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Occupational Dental Abrasion from Medieval Plovdiv

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Dental abrasion is a natural phenomenon with universal occurrence that has existed from the origin of humankind and depends on the lifestyle, diet and occupation. Dental abrasion was very serious in ancient populations up to the late medieval period. The paper presents a male skeleton from medieval Plovdiv with marked dental abrasion which is considered to be occupational, possibly related to carpentry or shoemaking. The hypothesis of occupational abrasion is tested in archeological experiment.

Key words: dental abrasion, nails, occupation,medieval

Introduction

In anthropology and archaeology, it has been assumed for several decades that teeth provide interesting material for observation because of their high mineral content, which gives them strong resistance to post mortem taphonomic processes [4]. The paleopathological findings reveal the prevalence and evolution of a number of pathological processes than the morphological changes in teeth are relevant to living conditions, mostly with occupational and environmental factors, which allows to draw conclusions about the life and the socio-economic situation of the studied population [9]. Tooth wear is of particular interest in the study of relationships between man, his environment and his pattern of subsistence.

From the point of view of palaeopathology, the Middle Ages constitute an interesting period because of the numerous collections available and the fact that many authors have confirmed the existence of notable tooth wear on the populations studied. Brabant [1], one of the pioneers of dental anthropology in Europe, wrote that “tooth wear in the Middle Ages was much more accentuated than today”. In the medieval

population of Valjevo (Serbia, 15th century), Djuric-Srejic[3] estimated that "tooth wear was the most common finding". Caglar et al. [2] wrote, about a Byzantine medieval sample (12th century), that "in contrast with dental caries, tooth wear was remarkable in our sample". More recently, Meinl et al. [6] found "a very pronounced attrition" in an Austrian sample from Avar (11th century).

In these anthropological and historical contexts, the aim of the paper is to present a medieval male dentition that displays marked dental abrasion which is considered to be occupational, possibly related to carpentry or shoemaking. The examined skeleton originates from the medieval necropolis at the archeological site "Bishop's Basilica of ancient Philippopolis" in Plovdiv, Bulgaria [8].

Materials and Methods

During the anthropological examination of 216 dentitions from a medieval necropolis (10th - 12th century) at the archeological site "Bishop's Basilica of ancient Philippopolis" in Plovdiv, Bulgaria, one case (grave #28) of marked dental abrasion in a 35–40 year old male individual was found. The most severe changes involve the anterior left maxillary incisor and its antagonist – mandible left central incisor. In central occlusion the affected teeth display loss of enamel and dentine that frames a triangular-shaped defect (**Fig. 1**). These unusual findings were the reason for more detailed anthropological study including use of X-ray examination and computerized evaluation of the occlusion and tooth wear pattern.

Fig. 1. Marked dental abrasion of both anterior left maxillary incisor and its antagonist. In central occlusion the affected teeth display loss of enamel and dentine that frames a triangular-shaped defect.

Results

Except the maxillary right central incisor and the mandible left canine which are lost post mortem and were not found at the excavation site, the other teeth are present and intact. The occlusal view of the maxillary first left incisor (**Fig. 2A**) and segmented X-ray of the same tooth (**Fig. 2B**) revealed irregular loss of tooth substance with larger distal defect and root resorption. There is no evidence for communication between the defect and the pulp chamber but the consequences from pulpal necrosis are beyond any doubt. Both the bone defect and root resorption could be attributed to chronic occlusal trauma. The incisal aspect of the left mandible central incisor displays a wide plane abrasion extended in a buccal aspect with loss of enamel and substantial loss of dentine but not exposing the pulp. The deposition of calculus at the mandible frontal area is significant.

