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Bilateral odontogenic maxillary sinusitis due to advanced tooth wear in a female individual from late antiquity Philippopolis (Bulgaria)*

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Abstract

A rare case of bilateral odontogenic maxillary sinusitis associated with advanced tooth wear in female individual from late antiquity Philippopolis (modern Plovdiv, Bulgaria) is presented and discussed.

Keywords: odontogenic maxillary sinusitis; tooth wear; late antiquity

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Introduction

The odontogenic maxillary sinusitis (OMS) referred to the pre-modern times is described as a subtype of maxillary sinusitis (MS) or inflammation of the maxillary sinus which is secondary to adjacent infectious maxillary dental lesion (1). A meta-analysis of 31 studies has revealed that on the basis of CT imaging, the aggregated prevalence of OMS in the modern human population was found to be 51% for each maxillary sinus and 50% on a per-patient basis (2). Other meta-analysis revealed that the maxillary first molar is most commonly implicated in OMS (22.51%) and the sinus involvement is usually unilateral with 2% more cases on the left maxillary sinus compared to the right one (3). The prevalence of OMS amongst the past population is unclear because in intact skulls the maxillary sinuses are not available for direct observation. In the majority of paleopathological studies on MS the condition is mostly studied as an indicator of respiratory health in past populations with no emphasis of its potential dental origin (4, 5, 6). The very informative review of Lee et al. (seventy-five studies on chronic maxillary sinusitis in palaeopathology) revealed that only twenty-seven of them included a discussion of maxillary dental disease within their methodologies providing an explanation of which criteria could be considered potentially diagnostic of odontogenic sinusitis (7). The lack of medical imaging is also considered as a weakness of these studies - in addition to macroscopic and endoscopic visualization, only two studies used CT scanning to examine sinuses (7). The only one publication by Bulgarian authors referring maxillary sinusitis is done by V. Russeva and the diagnosis is based on visual observation only without using any medical imaging (8).

The aim of the presented study is to describe a rare case of bilateral OMS associated with advanced tooth wear in female individual from late antiquity Philippopolis.

Materials and Methods

The skeleton originates from a rescue archeological excavation at the territory of the Southern necropolis of the late antiquity Philippopolis (Modern Plovdiv, Bulgaria). Figure 1. The detailed archeological background is published by the authors in 2020 (9). The coin placed in the mouth of the skeleton as a Charon obolus dated the burial around first half of the 4th century CE. (9) The skeletal remains are sent secondarily to the Medical University of Plovdiv for anthropological analysis.

After skeleton assembling an anthropological analysis was done according to the established protocols. The age and the sex of the individual were established according to the symphyseal surface relief of the pubic bone (after Todd), the relief of the auricular surfaces (after Lovejoy's scales), the cranial sutures obliteration (after Olivier-Simpson's scales for endo- and ectocranial surface and after Meindl-Lovejoy's scores for ectocranial vault points). The skeletal development was assessed according to the stages of epiphyseal fusion following Schwartz. For the sex estimation priority was given to the features of sexual dimorphism, particularly to pelvic bones, as summarized in Acsadi and Nemeskeri. The sexual dimorphism of cranial bones was assessed after Buikstra and Ubelaker. Data from osteometrical analysis following the methodology of Martin-Saller, and their correlation with the results for diameters of femoral, humeral, and radial heads, as well as with the femoral and humeral bicondilar breadth in the table of Pearson served as additional information about sex estimation. Smith and Knight index was used for measuring the wear of teeth. (10) The upper dental arch and the adjacent maxillary sinuses were additionally evaluated by using segmented X-rays. The identified pathological features related to the teeth were carefully measured and photographed in different positions and magnifications.

Results

The material from the grave represents fragments of almost complete cranial and postcranial skeleton. The initial investigation determined the individual as a female on the basis of the reconstructed pubic angle, the preserved features of cranial bones, and the measurements of the long bones of the limbs. Based on the symphyseal surface relief and cranial sutures obliteration, the age at death was estimated to 40-45 years. The dentition shows pathological changes, related to advanced tooth wear. (Figure 2. A, B) Tooth 21 and tooth 28 are lost postmortem.

Pulp exposure was identified in tooth 16 and 26 (Score 4), together with buccal bone resorption and periapical lesions (Figure 3. A, C) seen on the segmented X-rays (Figure 3. B, D). The radiological observations revealed also interrupted floor of the both right and left maxillary sinuses. The visual observation of the maxillary sinuses' floors revealed pitting, spicules, and white pitted bone for both left and right. (Figure 4. A) Additionally, a round hole (an accessory

maxillary ostium) was identified between the uncinate process and the inferior concha of the left maxillary sinus. (Figure 4. B). The pathological findings in their complexity revealed bilateral maxillary sinusitis. Both macroscopic observation and X-ray imaging are summarized in Table 1.

Table 1. Presence of pathological findings relevant to maxillary sinusitis in the evaluated individual.

	Pitting	Bone spicules	White pitted bone	Thickened sinus walls (X-Ray)	Cysts	Hole	Other
Presence in the evaluate individual	X	X	X	X	X	X	X

Figure 1. General view of the grave (provided by M. Martinova-Kyutova and B. Grueva-Zdravcheva).

Figure 2. Occlusal view of the maxilla and the mandible (A). The white arrow indicates bone resorption (or post mortem fracture) around the palatal root of tooth 26. Both of the maxillary first molars have advanced tooth wear with exposure of the pulp cavity. (B).

Figure 3. Lateral view of teeth 16 (A) and 26 (C) and the corresponding segmented X-rays of right side (B) and the left side (D). Presence of periapical bone lesions (cysts) and interrupted left and right sinus floor.

