6 Poundbury Camp] was buried in a mausoleum, and the older adult male [847 Poundbury Camp] was buried in a wooden coffin (Farwell and Molleson 1993, 252, 282). In conclusion, there is no overwhelming evidence to suggest the good treatment seen in the Iron Age did not continue during the Romano-British period.

Evidence for surgery in Roman Britain is dominated by trepanation (Roberts and Cox 2003, 161, however Dorset stands unique in Britain for having evidence for amputation [852 Alington Avenue] and embryotomy [1414 Poundbury Camp]. An amputation to the middle third of a right humerus was identified in a young male adult at the time of excavation [852 Alington Avenue] (Figures 25 and 83). The male was buried prone with the left arm by their side, but the right amputated humerus was flexed away from the body, and was the only right arm element found during excavation (Davies et al. 2002, 211). The remaining skeleton was carefully examined for signs of trauma and infection, however the preservation of the individual was not very good (stages 2 and 3) which seriously limited observation. The amputated surface has suffered abrasion, but is linear and does not conform to the criteria for dry-fracturing (Knüsel 2005, 51), and on the lateral aspect there is a possible ‘hinge’ consisting of a triangular step. Due to the abrasion, it was not possible to identify or suggest the instrument used to make the amputation, as Mays (1996) suggests that saw marks would indicate surgery rather than an injury sustained in combat (Mays 1996, 107). Aufderheide and Rodríquez-Martín (1998) propose that accidental amputations of major limbs rarely occurred in antiquity (Aufderheide and Rodríquez-Martín 1998, 30). During the Roman Period, punitive measures such as mutilation were employed (Adkins and Adkins 1998, 353), although in other examples of punitive amputation, the hand was removed at the forearm (Mays 1996, 108), rather than at the middle third of the humerus.

Figure 83: Grave drawing of the Romano-British young adult male with evidence for an un-healed limb amputation.



(after Davies et al. 2002, 144 Figure 66).

The reasons for arm amputations are numerous, ranging from soft tissue infection/gangrene, congenital abnormalities, malignant disease, or mutilation due to trauma (Ham and Cotton 1991). In developing countries, trauma is the primary reason for amputation, the mean age of those affected is 31 years, the majority are performed on males, and the most frequently amputated limb is the arm (Ham and Cotton 1991, 12-15). Surgical amputation was undertaken during the Roman period, doctors recognised that it carried considerable mortality risk, and was usually only undertaken as a last resort. The medical writer Celsus described how to ligature the bleeding vessels, to smooth the bone, provide adequate skin cover, and to pack the wound with lint soaked in vinegar (Ham and Cotton 1991, 2). Weaver et al. (2000) describe a surgical amputation at the middle third of an adult left femur, which they propose shows post-operative osteomyelitis, and note that by the 2nd century A.D. amputation was employed for tumours, trauma, and deformities (Weaver et al. 2000, 356). Jackson (2000) notes that prosthetics have been found from the 4th century B.C. in Italy, and that a veteran of the Punic War (218 to 201 B.C.) had an iron hand made to replace the one lost in battle.

4.5.3.2 Treatment and perception during the Romano-British period

This section focuses upon individuals with osseous evidence for specific diseases, and examines how these may have been treated during the Romano-British period. It aims to address how individuals with dwarfism were perceived during this period. Research of these areas with specific reference to Roman Britain is poor, and so the discussion relies upon evidence from within the Roman Empire, which is applied with caution. This section does not address disability or impairment, as insufficient skeletal evidence was found in the present study.

In the Roman period, the transmission of tuberculosis (phthisis) was thought to take place by contagious seeds, which were not visible to the naked eye, and were breathed out as fetid air by the infected individual. However, they were only regarded as initiating a disease, rather than being the causative agent (Nutton 1983, 5, 15). Roberts and Buikstra (2003) note that by the 5th century B.C., clinical descriptions of tuberculosis sufferers had been defined, and the Roman doctor Galen described phthisis as ulceration of chest, lung or throat, which causes coughing, fevers, and wasting of the body (Roberts and Buikstra 2003, 171, 215).

In the Roman period, a range of treatment has been recorded, such as drinking the milk of asses, mares, goats, cows (all animals present in Roman Dorset) and humans, and the limited consumption of fish, meat and fats. Exercise was also recommended, as was avoiding temperature changes (Meinecke 1927, 383; Pease 1940, 388). As in the Victorian period, cures in dry climates were recommended, and a range of drinks, inhalations, pills, and fomentations were also suggested (Meinecke 1927, 391). Treatments that were more physical, included blood-letting to reduce the spitting of blood, and the employment of hot irons to prevent suppuration (Meinecke 1927, 391). Pliny's work records a range of cures, from sea voyages, to smoked deer lung mixed with wine, or the touch of the dead which could cure a patient of the same sex, but only if the deceased had died prematurely (Meinecke 1927, 396; Hope 2000b, 121). Bathing was a popular method of medical treatment during the Roman period, and could be undertaken at home or in the public baths (both found in *Durnovaria*). It was considered that a sufferer could be cured by 'normal' or spa water (e.g. Bath) (Jackson 1999, 109). Bathing was particularly recommended for individuals with diseases of the joints, 'wasting', fevers, respiratory difficulties, and chest pains, or those who were convalescing, and in Britain there is no evidence to show these individuals were segregated from 'well' people (Jackson 1999, 108-109). Hydrotherapy took many forms, such as swimming, inhalation, injection, or drinking (Jackson 1999, 109). There is evidence to suggest that at many sanctuaries in the Empire, the water was bottled and sold so it could be used elsewhere, and that some individuals travelled great distances to receive treatment, for example one individual came from Germany to Bath to spend time at the spa (Aldhouse Green 2000, 15-17).

Whether the two females [1128 and 223 Poundbury Camp] sought medical treatment for their tubercular infection is unknown. The medical treatment of women in the Roman Empire has been addressed by Flemming (2000), who emphasises that there is no evidence to suggest that women were viewed as sickly, or that being ill was a female attribute (Flemming 2000, 75). Despite the presence of many female doctors and practitioners throughout the Empire, descriptions of female diseases (i.e. gynaecology) and treatments were written for their male counterparts, and male society (Flemming 2000, 181-182). The lack of primary and secondary evidence specific to Britain, which would suggest a decline in female status during the Roman Period, and the lack of osteological evidence to suggest a decrease in health, indicates that the only bars to females receiving treatment may have been financial or social (Miles 1992, 12-20; Long et al. 1999; Sims and Butter 2000). This evidence is supported by the lack of funerary evidence to suggest that tuberculosis sufferers were stigmatised in Roman Dorset, as they are not differentiated in terms of burial treatment (Hamlin forthcoming).

The treatment of neoplasms, which arise in the bone during the Roman period is unclear, "it is better not to treat those who have internal cancers since, if treated, they die quickly; but if not treated they last a long time" (Hippocratic Writings *Aphorisms* 38). The majority of available evidence for the treatment of neoplasms is dominated by tumour growths and surgery, such as mastectomy (Jackson 2000, 30, 91). Other known treatments from the Roman period were botanical and herbal, which were made into topical applications (Papac 2001, 391). Consequentially, the range of treatment that may have been given to the male [955 Poundbury Camp] with metastatic neoplastic changes, and the female [3 Poundbury Camp] with multiple myeloma is unknown. However, it is certain that the physical consequences of these neoplasms would have meant that these individuals were most probably reliant upon others for care, especially if only palliative treatment was available.

The only individual identified with a major congenital anomaly was a young adult female [766 Alington Avenue] who displayed dyschondrosteosis and mild bi-lateral Madelung deformity (Online Mendelian Inheritance in Man website). The burial was dated to the 3rd to 4th centuries A.D. (Davies et al. 2002, 209). Another example of dyschondrosteosis with Madelung deformity of the right arm was identified in a young adult male from

Gloucester, and dates to the 2nd to 3rd centuries A.D. (Waldron 2000). The female from Dorset is smaller (132.9 cm) than the Gloucester male (156 cm) (Waldron 2000), which most probably reflects the role of sexual dimorphism in stature. Other forms of dwarfism have been identified at Gloucester namely, a young adult female with pituitary dwarfism and tuberculous meningitis (Roberts 1987).

