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A study of the periodontal state of a late Medieval United Kingdom population

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ABSTRACT

Objective: To study the severity of bone loss in a Medieval UK population, and compare this with other ancient UK populations from different time periods.
Design: Skulls from a burial site in York (XI–XV century) were investigated. Skulls with a minimum of 17 teeth were included and were divided from childhood into five age groups. Direct measurements from the cement enamel junction (CEJ) to the alveolar crest (AC) were undertaken at six points around each tooth with a UNC 15 probe. The mean bone loss was calculated for each tooth type.
Results: Seventy five skulls were included in the study (12–60 years of age). Bone loss was found to increase with age, but stabilized in older individuals (>45 years). The mean CEJ-AC distance varied from 2.1 mm in the youngest group to a maximum of 4.1 mm in 36–45 year olds. Results were compared with a Roman–British population (Whittaker et al., 1982) where comparable values for mean bone loss were 2.2 mm and 5.4 mm respectively, and a population of XVIII century Londoners (Whittaker et al., 1998) where bone loss of 1.1 mm and 4.0 mm was reported for the youngest and oldest age groups respectively.
Conclusion: Measuring the CEJ–AC distance in dried skulls from ancient populations may be used as a proxy for the levels of periodontal disease irrespective of tooth wear. The findings from the current study suggest that the severity of periodontitis as determined by measurements of alveolar bone loss on dried skulls from this ancient population, seems to have declined in the United Kingdom from the III–V century to XVIII century. This may be due to changes in environmental factors including living conditions and diet, together with individual characteristics including systemic illness and genetic make up.

1. Introduction

Periodontal diseases affect the supporting tissues of teeth and in their severest form cause loss of periodontal attachment of teeth to alveolar bone (Fig. 1). They are initiated by plaque, but the response of the periodontium may be affected by the host defense system, systemic disease, medication and life style factors, such as smoking and psychosocial stress (Lindhe, Karring, & Araújo, 2008; Haake & Nisengard, 2002). Periodontal destruction results in loss of collagen and alveolar bone but occurs in an intermittent way, with periods of disease activity and inactivity. The inflammatory infiltrate tends to be proportional to the bone loss, inflammatory destruction being associated with the activity of various cytokines such as prostaglandins, interleukin 1α and 1ß, and tumor necrosis factorα (Rowe & Bradley, 1981).

Alveolar crest bone loss may occur throughout life as a consequence of chronic inflammatory periodontal disease, resulting in root exposure and gingival recession (Manson, 1976). The distance from the cement enamel junction (CEJ) to alveolar crest (AC) has been widely used in order to measure the degree of alveolar bone loss. This distance may be measured indirectly on radiographs or directly during periodontal surgery or on dried skulls using a periodontal probe. Distances exceeding 2 mm are generally classified as pathological bone loss, accepting however that all measurements can usually only be made to the nearest millimeter (Albandar, Abbas, & Gjermo, 1985; Albandar, Rise, Gjermo, & Johansen, 1986).

Paleopathology studies have shown that destructive periodontal disease accompanied by alveolar bone loss of varying degrees, has affected ancient populations as diverse as Egyptians and early pre-Columbian Americans (Ogden, 2007). With the collapse of the western part of the Roman Empire in 472 A.D., much of the medical knowledge continued to flourish in the Islamic civilization. The contributions from Ibn Sina and Abu'l-Qasim to periodontology literature are particularly important, in which there is emphasis placed on techniques to splint teeth with significant mobility and the development of a varied armamentarium of dental

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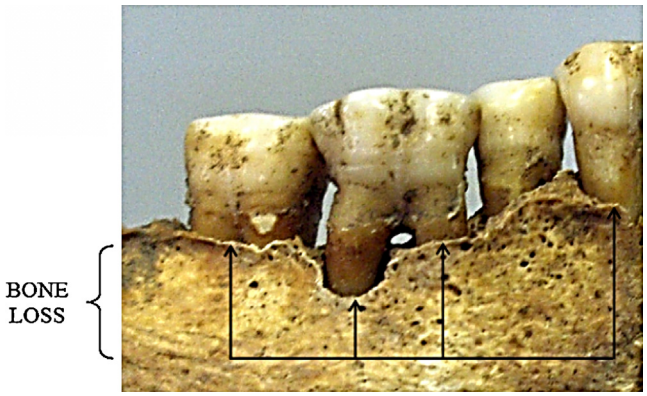

Fig. 1. Different Bone Levels Due To Periodontal Disease: York Excavation.

instruments exclusively dedicated to teeth cleaning to prevent gingival disease. Unfortunately, while science in Middle East was developing, Europe was languishing by losing its objectivity due to witchcraft beliefs and other superstitious thinking. In fact, many believe that if it was not for the fact that refined foods were so scarce during Middle Age, there would have been a dramatic increase in the numbers of those suffering with some sort of dental and gingival diseases that ultimately could have led to the development of a public health calamity (Shklar & Carranza, 2002).