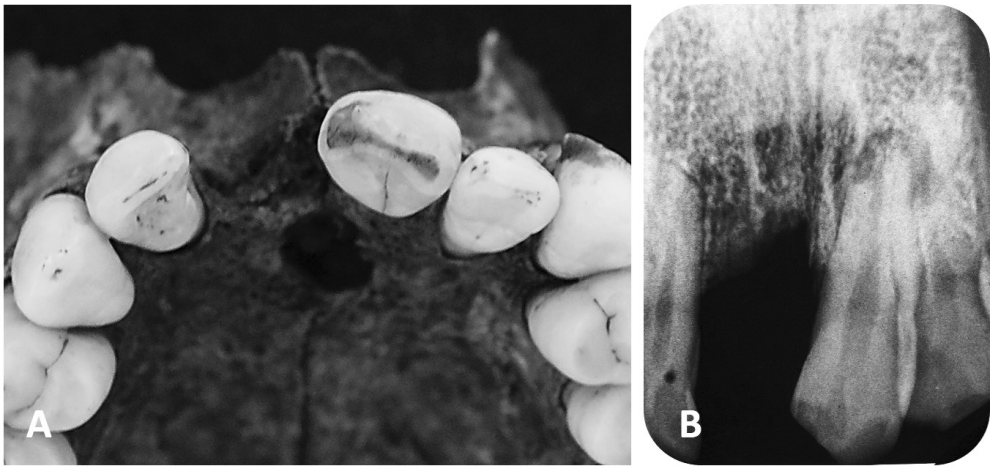

Fig. 2. Occlusal view of the maxillary first left incisor (**A**) and segmented x-ray of the same tooth (**B**) revealed irregular loss of tooth substance with larger distal defect and root resorption.

In order to evaluate the occlusion and the tooth wear pattern a digital impressions from the lower and upper jaws were taken with a Trios 3® (3Shape, Copenhagen) intraoral scanner (**Fig. 3A**). The software and hardware of Trios 3® have the capability to capture fully colored model. This scanner is a powder-free scanner which operates on the confocal principle with the video-recording method. The software version 3Shape Trios Classic 1.3.4.6 was used. Scanning procedures were performed according to the manufacturer's instructions. It was started with the upper jaw, followed by the lower one. Scanning was started on the right third molar and ended on the left third molar. The scanning strategy on the upper arch is the following: occlusal surface followed by buccal surface and, nally, palatal surface. Scanning strategy on the lower jaw starts with the occlusal surface, then the lingual surface and, nally, the buccal surface. The next step was bite registration in intercuspidal position on both sides. During bite scan the scanner tip was positioned at molar region, the buccal side of the teeth and slowly moved in mesial direction. After the scanning of the upper and lower arches, the virtual cast appeared on the screen (**Fig. 3B**). The virtual casts of upper and lower arches were found acceptable if included accurate scans of all the surfaces of every teeth with 3-4 mm of alveolar bone and no crack lines were found. The quality of the scans was satisfactory if the software could attach the arches to each other based on bite registration scan (**Fig. 3C**). The evaluation of the occlusion and the attrition pattern revealed that the attrition follows the normal pattern and a clear reversed or anti-curve of Monson has been established i.e. the greatest wear occurs on the buccal aspect of the lower molar and the palatal aspect of the upper molar crowns (**Fig. 3D**). The lack of evidence for contacts between the upper central left incisor and its antagonist raised the question about the ethiology of this defect.