Examination of the young adult female [766 Alington Avenue] suggests that they also suffered from mild Madelung deformity, although this may not have affected normal wrist function (Apley and Solomon 2000, 132). The individual does not display indicators of stress, or evidence for trauma. They were not differentiated by funerary treatment, but their grave did form part of a sub-group of burials that were aligned with a ditch (Davies et al. 2002, 129).

Barton (2002) states that "being, for a Roman, was being seen", and being visible was a test of a woman's honour (Barton 2002, 220). As the physical expression of dyschondrosteosis is visible at birth (Online Mendelian Inheritance in Man website) and the female received 'normal' funerary treatment, it suggests that individuals who were physically different were accepted by Romano-British society in Dorset. When Britain was incorporated into the Roman Empire, 'deformed' infants did not have to be killed at birth, and attitudes had become more sympathetic, with privileges made available to assist in their upbringing (Garland 1995, 17-18). The majority of evidence from the Roman period regarding 'deformed' infants pertains to those who do not fit the normal human form (Garland 1995, 18). The Hippocratic Writings assign infant deformity to in-utero problems, or a lack of space in the womb "if the space is confined, he will be smaller", and the reduced height of this female may have been understood in this way (Hippocratic Writings *The Seed* 9). This view was related to Aristotle's opinion that dwarves were deformed in the intrauterine period, and proportionate dwarves developed due to a lack of nourishment (Garland 1995, 157) (it is probable that many pituitary dwarves were confused with stunted individuals). Alternative explanations sought to understand congenital anomalies as inherited disorders, problems at the moment of fertilisation, or the result of environmental factors, such as cold and dry spring seasons producing defective children (Garland 1995, 146-150).

It is not known whether this female was a slave, as individuals who were physically different were often highly prized or sought after, and frequently enjoyed a better standard of living compared to other slaves. Plutarch records that in Rome there was a “monster market” as the demand for “freaks” was so high, due to their perceived talismanic qualities and entertainment value, however how widespread such markets were in the Empire is not known (Garland 1995, 46-47, 49, 104).

The evidence for such individuals were ‘seen’ in Roman Britain has not been addressed within the literature, and few attempts have been made to explore the extent to which they were regarded as ‘different’ by their community (e.g. Roberts 1987). The situation is made more complex by the limited osteological evidence for serious congenital anomalies (e.g. dwarfism, club-foot or limb amelia) in earlier periods, and the focus of the primary literature and research upon Italian Roman society. The lack of osseous indicators for maltreatment, and the normal burial rite given to the young adult female, implies that such individuals were accepted members of a community.

4.6 Chapter summary

4.6.1 Socio-cultural status and health-status

Females

- **Demography**: the results concur with historical and contemporary clinical data for greater female longevity. There is no evidence to support the practice of female infanticide.

- **Stature**: the influence of Romanization upon the female life course may have only compromised the biological advantage of a sub-sample of females, as the height of the shortest females decreases to less than 134 cm.

- **Indicators of stress**: female life-ways in both periods were differentially buffered, but this may not have disadvantaged biological females. In the Romano-British period, the number of elements displaying indicators of stress was lower than in the Iron Age, suggesting that female exposure to disease and cultural buffering changed with Romanization. The extent to which these changes represent socio-cultural transformations specific to Britain, or as a wider response to Roman colonisation is not clear.

Males

- **Demography**: the results concur with historical and contemporary clinical data for peak mortality during young adulthood, although the male-female differences in demography may not reflect living sex ratios. The results do conform to the proposed life tables for the Roman Empire.

- **Stature**: mean stature only increases by 0.4 cm in the Romano-British period, suggesting that environmental stressors and conditions were such that males could only adapt so far.

- **Indicators of stress**: the results suggest that environmental stressors may have worsened during the Romano-British period, although the cultural stressors present in Iron Age communities (e.g. warfare) were reduced. The influence of social change, such as a decline in social status may have acted as a cultural stressors for many. Male life-ways in both periods show evidence for differential buffering and non-adult engendering. As with the female sample, it is not known whether the osseous and dental changes were caused by British/local stressors or by non-adulthood episodes of stress in other provinces.

4.6.2 Violence and society: evidence for inter-personal trauma and sharp-force weapon injuries

- **Iron Age females**: the data provides evidence for active female participation in violent episodes. Osteological evidence for female directed violence indicates that some females were victims of frenzied attacks and/or over-kill. Their fracture pattern conforms to contemporary female victims of domestic violence.
- **Iron Age males**: the sample contains unique examples of sharp-force weapon injuries, and an embedded weapon. The data provides evidence for injuries and fractures being sustained in an assault context. Only the male sample has evidence for healed sharp-force weapon injuries. Fracture and sharp-force weapon recidivists show a history of violent episodes.

- **Romano-British Dorset**: the prevalence of fractures in both sexes declines, as only one male injury recidivist was identified. Females had a low mortality risk from violent episodes, although their fracture patterns show that cultural targeting changed, as nasal bone fractures increase. The male sample has the majority of evidence for episodes of violence, such as fractures to the hands and face. The region does not follow the national pattern for sharp-force weapon injuries and fracture produced by violent mechanisms, which may reflect the nature of Romanization in Dorset.

4.6.3 Diet: nutritional status and health

- **Iron Age**: the dental and osteological results correlate with the bioarchaeological data for an agrarian based economy. The consumption and access to sugary food may have been dictated by gender roles.
- **Romano-British period**: the dental results show that dietary change had occurred by the greater use of Roman/ized foodstuffs and food-ways. The results correlate to national data.

4.6.4 The relationship between the living environment, life-way and health

- **Agrarian life-ways**
  - **Iron Age**: the results are comparable to clinical and archaeological studies of rural and agricultural fracture patterns.
  - **Romano-British period**: the first examples of tibial plateau fractures are observed in both sexes. The results are similar to clinical and archaeological studies of rural and agricultural fracture patterns.

4.6.5 Community and settlement

- **Tuberculosis**
  - **Iron Age**: bioarchaeological and socio-cultural information supports the hypothesis that tuberculosis was spread by factors in the agrarian economy, by migration/travel, and local environmental conditions in dwellings.
  - **Romano-British period**: the transmission of tuberculosis between newcomers and natives (and vice versa) may have resulted from the settling of veterans in the local community, the establishment of an urban centre, and the introduction of new methods of transmission e.g. new architectural forms, and bathhouses. Infected people may have had continued exposure due to Roman medical treatments. Iron Age transmission factors most probably continued into this period.

- **Biology and environmental risk? Neoplastic changes**
  - **Malignant neoplasms**: the bioarchaeological evidence from Dorset and Roman Britain demonstrates that sources of pollution were present (e.g. lead), and these may have influenced the development of neoplasms.

- **Treatment: the osteological evidence**
  - **Iron Age trauma**: analysis of the fractured elements suggests that reduction and splinting were practiced. The well-healed sharp-force weapon injuries imply that treatments, such as poultices were given. Evidence for trepanation was identified on a disarticulated fragment of parietal bone.
  - **Romano-British trauma**: analysis of the fractured elements suggests that reduction and splinting were practiced. Two males have the most poorly reduced fractures in

the whole sample, indicating that the fracture had not been reduced or they had received poor treatment; alternatively, they had used the leg too soon. A young male had their right arm amputated at the middle third of the humerus, no other signs of trauma or disease were observed.

- **Treatment and perception during the Romano-British period**: the bioarchaeological and primary medical texts suggest that individuals suffering from malignant neoplasms and tuberculosis may have sought palliative treatments. The osteobiography of the young adult female with dyschondrosteosis and mild bi-lateral Madelung deformity shows that they were not regarded as ‘other’, or excluded by the community.