Investigating alveolar bone loss in antique populations, will increase our knowledge of periodontal disease patterns through the centuries, and may also provide an insight to understanding the factors involved in disease affecting their contemporary successors. These populations will not have been exposed to modern medicines, tobacco smoking or contemporary psychosocial stressors, but may have been exposed to other risk factors for oral and dental health. Previous studies on antique populations have tried to investigate these issues, however the lack of adequately preserved specimens and other difficulties such as the influence of attrition on the measurements obtained, have been challenging. This study was undertaken to further investigate bone levels as a proxy for periodontal diseases in a unique Medieval United Kingdom population from York, and to compare the findings with other ancient UK populations from different time periods.

2. Materials & methods

According to the Human Tissues Act (2004) that applies to England, Wales and Northern Ireland and that regulates any activities regarding the storage, use, removal and disposal of human tissue, it was unnecessary to obtain any specific ethical approval since the remains are more than three hundred years old. The Department of Archaeology at The University of Sheffield gave permission for access to their facilities and material.

Care was taken to follow normal clinical control of cross-infection procedures, and appropriate conduct regarding delicate material that was used. Dried skulls belonging to the Archaeology Department of The University of Sheffield, from a Medieval population excavated at All Saints Fishergate Parish Church in York and dating from the XI–XV century were available for the study. The inclusion criterion was a minimum of 17 teeth remaining in each skull. The following exclusion criteria was used: specimens in mixed dentition (younger than 12 years old), skulls with less than 17 teeth, jaw fractures that rendered any measurements impossible or inconclusive, teeth with broken roots, teeth with complete crown fracture, alveolar crestal bone with any degree of fracture, teeth with no socket retention, teeth that would not fit properly into any socket and deciduous teeth.

Sex and age determination was carried out by accredited staff from the Archaeology Department at The University of Sheffield.

Based on the work carried out by Whittaker et al., (Whittaker, Parker, & Jenkins, 1982) skulls were distributed in the following way: **Group I** (up to 16 years old), **Group II** (17–25 years old), **Group III** (26–35 years old), **Group IV** (36–45 years old) and **Group V** (>45 years old). According to the work developed by Gray, Todd, Slack, & Bulman, 1968) and Lavstedt (1975) there are no significant differences in the left / right side of the jaws with regards to prevalence of periodontitis, therefore no special attention was given to which sides were being studied. Loose teeth were carefully placed into their sockets in the closest position possible to their original place. We decided not to use any cement in order to help to maintain them in place since that could add some degree of extra height and would contaminate samples with an artificial material. The CEJ–AC distance was measured directly in six equidistant areas around each tooth (mesio-buccal, mid-buccal, disto-buccal, mesio-lingual/palatal, mid-lingual/palatal and disto-lingual/palatal) using a UNC 15 probe as parallel as possible to the long axis of the tooth (Fig. 2), maintaining the jaws as perpendicular as possible with the floor. The average value of CEJ–AC per tooth was calculated from the previous six figures and subsequently the mean per skull and age group was obtained. These measurements represented horizontal bone loss, since according to Muller & Perizonius (1980) bone loss reported in ancient skulls is largely horizontal and an average value should be calculated per tooth. A UNC 15 periodontal probe was used to record CEJ–AC measurements (Albandar, 1989) aided by a magnifying lens (3×) when any doubt arose, and this was especially helpful when the CEJ line was not very perceptible.

Tooth wear was recorded for each tooth using the Tooth Wear Index (TWI) proposed by Smith & Knight (1984) and adopted by a number of different investigators (Poynter & Wright, 1990; Bartlett, Coward, Nikkah, & Wilson, 1998) in the United Kingdom (UK).

2.1. Intra-examiner calibration

The CEJ–AC was measured in ten specimens (250 teeth) on three occasions prior to the study, and then as part of the calibration process *per se*, this distance was re-measured twice in the same specimens a week apart (Klipstein, Georg, & Boeing, 1997).

2.2. Statistical analysis

The Kolmogorov–Smirnov test (K–S Test) was used to assess the "normality" of the distribution of the CEJ-AC measurements

Fig. 2. Measurement of Mesio-Buccal Aspect. Importance of Positioning: York Excavation.