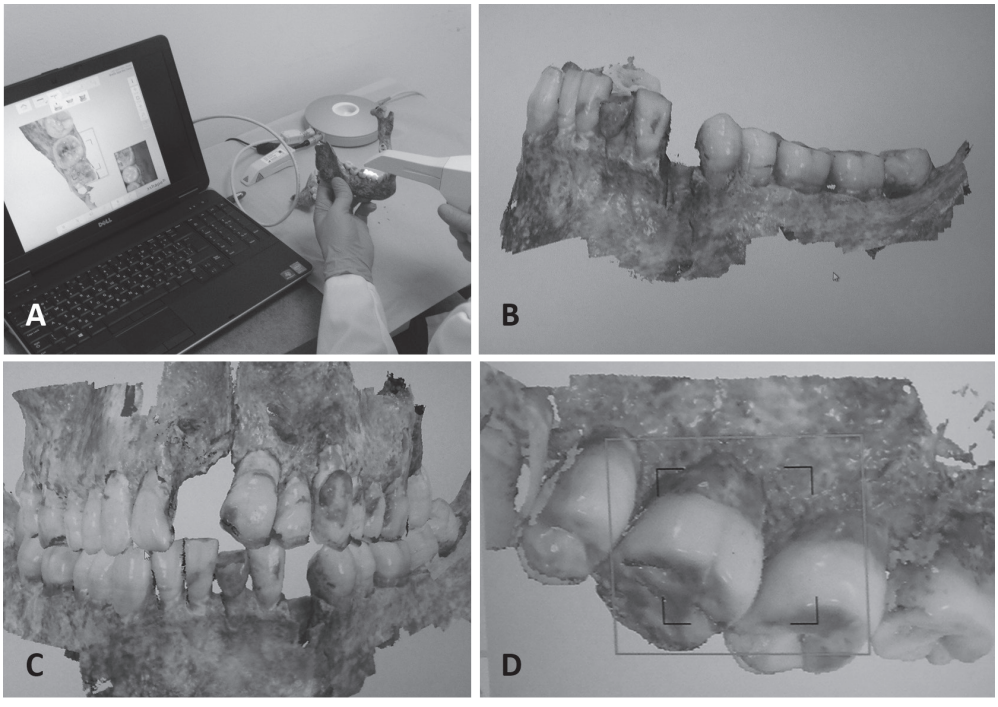

Fig. 3. Digital impressions of the lower and upper jaws were taken with a Trios 3® intraoral scanner (**A**). The virtual after complete scanning (**B**). Software attaches the arches to each other based on bite registration scan (**C**). Evaluation of the tooth wear patterns (**D**).

Discussion

Marked attrition, reaching the dentin and pulp chamber is not unusual in archaeological material [1, 2, 3, 4, 6, 9]. The chewing of hard objects and the mastication of materials such as leather or rope would result in marked regular attrition of the tooth crowns, possibly with linear grooves occlusally [5]. However, this is quite dissimilar to the present case with irregular, sharp abrasions only of two antagonist teeth. Nor does the overall appearance, varying degrees of involvement and asymmetrical presentation support deliberate mutilation. Such dental mutilations appear to be largely confined to Africa, North and South America [7] but are not relevant to cultural tradition of the medieval Europe.

Our hypothesis is that the dental abrasion is related to occupational activity as it was already reported once by Turner G. and Anderson T. [9]. In their publication they reported for marked occupational dental abrasion from medieval Kent. In experimental study done with nails found at the archeological site they confirmed the relation between the dental loss and the use of frontal teeth as a tool for holding nails during work. Considering the possibility to deal with a carpenter or a shoemaker who repeatedly held nails between his teeth we reconstructed the situation with nail found at the same site. The results revealed that the example of iron nail known to date from the medieval period appears to fit very accurately into the abrasion defect (**Fig. 4A, 4B, 4C**).

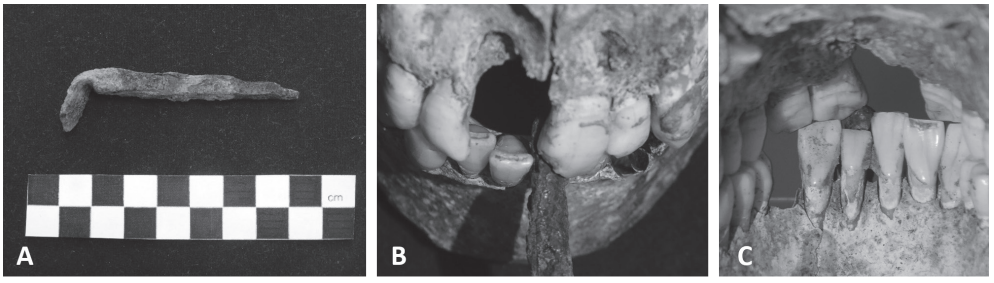

Fig. 4. Medieval iron carpentry nail recovered from the same archeological site (lengths: 72 mm; rectangular in cross-section and tapering to a 2 mm point); (**A**). Vestibular (**B**) and palatal (**C**) view of the dentition in occlusion with the nail fitting accurately into the anterior incisal abrasion.

Conclusions

A medieval male skeleton from Plovdiv displays marked dental abrasion of the anterior teeth, which appears to be occupational. The evaluation of the occlusion and the tooth wear pattern revealed normal distribution of the occlusal forces and attrition relevant to the sex and age with only one exception – the upper central left incisor and its antagonist. Although we cannot be certain of the etiology, medieval iron nail appears to fit into the incisal abrasion very precisely. This suggests that the individual may have followed the occupation of carpenter or shoemaking for many years. The hypothesis of occupational abrasion is confirmed in archeological experiment and the skeletal remains are exhibited at the Museum of medical history in Medical University of Plovdiv, Bulgaria.

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