CHAPTER 5.0 – CONCLUSIONS

"Human life implies adventure, and there is no adventure without struggles and dangers"
(Dubos 1995, 9).

5.1 Introduction

The present study had three sets of aims and objectives and proposed to address these using, a medical ecology approach, theoretical frameworks, and socio-cultural evidence (sections 1.3 and 1.4). It sought to understand each period, but also any differences between the two, enabling an important transition in British archaeology to be addressed from a health perspective.

5.2 Aims of the research

5.2.1 Health at the population scale of analysis

The primary aim of the thesis was to examine health at the population level, an under-used scale of analysis in Britain (Roberts and Cox 2003, 22-23). A standardised recording system was employed allowing a constant and reliable measure of health to be recorded (Buikstra and Ubelaker 1994). As a result this study provides the most standardised recorded sample of human remains from Iron Age and Roman Britain. Finding reliable comparable samples, however, was incredibly difficult, despite the recent study by Roberts and Cox (2003). Their study investigated levels of health in the United Kingdom from prehistory to the present, but unlike the Western Hemisphere Project (Steckel and Rose 2002), they were unable to study all the material themselves using a standardised recording system, and were reliant upon the quality of each osteological report (Roberts and Cox 2003, 26). Due to the disparities in recording quality and publication, not all the material available could be incorporated, creating a bias in the distribution of diseases for particular periods and an under-estimation of overall prevalence rates (Roberts and Cox 2003, 26-30). Despite these irresolvable problems, their synthesis permitted the results from Dorset to be understood in relation to other locales and to national patterns, enabling the heterogeneous patterns of health in Roman Britain to be demonstrated.

By using a population scale of analysis, this study resolved several issues of bias that exist within Dorset. Firstly, Romano-British urban and rural cemeteries have been defined using material culture and funerary architecture. In Dorset there is a lack of (numerous) large cemeteries outside the periphery of Dorchester, creating a very small rural sample for comparison (Figure 3). The situation is further compounded by the classification of several cemeteries on the boundaries of *Durnovaria* as rural (e.g. Alington Avenue). In addition, many of the samples from rural Dorset consist of five or less individuals, which meant that inter-site differences could not be reliably addressed.

In conclusion, the use of a population scale of analysis resolved rural/urban differences in site classification and permitted the use of small or isolated samples, which increased the number of individuals available for analysis. It also enabled general patterns of health to be identified and statistically tested between the two periods.

5.2.2 Application of age, gender, feminist, and masculinity theories

The use of theory as an additional tool to interpret past health statuses has received limited attention in British human osteology, despite clinical and historical data showing that an individual's health status is inextricably connected to their age, gender, and social-status. The integration of social theory into a medical ecology approach established a framework that critically evaluated the socio-cultural evidence, acknowledged intra-community variation, and enhanced the interpretation of many aspects of Iron Age data, such as indicators of stress and evidence for trauma.

The use of age theory, primarily the life course approach, enabled this study to address the cumulative effect of factors such as, differential or preferential buffering, exposure to pathogens, and mortality risk. Gender theory allowed the range of occupations, roles and identities that may have been present in both periods to be explored, for example female engagement with violence in the Iron Age. Feminist theory enabled the information for past female lives to be critically assessed and allowed the interpretation to break down past stereotypes providing a more realistic understanding of women, especially for the Iron Age. Masculinity theory was especially useful in interpreting the evidence for male health in the Iron Age, as there is a lack of information on male life-ways. It also enabled differences in male health-statuses to be considered in a more nuanced way.

5.2.3 Medical ecology approach to health

The difference between a medical ecology approach (McElroy and Townsend 1992) and a biocultural approach (Bush and Zvelebil 1991) can be viewed as differences amongst the sub-disciplines of anthropology. The biocultural approach has been accepted within British osteological research since the late 1980's, however unlike the medical ecology approach, the theoretical aspects are poorly developed.

The use of a medical ecology approach enabled physical and medical anthropology studies to be included, as they had used the same framework, and this multi-faceted approach aided the use of social science theory in the discussion. The medical ecology approach facilitated the integration of bioarchaeological and socio-cultural data, which enhanced interpretation of the osteological data and enabled the study to contribute to Iron Age and Romano-British studies.

5.3 Objectives of the research

5.3.1 To obtain a new insight into past health-statuses

The recognition of the relationship between gender and biological sex is well established in clinical studies, but it has yet to be so in palaeopathology and human osteology. By appreciating this relationship during the Iron Age and Romano-British period this study was able to connect the results of the osseous data to existing knowledge of these periods and demonstrated how and where they united or differed, providing a more realistic appreciation of the past lived experience.

5.3.1.1 Iron Age

- The health-statuses of males and females indicate that differential buffering may have occurred during non-adulthood, but that equal access to nutrition, treatment, and resources existed.
- Young adults, particularly males, had the highest rates of trauma and many conformed to an injury recidivist profile. The majority of trauma observed was produced by violent mechanisms and there is evidence of female-directed violence. Both sexes include individuals who may have formed a combatant sub-group within society.
- The evidence for specific infectious disease was limited to one individual and there was no evidence for specific metabolic diseases.

- The osteological evidence for diet correlated with stable isotope and lipid analysis of diet and sources of food. Statistically significant differences in dental health suggested that equity between the sexes existed, but variation did exist for sugary foodstuffs and occupations that employed teeth as a processing tool.
- The life-ways of Iron Age individuals support the archaeological evidence for an agrarian economy.

5.3.1.2 Romano-British period

- The most significant change observed was the decrease in trauma produced by violent mechanisms. Female-directed trauma continued, but there was a change in body targeting. In both sexes the majority of trauma is similar to rural agrarian communities. Unlike the rest of Britain, Dorset does not have evidence for sharp-force weapon trauma.
- The prevalence of specific infectious disease increases, which can be explained by increased population movement and expansion of the agrarian economy.
- Statistically significant changes were observed for dental health, which correspond to bioarchaeological and stable isotope evidence for changing food-ways.
- Indicators of stress demonstrate that the differential treatment of males and females during non-adulthood altered, with some individuals providing evidence for preferential male buffering.
- There is no osteological evidence to support the hypothesis for a decline in female status within Dorset. Critical evaluation of the archaeological evidence for females demonstrates that their low numbers, for the most part, are caused by problems with

osteological methodologies, and the universal trend for more males to be present in archaeologically derived samples.

- Life-ways in Roman Dorset do not considerably change for the majority of the population. Many changes in health-statuses are related to greater population variation, and widening access to nutritional and socio-cultural resources.
- Changes in living conditions, occupation, and access to resources are indicated by the increase in tuberculosis, the poor treatment of some fractures, evidence for surgical treatment, and changes in dental health.
- An increase in population and changes to socio-cultural frameworks are suggested by demographic changes, the identification of metastatic neoplasms, indicators of stress, and stature.

5.3.2 To produce a regional study of changing health

Dorset is the only county in England where inhumation was the dominant burial practice from the middle to late Iron Age and the Romano-British period. The continuation in burial practice enabled a large sample from each period to be identified and recorded, allowing the data to be statistically tested and for meaningful interpretations to be made. Despite including samples from throughout the county a certain degree of bias remains; samples from the north and west were poorly represented, and the majority of samples (particularly from the Roman period) are located in or close to Dorchester. Unfortunately, this bias cannot be resolved until the targeted excavation of cemeteries and/or settlements in these locales is undertaken. The selection of samples was also hindered by the poor or unreliable dating of many contexts, which resulted in them being excluded from the study (e.g. those dated from the 4th to 6th centuries A.D.). Many samples were also excluded because some site archives did not have accurate inventories; many excavators had not deposited the human remains with museums; and un-marked elements had become commingled.