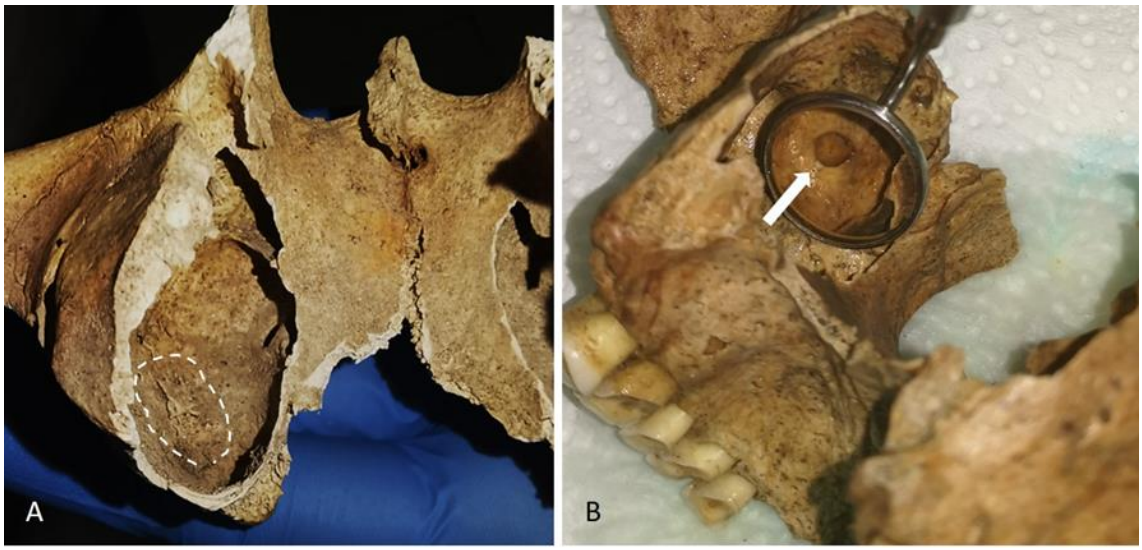

Figure 4. Pitting, bone spicules, white pitted bone (A) and an accessory maxillary ostium (B) located between the uncinate process and the inferior concha of the left maxillary sinus.

Discussion

The first systematic guide to bone changes seen in archaeological examples of chronic maxillary sinusitis was published by Boocock et al. in 1995. (6) Additional diagnostic categories seen in the modified methods are “Plaque” and “Cysts”, adapted from Merrett and Pfeiffer in 2000 (5) and “Hole” (Mushrif-Tripathy in 2014) (11). Currently, the eight changes noted within maxillary sinuses were categorized as follows Lee et al. (7):

1. Pitting: Fine pits are often seen in association with other types of bone changes.
2. Spicules: Thin spikes of bone which have a cancellous nature and which appear to have been applied to the original bone surface.
3. Remodeled Spicules: The spicule formations appear to be remodeling into the sinus walls. The spicules may merge and become plaque-like or form bone with the appearance of molten wax.
4. White Pitted Bone: Discrete areas of change which are highly pitted and white when compared to the surrounding bone. This may sometimes transmit to the outer surface of the sinus.
5. Thickened Sinus Walls/Lobules: The walls of the sinus are thickened and porous and the interior of the sinus contains lobules of white bone. It should be noted that whilst Boocock et al. (6) note this bone change as being sometimes present, they do not list it specifically as part of their diagnostic criteria. As such, most subsequent studies using Boocock et al. do not include it as part of the original diagnostic criteria.
6. Plaque: A deposition of smooth and dense or porous bone on the sinus walls.
7. Cysts: Hemispherical depression with a smooth interior surface into the bone.
8. Hole: An opening with a rounded margin that has formed due to tooth roots penetrating the sinus floor.
9. Other: Changes not otherwise described by Boocock et al. (6) In the described case the presence of accessory maxillary ostium (AMO) was considered as an additional sign related to maxillary sinusitis in accordance with several investigators who have showed results supporting that the AMO are maxillary sinus perforations caused from maxillary sinusitis (12, 13)

Our findings met the modified Boocock et al. diagnostic criteria summarized by Lee et al. (7) with two exceptions – lack of remodeled spicules and a plaque. The presence of 7 from 9 criteria confirmed by using both visual and segmented X-ray evaluation gives some certainty in diagnosis, namely bilateral maxillary sinusitis. The added value of the described rare finding is that this is only the second case of maxillary odontogenic sinusitis for Bulgaria and the diagnosis is based on both visual observation and use of medical imaging. This case also emphasizes on the need for meticulous maxillary sinus(es) evaluation when dental pathology is presented on skeletal

remains which is not a common practice in Bulgaria.
In this study, we were guided by the suggestions of Lee et al. (7) who consider that additional researches into sinusitis in archaeological populations outside of Western Europe and USA are required to enrich the exiting metadata. We also met their suggestion to evaluate the pathological changes using both macroscopic observation and medical imaging which Lee et al. consider advantageous to palaeopathology as a whole.

Declaration of Interest

The authors declare no conflict of interest.

Author Contributions

Conceptualization - G.T and M.M.; methodology - G.T.; validation - M.M.; investigation - G.T.; formal analysis - G.T and M.M.; writing—original draft preparation - G.T.; editing - G.T. and M.M; visualization - G.T.; All authors have read and agreed to the published version of the manuscript.

Statement on the use of artificial intelligence in manuscript preparation

Artificial intelligence was not used in the preparation of this manuscript.

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