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Dental health and diet in early medieval Ireland

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ABSTRACT

Objective: With the aim to get a better picture of dental health, diet and nutrition in early medieval Ireland a population-based study focusing on several attributes of oral health in adult individuals was conducted. The study focused on possible differences between sexes and age groups in terms of frequency and distribution of studied pathologies in order to determine whether these differences result from different diets, cultural practices or are age-related.

Design: Permanent dentitions belonging to adult individuals from five Irish early medieval sites were examined for the evidence of caries, ante-mortem tooth loss, abscesses, calculus, alveolar bone resorption and tooth wear. All pathologies were analysed and presented by teeth and alveoli.

Results: A total of 3233 teeth and 3649 alveoli belonging to 167 individuals (85 males and 82 females) were included into the analysis. Males exhibited significantly higher prevalence of abscesses, heavy wear and alveolar bone resorption, while females exhibited significantly higher prevalence of calculus. All studied dento-alveolar pathologies showed a strong correlation with advanced age, except calculus in females. Additionally, dental wear associated with habitual activities was observed in two females.

Conclusion: The results of the present study confirm the data gained by written sources and stable isotopes analyses suggesting the diet of the early Irish was rich in carbohydrates with only occasional use of meat. Furthermore, significant differences between the sexes in terms of recorded pathologies strongly suggest different nutritional patterns with females consuming foods mostly based on carbohydrates in comparison to males. The observed sex-differences might also occur due to differences between male and female sex such as reproductive biology and pregnancy, a somewhat different age distributions, but also as a result of different cultural practices between the sexes.

1. Introduction

Dento-alveolar pathologies are one of the most frequently studied aspects of human health in the past.[1–9] A study of oral health in an archaeological population can provide valuable data on its diet and nutrition, predominant cultural practices, socio-economic status, but also general health and life-style.[10–19] Additionally, some studies tried to determine long-term trends in general health by studying changes and variations in frequency and distribution of oral pathologies through time in a specific region.[20–25]

Although there is a long tradition of osteoarchaeological research in Ireland[26] paleodontological analyses have never

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been in the focus of experts dealing with this topic. They were usually published as integral parts of larger archaeological and/or osteoarchaeological papers and monographs, but very rarely as separate studies.[27,28] Most of these analyses were focused on one site or even an individual, very rarely taking into consideration processes taking place in a wider geographic region or changes occurring through longer periods of time.

With the aim to get a better picture of dental health, diet and nutrition in early medieval Ireland a population-based study focusing on several aspects of oral health in adult individuals was conducted. This research will try to investigate possible differences between sexes and age groups in terms of frequency and distribution of studied pathologies. It will also try to determine whether these differences result from different diets, cultural practices or are age-related. In order to reach this goal, early medieval written sources from Ireland together with preliminary data gained by stable isotopes studies (carbon and nitrogen) will be consulted. In order to get a broader perspective the results obtained by this research will be compared with similar data from other European sites.

2. Materials and methods

This study examines the remains of 167 adult individuals with permanent dentition from five early medieval Irish skeletal populations. All sites (Ardsallagh 1, Augherskea, Claristown 2, Collierstown 1, and Omey Island) represent rural communities located on the sea-coast or in the immediate vicinity of the sea. The use of these sites is dated to the early medieval period, i.e. between the 5th and 11th centuries AD, based on the radiocarbon dates, horizontal and vertical stratigraphy, and recovered artefacts.[29–33] The osteoarchaeological analysis was carried out at the School of Archaeology, University College Dublin, and the National Museum of Ireland Collections Resource Centre, Swords. The sex and the age at death of the studied individuals were estimated using standard anthropological methods. Sex was established based on the differences in pelvic and cranial morphology.[34–36] Age at death was estimated by using pubic symphysis[37] and auricular surface morphology,[38] sternal rib end changes,[39,40] and ectocranial suture fusion.[41] All individuals were assigned to one of three age categories: 'young adults' (between 18 and 35 years), 'middle adults' (between 36 and 50 years), and 'old adults' (over 50 years). Only individuals with at least eight teeth and tooth sockets in each jaw were included in the analysis.

The study presented in this paper focused on six dental pathologies: caries, ante-mortem tooth loss (AMTL), abscesses, calculus, alveolar bone resorption (ABR) and tooth wear. All pathologies were analysed and presented by teeth and alveoli. The frequencies (%) of the studied attributes were calculated by using formula: [total number of teeth (or alveoli) affected by studied changes/total number of analysed teeth (or alveoli)] × 100. The overall sample includes only those individuals for whom each of the studied pathologies could be assessed. No significant differences between the sites in any of the studied pathologies were observed so all results are reported only in a form of a composite early medieval sample.

A lesion was considered caries if there was a clear defect (cavitation) in tooth tissue. Colour changes of the enamel were not considered caries unless there was cavitation underneath.[42] All teeth were examined macroscopically under a bright light with a help of a dental probe. The number of carious lesions was noted for each tooth together with their locations (occlusal, buccal/lingual, interproximal and root).

A tooth was considered to be lost ante-mortem if the alveolar socket showed any sign of alveolar bone resorption.[43] The tooth was considered to be lost post-mortem if there was no evidence of remodelling.

Diagnosing an alveolar abscess may prove difficult in some cases, especially since a cavity in the bone around the root of a tooth may also be a periapical granuloma or a benign cyst.[44] Nevertheless, the presence of a drainage channel (sinus) is generally accepted as evidence of an abscess in skeletal samples.[45] Consequently, alveolar abscesses in this study were diagnosed only when the presence of a perforating fistula and a sinus in the bone at the apex of the tooth root were unambiguously established.[43,46]

A detailed macroscopic examination of the teeth deposits distinguished true dental calculus from post-mortem deposits such as sand or soil. Dental calculus was recorded and separated into three levels using the criteria proposed by Brothwell[47]: slight (a slight line of calculus), moderate (up to 50% of the tooth surface is covered in calculus) and severe (between 50 and 100% of the tooth surface is covered in calculus).

In this study a tooth was considered positive for alveolar bone resorption if the alveolar bone displayed porosity or if the distance between the cemento-enamel junction and the alveolar crest was greater than 2 mm (for more details on possible problems when using this method see Hillson,[46] Hildebolt and Molnar,[48] and Dewitte[49]).

Dental wear was recorded according to the system proposed by Smith[50] that employs an eight stage system to describe degree of dental wear. In this study Smith's system was slightly modified as the degrees of dental wear were classified as mild (Smith's degrees 1 and 2), intermediate (3 and 4) and heavy (degrees 5–8). Only the results for heavy wear (Smith's degrees 5–8) were presented in this paper. Additionally, all analysed teeth were classified as anterior (incisors and canines) and posterior (premolars and molars). Those teeth whose occlusal surfaces were destroyed by caries were excluded from the study of attrition. Possible cases of dental attrition caused by habitual activities were described separately.

Data gathered in this study were statistically analysed using software package SPSS 17.0 for Windows. The observed differences between the sexes and the age groups were evaluated with the chi-square test using Yates correction when appropriate, and statistical significance was defined by probability levels of $P \leq 0.05$.

3. Results

The early medieval Irish composite series consists of 167 adult individuals (85 males and 82 females; Table 1). The male/female ratio in the studied sample is almost identical (1:0.96), and the age distributions between the sexes do not show any statistical differences. A total of 3233 teeth and 3649 tooth sockets were included into the study.