Despite these limitations, the samples used in the present study have enabled the first regional perspective of health in Britain to be undertaken , which has demonstrated that considerable regional variation may exist in one archaeological period and most importantly of all, within the region itself. This was most evident in the data from Maiden Castle and Poundbury Camp, demonstrating that views of past lives based solely upon the results of these cemeteries creates an homogeneous and unrealistic perspective of these periods and data-set.

5.3.3 To provide new data on past health in Iron Age and Roman Britain

The recent publication of Roberts and Cox (2003) synthesised the available British data providing an overview of the periods, but was reliant upon available resources. The present study provides the first population analysis based upon the work of one researcher, with the standardised recording allowing datasets to be pooled, and for the comparison of data from different periods to be reliable.

The study is the first to examine these periods using a population scale of analysis and to enhance the interpretation using osteological data. Current discussions have not integrated human remains into the interpretation of these periods consequently providing a very narrow and limited view of these communities (see section 1.5). This situation has perpetuated stereotypes (e.g. Watts 2005), continued the over-reliance upon primary evidence, and/or material culture. In contrast the results of the present study will enable both periods to be understood in relation to their environment and socio-cultural frameworks. It also provides evidence to challenge the ‘known’ repercussions of Romanization, such as the proposed decline in female status, and supplies new information on the complexities of gender and age statuses throughout the life course.

Above all, the present study shows that the academic division of the Iron Age and Romano-British creates a false understanding of both periods, because it shows that in many respects life-ways and identities did not significantly change for the majority of the population.

5.4 Future research directions

The present study has shown that cultural transformations associated with Romanization can be traced using human remains. Therefore, it is important for these to be explored using British and European samples and to determine whether results such as an increase in specific infections, is a pattern specific to Dorset and/or England. Intra-regional variation within the Roman Empire should be a greater area of focus and investigations should be undertaken using all available evidence. The study has shown that human remains have been a neglected source of information in both periods; greater efforts should be made to disseminate osteological studies to a wider audience and to emphasize their relevance to archaeological interpretation.

The findings of this study suggest that future research should be directed towards understanding populations using a medical ecology approach, supplemented by stable isotope testing. For example, important social factors such as migration cannot be understood without undertaking stable isotope research at a regional scale to determine the nature of the population pre- and post-conquest. Scientific analysis of diet would also allow osteological evidence for metabolic and dental diseases to be understood in more nuanced ways, providing a suite of data to investigate the funerary expressions of age, identity, and gender.

Future research into Iron Age and Romano-British communities should be focused on combining bioarchaeological, funerary and socio-cultural studies. The current false separation of these sources of evidence limits interpretation because it fails to recognise that they were inter-connected by individual and community identities. Interpretation of human remains should not be undertaken in isolation, as it compounds this situation and reinforces the view that these are an 'add-on' to funerary and social studies.

The overwhelming finding of the study revealed that we possess a very limited knowledge of how identities, age and gender were expressed in both communities. In order to improve this situation, more nuanced funerary and material cultural studies need to be undertaken, in conjunction with osteological analysis, and/or re-appraisal of existing samples.

5.5 Final conclusions

"Our bodies, which grow so slowly, perish in the twinkling of an eye; so too the mind and its pursuits can more easily be crushed than brought to life again" (Tacitus, *Agricola*, 3).

The present study provided an opportunity to investigate these important archaeological periods using the people who created and experienced them. Analysis of their life-ways gives us a unique insight into these periods as their health was directly affected by the community in which they lived and determined what they could achieve. It is hoped that this study has enabled the lives of Iron Age and Romano-British communities to be better understood and their contribution to the Dorset landscape and culture to be valued.

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http://www.who.int/docstore/peh/archives/women/9411nut.pdf 27/09/2004

World Health Organization: Definition of Health
http://www.who.int/about/definition/en/ 26/09/2005

Appendix 1: Gazetteer of Sites included in the Sample

1.0 Gazetteer information

The information in the gazetteer covers three main areas of information for each sample of human remains, information on the site including location, excavation, date, and details of the inhumations and,

Details of problems encountered during analysis of the human remains, for example missing elements or an incomplete archive for the human remains.

Unfortunately, there is considerable variation in the information available for each site, and some sites are only partially published. All site archives and samples of human remains, unless stated otherwise, are held by Dorset County Museum, Dorchester. Tables 136 and 137 detail the number of individuals from each site included in the study.

Table 136 Iron Age sites used in the study and the number of individuals recorded from each.

Site	Male	Female	N
Alington Avenue and Trumpet Major II	4	4	8
Broadmayne	1	0	1
Flagstones	1	3	4
Gussage All Saints	4	4	8
Kimmeridge	0	1	1
Maiden Castle	32	26	58
Newfoundland Wood	1	0	1
Poundbury Camp	8	5	13
Tarrant Hinton	1	1	2
Tolpuddle Ball	3	2	5
Western Link	4	3	7
Whitcombe	5	2	7
Total	64	51	115

Table 137 Romano-British sites used in the study and the number of individuals recorded from each.

Site	Male	Female	N
Alington Avenue	24	15	39
Crown Building	1	0	1
Greyhound Yard	9	2	11
Gussage All Saints	1	0	1
Hod Hill	1	0	1
Littlewood Farm	1	0	1
Maiden Castle Road	5	6	11
Old Vicarage, Fordington	5	2	7
Poundbury Camp	40	23	63
Poundbury Pipeline	0	3	3
Southfield House	0	1	1
Tolpuddle Ball	3	4	7
Western Link (Dorchester bypass)	6	3	9
Total	96	59	155

1.1 Alington Avenue and Trumpet Major II: Iron Age and Romano-British period

These two sites are situated opposite each other, and are located on the outskirts of Roman Dorchester. Trumpet Major II was excavated before development of the site, and only used footing trenches, except where graves were encountered (Davies et al. 2002, 5-6).

The Iron Age inhumations were recovered from graves oriented west east, with pins and brooches on the lower legs, suggesting that some individuals had been shrouded. Some of the inhumations were situated close to a D-shaped enclosure at the northern part of the site, or to a round barrow to the south. The Romano-British extended inhumations were found aligned in an arc along the D-shaped enclosure, two individuals had been buried in gypsum, and one individual had been decapitated (with the skull absent), buried with a dog at the side of the coffin. One decapitated prone burial had been covered with flints; another burial was also accompanied by a decapitated dog. The cemetery also contained the burials of a dwarf, and a young adult male with an amputated arm (Davies et al 1986; Davies et al. 2002).

No osteological recording forms or photographs of pathology were deposited in the site archive. Therefore, the sample was re-analysed, which highlighted several key problems listed below.

- Missing individuals from Trumpet Major = 501, 502, and 503,
- Missing individuals from Alington Avenue = 268, 277, 278, 280, 286, 577, 617, 861, 863, 893, 934, 1037, 1066, 1111, 1568, and 1569.
- Some individuals had been labelled incorrectly with wrong burial number (780) or, had multiple intrusive elements labelled with the same number (1088 and 1138),
- Three individuals had elements missing which had been present at the time of excavation (when compared to the grave context sheet) = 789 (neoplasm left parietal), 1088 (tuberculosis of the spine), and 1089 (periosteal lesions to lower limbs),
- Eldridge (2002) analysed lead levels by sampling the ribs of 49 individuals, but no records could be found to state how many ribs had been taken, and from which individuals (not all are provided in the report). Therefore, the total number of ribs recorded for this sample is biased, and
- Many individuals were found which were not included in the published skeletal report, but did have grave context sheets = 780, 265, 302, 780, 1016, 1145, 4429, site G context 126, site sub 6 context 126 human bone, site sub E 064, and trial trenches 064. Where appropriate these individuals were included in the sample.

1.2 Broadmayne: Iron Age

The burial was found during construction of a domestic structure in the village of Broadmayne, and the individual was inhumed in a flexed position (Woodward 1982). The individual was re-recorded for this study.

1.3 Crown Building: Romano-British period

This site is located a few hundred metres from the Roman defences of Dorchester, and roughly six hundred metres from the cemetery at Poundbury Camp. During the construction of the new Crown Buildings in the 1970s, fifty graves were discovered, however only one could be recovered. This grave consisted of a lead coffin, perhaps originally placed within a wooden outer casing, and contained a gypsum burial. Due to the presence of gypsum within the coffin, a ‘head’ of hair and a separate plaited length of hair had been preserved (Sparey Green et al. 1981, 67, 81-84). The remains were originally analysed by Harman (1981), who observed fractures to five ribs, a fracture to the distal third of the left clavicle, and a protuberance on the right tibia (Harman 1981, 79). When the remains were re-examined at the British Museum of Natural History, the cranium, the fractured ribs and both clavicles were not present, and could not be located. Consequentially, the data from the missing elements was not included in the study.

1.4 Flagstones: Iron Age (Site 3 Dorchester bypass)

This site is located on the chalk ridge east of Dorchester. A total area of $120m^2$ was investigated from 1986 to 1988 by trial trenches and large excavations. The excavations uncovered a 1st Century B.C. field system, settlement, and enclosure. Burials were found in storage pits and cut graves, and formed part of the cemetery originally discovered by Thomas Hardy during the building of his house ‘Max Gate’ in the 1880’s. The modern excavations recovered the remains of eight individuals who were placed in a crouched position, and were not accompanied by grave goods (Smith 1997, 42-44, 48). The inventory and femoral measurements were taken from Dr J. Rogers papers (1997) held in the archive.

1.5 Fordington Old Vicarage: Romano-British period

The site is located at top of Fordington High Street, with two trenches located at the Old Vicarage, and two in an adjacent demolished cottage. During the Romano-British period, the site was located 130 metres from the east wall of the town (*Durnovaria*). The excavation un-covered 21 inhumations and three cremations, all which had been cut into the chalk bedrock, and three inhumations also contained disarticulated human remains (5a, 5b, 9a, and 12). One burial (13) is suggested to be a re-inhumation, as it only consists of a cranium and long bones, with a bronze bracelet on the right ulna. A further six graves were encountered, but not excavated.

No consistent grave orientation was observed and considerable variation in funerary treatment was also encountered. For example, one individual was decapitated, one grave (8) contained three layers of limestone fragments, and only three graves contained jewellery (12, 4, and 9). The majority of individuals had been inhumed in wooden coffins, with other individuals placed in a flexed position (O'Connor and Startin 1972, 152; Startin 1982, 43-66).

All adult inhumations that fulfilled the criteria for inclusion in the present study were re-recorded (section 2.1).

1.6 Greyhound Yard: Romano-British period

The site is set within the modern town of Dorchester, and the large excavation enabled a significant area of the Roman town *Durnovaria* to be explored (2175m²), revealing the presence of domestic and industrial activity and buildings. Human remains were excavated from 23 contexts, 13 were in cut graves, three from well-shaft/cess pit fills, one was a subsidence layer at the top of a pit, three were in wall robber trenches, one was in a general layer, and two were un-stratified. Seventeen pieces of human material were also identified during the faunal analysis. Ten were recovered from pits, two in cesspits, one in a well, and four in soil spreads and rubble deposits (Woodward et al. 1993). The inventory and femoral length measurement were taken from Dr J. Rogers' papers (1993) in the site archive.

1.7 Gussage All Saints: Iron Age and Romano-British period

This is an Iron Age settlement site that is surrounded by two enclosure ditches. The human remains from the Iron Age were recovered from pit burials within the ditch, where they had been placed in crouched positions, and one individual was buried prone. A Romano-British coffined burial was also recovered from the site (Wainwright 1979). One individual (130Lii) could not be located, and was not recorded in the original report. As the human remains had not been analysed since the original publication (Keepax 1979), all were re-recorded for the study.

1.8 Hod Hill: Romano-British period

The hillfort covers an area of 0.2 km^2, it is inter-visible to Hambledon Hill and is located on a chalk cliff on the eastern bank of the River Stour (Boyd Dawkins 1900, 53). In the northwest corner, a Roman fort dating to the Vespasian invasion had been built (Gale J. 2003, 160). The initial excavation of the hillfort was carried out in 1897 by Sir Talbot Baker who owned Hod Hill, under the supervision of Boyd Dawkins, although artifacts had been previously recovered from the site by Mr Durden for the British Museum (Boyd Dawkins 1900, 53,57). The 1897 excavation recovered human remains from a series of pits (Boyd Dawkins 1900, 58), including axial and appendicular elements (Boyd Dawkins 1900, 60-61). One complete inhumation of an adult, with some elements belonging to a non-adult was recovered from a pit (1900, 61), and an earlier excavation by Mr Durden had found a crouched inhumation (Boyd Dawkins 1900, 61). Excavations within the Roman fort uncovered a Roman trench in which a femur, vertebrae, and a calcaneus were recovered (Boyd Dawkins 1900, 64).

Later excavations by the Trustees of the British Museum in the 1950s discovered a series of Iron Age huts and settlement activity. A number of human remains were also found, one individual had been buried beneath a palisade, another was recovered from a ditch, and six individuals had been inhumed in a horseshoe–shaped scoop enclosure (Richmond 1968, 8-18, 26-28). Disarticulated remains were also found in a series of pits, and an external inhumation burial was found outside the rampart of the hillfort (Richmond 1968, 30-31).

The human remains are held by the British Museum of Natural History Museum, and examination of the archive found that most of the elements had been labelled, and could be assigned to the contexts described in the report and matched to the original osteological analysis (Bunting and Verity 1968, 123-124). Another individual dating to the Romano-British period was located at the Duckworth Laboratory, Cambridge. All the human remains available for study were re-analysed, however only two individuals (one Iron Age female [557] and one Romano-British male [EU1.3.216]) could be included in the study, because the other elements had become commingled.

1.9 Kimmeridge: Iron Age

Two individuals were recovered in 2000 as part of rescue excavations near the cliff-top at Kimmeridge. The excavation revealed a grave containing an adult female and neonate (O’Connell 2000), who are curated by Bournemouth University and were re-recorded for the present study.

1.10 Littlewood Farm, Frampton: Romano-British period

Frampton is located to the north west of Dorchester, and the individual from this site was located in a shallow grave dug into the upper fill of a Roman fort ditch. The fort was constructed to protect the building of a dam, which supplied water to Dorchester. The individual was inhumed after the fort was demolished, the pottery with the skeleton was Durotrigean of the 1st century A.D., however the excavator considers the burial to date to 70-120 A.D. (Putnam 1998). The remains were analysed for inclusion in the study.

1.11 Maiden Castle: Iron Age

The large-scale excavations of this hillfort were undertaken by Wheeler (1943), although an expedition by the Royal Archaeological Institute undertaken by Cunnington in 1865, found a human mandible and a complete skeleton (Wheeler 1943, 6-7). In Wheeler's (unpublished) personal notebooks, the damage inflicted by earlier excavations is noted, such as "skull missing as dug away by Cunnington Trench" (Wheeler 1937). Therefore, we must conclude that the incompleteness of some individuals is due to the nineteenth century excavations.

Wheelers' excavations in the 1930s uncovered an Iron Age cemetery that included males, females, and non-adults, a fact sadly neglected in subsequent analyses. These individuals were buried in graves within a formal cemetery, which overlay evidence for roundhouses and pits. The individuals were placed in crouched or extended positions, sometimes two individuals were placed in one grave, and there are several instances of prone individuals (e.g. P29) (Wheeler 1943). Sharples' (1991b) excavation and analysis of the hillfort, proposes that Wheeler had not excavated all of the late Iron Age cemetery, and that Wheeler's interpretation of a 'war cemetery' resulting from a battle during the Roman invasion was over-played (Sharples 1991b, 119, 125). Instead, Sharples proposes that the cemetery is attritional (Sharples 1991b, 125) (see also Bishop and Knüsel 2005).

The analysis of the human remains excavated by Sir Mortimer Wheeler was carried out at the Duckworth Laboratory (University of Cambridge). During recording, a number of problems arose, which directly affected the data that could be used in this present study, and are listed below.

- Very few elements were labelled,
- Elements broken post-mortem had been mended, and many had subsequently broken,
- Peri-mortem fractures had been glued back together using a medium that obscured the margins and portions of the affected elements,
- The dentition in many individuals had been glued into position, often incorrectly,
- Several skeletons were used in the Department of Biological Anthropology's teaching collection, and had been broken (significant damage was observed over three years),
- One femur had been sampled for unknown analysis,
- Some individuals had their elements dispersed among various locations,
- Multiple elements were identically numbered,
- In the majority of cases the extremities, scapulae, and spinal column had not been washed,
- The inventory published in the original report did not tally with that held by the Duckworth, and
- Numerous elements could not be assigned to individuals or contexts. This resulted in many pathological elements not being included in the study.

Two individuals [P7 and P7A] from the Wheeler excavation are curated at the Dorset County Museum and are on public display. Access to the skeletons was kindly given by the curator, however the analysis was constrained by the inability to wash the elements that had become incrusted with dust over time.

Individuals were only included in this present study if their context could be established using the Wheeler notebooks held at the Dorset County Museum.

1.12 Maiden Castle Road: Romano-British period (Site 6 Dorchester bypass)

This site (4700 m^2) on the outskirts of Dorchester, and is located to the north of Maiden Castle Road. In 1987, excavations began on an area identified by field-walking, geophysics, and trial trenches. Twenty-three graves were encountered and nineteen individuals were excavated. A square enclosure, dating to the early Romano-British period (2^{nd} to 3^{rd} century A.D.), contained a single central flexed inhumation. The majority of individuals recovered from the site dated to the 4^{th} century A.D., when an inhumation cemetery had been established at the site. Individuals had been inhumed in wooden coffins in an orderly fashion, the organisation and alignment of the graves suggests a planned cemetery (Smith 1997, 56-67). The inventory and femoral measurements were taken from the recording forms of Dr J. Rogers (1997) held in the site archive.

1.13 Newfoundland Wood (Church Knowle): Iron Age

Two graves were encountered during the excavation (1967 and 1969) of an Iron Age and Romano-British shale-working site. One grave dated to the Iron Age, and was located outside a supposed hut, whose border had been marked by irregular limestone slabs that would have projected above the ancient ground surface. The other grave had been disturbed, and the skeleton was not complete enough to be included in this present study. This skeleton (of a female) was found with two Roman coins dating to the 1^{st} Century A.D. (Toms 1970, 178-9). Both individuals were re-recorded.

1.14 Poundbury Camp: Iron Age and Romano-British period

This site is situated in-between the Roman road, aqueduct, and River Frome, on the northwest outskirts of Dorchester. Iron Age activity consists of a hillfort, which was occupied from the early to middle periods. In the late period, the area consisting of huts and settlement debris was superseded by Roman occupation levels dated to the 2nd and 3rd centuries A.D., these layers were in turn cut through by the graves of the late Roman cemeteries. In the 4th century A.D., farms surrounding the hillfort went out of use, however on the margins of the cemetery, evidence for timber buildings and occupation was also found. Evidence from the hillfort, indicates that the interior was occupied, and the defences were refurbished. During the 5th century A.D. the cemetery went out of use, and its central area contained a settlement consisting of circa eight timber buildings that utilised the walls of some mausolea, and settlement evidence was found within the hillfort (Farwell and Molleson 1993, xi-xii, 2-5). The cemetery use is summarised in Table 138.

Table 138 Summary of cemetery use at Poundbury Camp.

Date	Cemetery Phase	Information
Late 2nd to early 4th centuries A.D. Also used into the 3rd-4th centuries A.D.	IVA	Enclosure 1: extended inhumations in northern and eastern 'arms'. The northern peripheral cemetery contained 35 inhumations in wooden coffins, widely spaced on west east and north south alignments. Eastern peripheral: 89 inhumations, three cremations, smaller graves, graves often arranged in tight clusters in south north alignments, some burials in building R16, others aligned to it, the majority aligned with and or on boundaries of enclosure 1.
Late 4th century A.D. Late Roman	IV B-C	Buildings R13 and 14 and courtyards cut by inhumations. Northern and eastern peripheral burials continue into the 4th century A.D. Enclosures 2 and 3 in the main late cemetery were used through 4th century. Cemetery filled east west and 1114 burials excavated. Inhumations organised in orderly rows or placed in mausolea and a range of coffin types observed, wooden Ham Hill stone, lead lined wooden coffins. Enclosure 4 added to cemetery (unexcavated, but contained inhumations), three ditched funerary enclosures and isolated inhumations found to the west and east.
5th Century A.D.	VA	Main cemetery went out of use and central area used for settlement.
Post-Roman	VA-B	Shallow un-coffined inhumations inserted into the orderly rows of the main cemetery may belong to this period.

(Farwell and Molleson 1993, xi-xii).

Analysis of the sample raised the following problems, which have acted as limiting factors upon this study.

- Many examples of osseous change had been reconstructed, making observation very difficult,
- Due to the intensive use of the sample since excavation, many elements have been damaged, mixed or stolen, and

- Earlier studies focusing upon the clavicle and ribs had not returned these elements (often un-marked) to their original contexts.

1.15 Poundbury Pipeline: Romano-British period

In 1986, Wessex Water Authority constructed a pipeline extension which cut through the Poundbury Camp cemetery and surrounding areas. To the east of the cemetery, five graves dating from the Romano-British period were found. The individuals were inhumed in wooden coffins, although one individual was inhumed in a gypsum filled lead coffin, which was then placed in a stone coffin. Unfortunately, during the excavation of the individuals, the cranium, vertebrae, radii, and ulnae of an adult were stolen from the site (Davies and Grieve 1986, 81-88). The inventory and femoral measurements were taken from the recording forms of Dr J. Rogers, held in the archive.

1.17 Southfield House: Romano-British period

The site is interpreted to be part of the urban cemetery of Dorchester, located east of the proposed site of the southern town gate. The earliest ditch was cut by three individuals, inhumed in wooden coffins. Before the excavation, burials were not expected and as such, only two were excavated and one was lifted. The lifted individual was buried with their arms crossed over the chest and had been decapitated, with the cranium, atlas, 3rd and 4th cervical vertebrae placed between their feet (Davies and Thompson 1987, 126-128). The osteological report by McKinley (1987) observed that the head must have been removed at the 5th-6th cervical vertebrae, as these are not present, and may have been destroyed during multiple attempts to severe the head (McKinley 1987,128). The inventory and femoral measurement was taken from McKinley's report (1987) held in the site archive.

1.18 Tarrant Hinton (Barton Hinton): Iron Age

This site is situated in the north of the county, and is located near to Gussage All Saints. It is located on a chalk spur over-looking the Tarrant Valley and excavations took place at the site from 1968-1984. Activity at the site dates from the Bronze Age, however during the Iron Age, an extensive settlement was present (boundaries unknown) that was then superseded by a villa in the Romano-British period. The Iron Age settlement dates from the 6th Century B.C. to the early 1st Century A.D. and is comparable in form to Gussage All Saints, as it consists of four roundhouses, multiple pits, and ditches. The villa settlement develops from the previous habitation over the course of three hundred years, suggesting Durotrigian continuity. The settlement during the 1st and 2nd Centuries A.D. has a large body of 'Romanized' possessions, with the Iron Age settlement developing into a provincial village. This in turn was removed, and a large villa with a central courtyard constructed, surrounded by other buildings and houses.

Three Iron Age inhumations were found outside a ditch, the graves consisted of small oval pits, however burial eight was inhumed prone, with the arms beneath the torso, and the legs were bent upwards, accompanied by brooches and an iron fibula. The remaining eight individuals were inhumed in graves, in an extended or crouched position, and only one was accompanied by a grave-good of faunal remains (Graham pers.comm.). Unfortunately, only two individuals from the site could be recorded, because they had been assigned a secure date. These are curated by the Priests' House Museum at Wimborne Minster (AB 1 and AB 2). The dates of the remaining individuals were not available as the site report is being published after completion of this thesis (Graham pers.comm.).

1.19 Tolpuddle Ball (Tolpuddle to Puddletown bypass): Iron Age and Romano-British **period**

Before the construction of the A35 Tolpuddle to Puddletown bypass, which was built north of the existing A35, the Archaeological Field Unit of Liverpool University conducted evaluations and excavations east of Tolpuddle, known as Tolpuddle Ball, from 1990 to 1993 (TP91 and TP93). During 1996-1997 and 1998, excavations were carried out in the same area by Wessex Archaeology (W2402), and these three excavations identified the remains of 11 adult and seven infant individuals (Hearne and Birbeck 1999). In the present study, five Iron Age (middle to late and late to the early Romano-British period), and five Romano-British (100 to 410 A.D.) adult individuals could be included in the study, using the inventory and femoral measurement provided by McKinley's report (1999) held in the site archive.

Excavations by Wessex Archaeology also revealed a late/post Romano-British cemetery (W2405.17) located adjacent to the earlier inhumations (TP91, TP93 and W2402). The cemetery was not included in the study, as the burials (apart from two) are 5th century A.D. in date (Hearne and Birbeck 1999). One male individual from this cemetery has evidence for a healed tubercular infection (McKinley 1999, 150-172).

The Iron Age individuals (TP93) were buried in flexed, or partially flexed, or crouched positions in pits, accompanied by grave-goods of pottery, faunal material, and jewellery (Hearne and Birbeck 1999, 29-55). In the Romano-British period (TP91, TP93 and W2402), individuals were buried in extended positions, frequently in coffins accompanied by jewellery, pottery, and faunal remains (Hearne and Birbeck 1999, 39- 60).

1.20 Western Link (Site 10 Dorchester bypass): Iron Age and Romano-British period

The site was encountered during the Dorchester bypass excavation at Fordington Bottom, and Fordington Down. No activity was found from the early to middle Iron Age, as the area was then pasture. By the late Iron Age to early Romano-British period, the coombe side had a settlement associated with an inhumation cemetery. In the later 1st century A.D., the aqueduct for Dorchester (*Durnovaria*) ran by the site, and was kept in use until the 4th century A.D.. During the 1st to 2nd centuries A.D., burials continued in the cemetery, but there was also expansion of burials onto the coombe floor, with three burials found at the field boundary (which probably formed the edge of the settlement), suggesting that they were part of a larger cemetery. The settlement was abandoned in the late 4th century to early 5th century A.D. (Smith et al. 1997, 221). The inventory and femoral measurements were taken from the recording forms created by Dr. J. Rogers in the archive. Additional human remains not included in Dr. J. Rogers' study were recorded for this sample.

1.21 Whitcombe: Iron Age

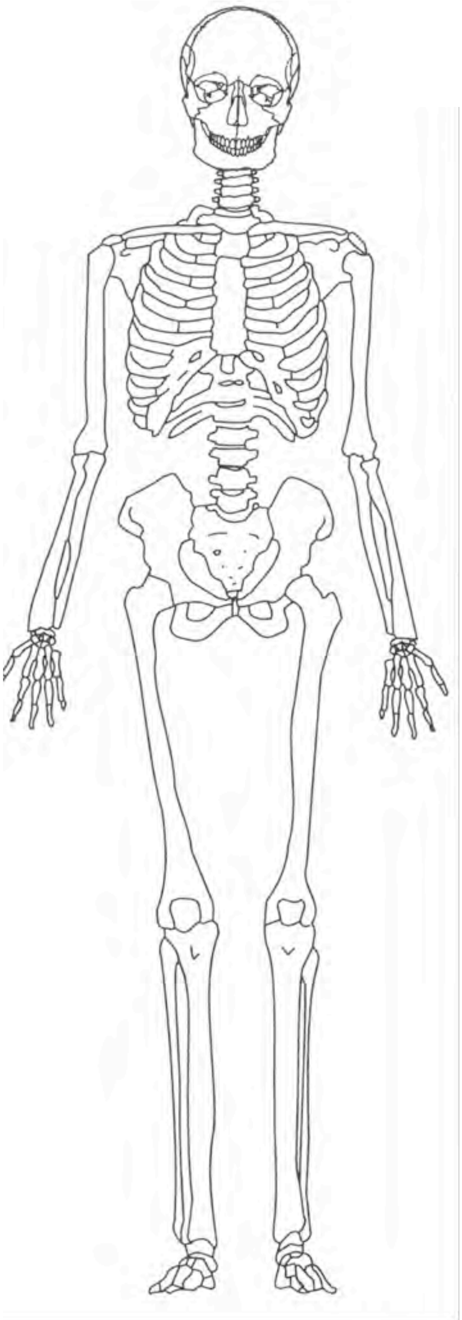
These individuals were recovered from an Iron Age settlement site, which was later re-occupied from the 3rd century AD. The Iron Age human remains were recovered from graves or pits close to the settlement ditches (crouched inhumations), whereas the remains dating to the Romano-British period were located in association with construction debris from a building (Aitken and Aitken 1991, 60,70). These remains were re-buried after excavation.

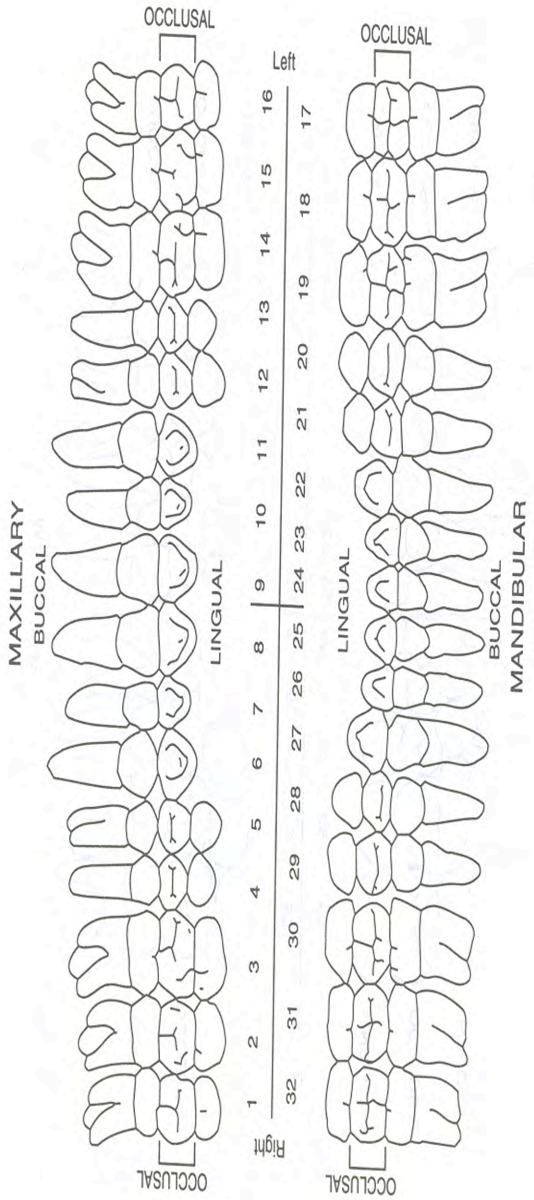
Re-analysis of the individuals from this site discovered that the crania of four individuals had not been deposited at the Dorset County Museum, and no information to their whereabouts could be obtained by the curator. The Iron Age sample was recorded for this present study.

Appendix 2: recording form used in the present study

Inventory Recording Form for Complete Skeleton

Skeletal Number:
Location:
Observer:
Date:





INVENTORY RECORDING FORM FOR COMPLETE SKELETONS

Skeletal Number:
Location:
Observer:
Date:

Cranial Bones and Joint Surfaces:

	Left	Right		Left	Right
Frontal			**Sphenoid**		
Parietal			**Zygomatic**		
Occipital			**Maxilla**		
Temporal			**Palatine**		
TMJ			**Mandible**		

Postcranial Bones and Joint Surfaces

	Left	Right		Left	Right
Clavicle			**Ilium**		
Scapula Body			**Ischium**		
Glenoid Fossa			**Pubis**		
Patella			**Acetabulum**		
Sacrum			**Auricular Surface**		

Vertebrae:

Sternum: Manubrium___ Body ______

N of rib heads:

Long Bones:

	pe	p1/3	m1/3	d1/3	de
Left Humerus					
Right Humerus					
Left Radius					
Right Radius					
Left Ulna					
Right Ulna					
Left Femur					
Right Femur					
Left Tibia					
Right Tibia					
Left Fibula					
Right Fibula					

Hand Carpals N:____ Metacarpals N: _____

Foot Tarsals N: _____ Metatarsals N: _____ Phalanges N: _____

Adult Sex/Age Recording Form

Site Name:
Burial Number:
Location:
Observer and Date:

SEX

Pelvis	Left	Right
Ventral Arc (1-3)		
Subpubic Concavity (1-3)		
Ischiopubic Ramus Ridge (1-3)		
Greater Sciatic Notch (1-5)		
Preauricular Sulcus (0-4)		

Estimated Sex, Pelvis (0-5)

Skull	Left	Right
Nuchal Crest (1-5)		
Mastoid Process (1-5)		
Supraorbital Margin (1-5)		
Glabella (1-5)		
Mental Eminence (1-5)		

Estimated Sex, Skull (0-5)

AGE

Pubic Symphysis
Suchey-Brooks (1-6) L= R=

Auricular Surface (1-8) L= R=

Rib End morphology =

Estimated Age =

Cranial and postcranial measurement recording form:

Skeletal number: **Observer/date:**

Cranial measurements -

3. **Bizygomatic** diameter -	18. **Interorbital** breadth -
7. **Maxillo-Aveolar** breadth -	24. **Mastoid** length -
8. Maxillo-Aveolar length -	25. **Chin** height -
9. **Biauricular** breadth -	26. Height of **Mandibular body** -
10. **Upper facial height** -	27. Breadth of Mandibular body -
11. **Minimum frontal breadth** -	28. **Bigonial** width -
12. **Upper facial breadth** -	29. **Bicondylar** breadth -
13. **Nasal** height -	30. Minimum **ramus** breadth -
14. Nasal breadth -	31. Maximum ramus breadth -
15. **Orbital** breadth -	32. Maximum ramus height -
16. Orbital height -	33**. Mandibular** length -
17. **Biorbital** breadth -	34. Mandibular angle -

Postcranial measurements –

35. **Clavicle**: max length -	57. Os cox iliac breadth -
36. Clavicle: ant-post diameter -	58. Os cox pub length -
37. Clavicle: sup-inf diameter -	59. Os cox ischium length -
38. **Scapula** height -	60. **Femur** max length -
39. Scapula breadth -	61. Femur bicond length -
40. **Humerus** max length -	62. Femur epicond breadth -
41. Humerus epicondylar breadth -	63. Femur max dia of head -
42. Humerus vertical diameter of head -	64. Femur ant-post subtroch dia -
43. Humerus max dia at midshaft -	65. Femur med-lat subtroch dia -
44. Humerus mini dia at midshaft -	66. Femur ant-post midshaft dia -
45. **Radius** max length -	67. Femur med-lat midshaft dia -
46. Radius ant-post dia -	68. Femur midshaft circumference -
47. Radius med-lat dia -	69. **Tibia** length -
48. **Ulna** max length -	70. Tibia max prox epiphys breadth -
49. Ulna ant-post dia -	71. Tibia max dis epip breadth -
50. Ulna med-lat dia -	72. Tibia max dia at nutrient foramen -
51. Ulna Physiological length -	73. Tibia med-lat dia at nutrient foramen -
52. Ulna minimum circumference -	74. Tibia circum at nutrient foramen -
53. **Sacrum** ant length -	75. **Fibula** max length -
54. Sacrum ant-sup breadth -	76. Fibula max dia at midshaft -
55. Sacrum max trans dia of base -	77. **Calcaneus** max length -
56. **Os coxae** height -	78. Calcaneus mid breadth -

Palaeopathology Recording Form

Bone:	Bone:	Bone:
Side:	Side:	Side:
Section:	Section:	Section:
Aspect:	Aspect:	Aspect:
1:	1:	1:
2:	2:	2:
3:	3:	3:
4:	4:	4:
5:	5:	5:
6:	6:	6:

Bone:	Bone:	Bone:
Side:	Side:	Side:
Section:	Section:	Section:
Aspect:	Aspect:	Aspect:
1:	1:	1:
2:	2:	2:
3:	3:	3:
4:	4:	4:
5:	5:	5:
6:	6:	6:

Additional observations:

Appendix 3: Intra-observer error tests

3.1 Technical error of measurement

In order to assess the accuracy of the femoral length measurement (measurement 60) taken by the observer, twenty individuals (10 females and 10 males) from a random selection of sites were re-measured and the technical error of measurement was calculated, using the equation provided below,

TEM= $\sum D^2/2N$

D = difference between measurements.

N = number of femora measured.

The coefficient of reliability (R) was also calculated to determine the percentage of variance between measurements produced by the measurement error, using the equation provided below,

R=1 –{(TEM²) / (SD²)}

$R = 1 - \{(TEM^2) / (SD^2)\}$

SD = the total measurement error.

3.2 Measurements

Table 139 Measurements taken for the intra-observer test

Males			Females		
First	**Second**	**Difference**	**First**	**Second**	**Difference**
435	434	0.1	409	410	0.1
425	426	0.1	423	425	0.2
431	432	0.1	418	419	0.1
380	378	0.2	402	403	0.1
455	453	0.2	398	400	0.2
464	465	0.1	400	401	0.1
457	459	0.2	433	434	0.1
435	434	0.1	386	388	0.2
466	467	0.1	419	420	0.1
454	453	0.1	407	409	0.2
	TOTAL	**1.3**		**TOTAL**	**1.4**

3.3 Results of the intra-observer error test

3.3.1 Males

$\sum = 1.3$
$\mathbf{D^2} = 1.69$
2 x 10 = 20

1.3 x 1.69 = 2.197
TEM = 2.197 $\div$20 = 0.10985
Result = 0.1

$\mathbf{TEM^2}$ **=** 0.012037022
$\mathbf{SD^2}$ **=** 1.69
0.012037022 $\div$1.69 = 7.122498225
R = 1 - 7.122498225
R = -6.122498225

The result shows that the TEM in males was 0.1cm and the coefficient of reliability was -6.1, indicating that the variance in measurements was not due to intra-observer error, as a result over .80 indicates good reliability.

3.3.2 Females

$\sum = 1.4$
$\mathbf{D^2} = 1.96$
2 x 10 = 20

1.4 x 1.96 = 2.744
TEM = 2.744 $\div$20 = 0.1372
Result = 0.13

$\mathbf{TEM^2}$ **=** 0.01882384
$\mathbf{SD^2}$ **=** 1.96
0.01882384$\div$1.96 = 9.604
R = 1 – 9.604
R = -8.604

The result shows that the TEM in males was 0.1cm and the coefficient of reliability was -8.6, indicating that the variance in measurements was not due to intra-observer error, as a result over .80 indicates good reliability.