BIOARCHAEOLOGICAL ANALYSIS OF A 17TH CENTURY HUMAN SKELETON DISCOVERED IN THE SITE "ROSENSTEIN HOUSE" (PALAT 4 ST.) IN IAŞI (ROMANIA)

BY

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Abstract*:*
In this study, the authors present a human skeleton of 17th century discovered in the site "Rosenstein House" (Palat 4 Street) from Iași City (Romania). The skeleton is originated from an inhumation grave, and it was excavated in 2023 by archaeologists from the Institute of Archaeology of the Romanian Academy - Iaşi Branch.
In this study, classical paleoanthropological and paleopathological evaluations were done, as well assessment of, dental wear, and nonmetric dental traits. Estimations of age at death (i.e., 35-40 years old; middle adult) and sex (i.e., female) were performed according to classic methodology. The few morphometric data that were taken did not allow establishing an anthropological type for the skeleton.
The dentition is characterized by moderately advanced and advanced wears, with several antemortem tooth loss, and chipping in the anterior teeth. Also, this individual stands out for an asymmetry in the disposition of the teeth on the jaw, especially the posterior ones, a situation due to a possible agenesis of the right first upper molar or its loss from very early childhood.
Several pathologies/anomalies have been identified, such as dental caries, dental calculus, unilateral edentia, cribra orbitalia and xiphisternal junction.
Keywords*: bioarchaeological analysis; human skeleton; 17th century; "Rosenstein House"; Iași (Romania).*

INTRODUCTION

The preventive archaeological research[1], required for the implementation of street modernization works in the municipality of Iași (Romania), in the area between "Sf. Andrei" street, "A. Panu" boulevard, "Palat" street, "Sf. Trei Ierarhi" street and "Trantomir" street, led to the discovery an isolated grave (Fig. 1.a,b).

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[1] BILAVSCHI *et al.* 2023: 568-574.

The area subjected to preventive archaeological research is located on the upper terrace of Bahlui, right in front of the former Royal Courts and the Administrative Palace from Iași, from where the medieval town developed.

The funerary complex (Cx2) was discovered in Unit 13, located north-east of the Rosenstein House foundations, and dated with two coins from the first half of the 17th century. The both coins were found on the level of the deceased, with no immediate connection to it, but sufficiently correlated to provide a date. The skeleton was oriented NW-SE, and its posture shown an intentional deposition, lying down, face S-E and hands on the sternum (Fig. 2). The grave of 17th century has been cut by another modern one, so the bones of lower limbs in older skeleton were completely missing.

This study is focused on the bioanthropological analysis of the isolated skeleton (codified – Cx2/13) discovered in the "Palat" 4 street – "Rosenstein House", Iași City (Romania).

Material and Methods

In the present paper, we describe the human skeleton originated from an inhumation tomb and codified with Cx2/13. The study of the skeleton was preceded by a process of bone restoration to allow the morphoscopic analysis, recording of biometric data, estimation of age at death and sex, as well as a paleopathological analysis.

The biological age at death was estimated combining different criteria: pubic symphysis degeneration and sacroiliac surface transformation[2], changes in the spongy tissue from the humeral epiphyses, involution in the skeleton and the sternal rib morphology, specific pathological processes associated with age[3], dental attrition data[4], and cranial suture obliteration[5].

The estimation of the sex was based on the following aspects: the development of bone relief, shape and inclination of the forehead, size of mastoid apophysis, the mandible robustness, the teeth shape and size[6], the pelvis characteristics[7], the development of the muscle insertions, the size of the joint surfaces, the skeleton's massiveness and robustness[8].

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[2] BROOKS, SUCHEY 1990: 227-238; BUIKSTRA, UBELAKER 1994: 10-32; SCHMITT 2005: 89-101.

[3] IȘCAN, LOTH, WRIGHT 1984: 1094-1104; UBELAKER 1979: 72-80.

[4] BROTHWELL 1981: 59-72; LOVEJOY 1985: 47-56.

[5] BUIKSTRA, UBELAKER 1994: 10-32.

[6] WALRATH, TURNER, BRUZEK 2004: 132-137.

[7] BRUZEK 2002: 157-168; FEREMBACH, SCHWIDETZKY, STLOUKAL 1979: 7-45.

[8] UBELAKER 1979: 72-80; BUIKSTRA, UBELAKER 1994: 6-21.

Fig. 1. Location of the of archaeological site in the center of Iași ("Palat" 4 street).

Fig. 2. Skeleton Cx2/13 *in situ* ("Palat" 4 Street – "Rosenstein House");
(Photo: archaeologist Cătălin Hriban).

The anthropometric and conformational analysis was based on the Martin and Saller techniques[9], whereas for size evaluation we used the dimorphic scales of Alexeev and Debetz (1964)[10]. Morphoscopic observations were recorded and analyzed based on the methods suggested by Olivier (1969)[11]. Stature was calculated based on the dimensions of humeri, radii and ulnae, using the dimensional scales proposed by Manouvrier (1893)[12], Breitinger (1938)[13], Trotter, Glesser (1951; 1952; 1958)[14], Bach (1965)[15]. Paleopathological literature was also consulted[16].

[9] MARTIN, SALLER 1956-1966.
[10] ALEXEEV, DEBETZ 1964.
[11] OLIVIER 1969.
[12] MANOUVRIER 1893: 347-402.
[13] BREITINGER 1938: 249-274.
[14] TROTTER, GLESSER 1951: 311-324; TROTTER, GLESSER 1952: 469-514; TROTTER, GLESSER 1958: 79-123.
[15] BACH 1965: 12-21.
[16] AUFDERHEIDE, RODRIGUEZ-MARTIN 1998; ORTNER 2003.

DENTAL WEAR EVALUATION

The dental material belonging to the Cx2/13 skeleton was prepared for imaging according to the steps proposed by Mahoney (2006)[17]. Dental surfaces were digitized using a Carl Zeiss Stemi 305 with an attached camera. The occlusal/ incisal dental macrowear was assessed using ordinal scales proposed by Smith (1984) for incisors (I), canines (C), premolars (P), and by Scott (1979)[18] for molar teeth (M). According to attributed scores, the teeth were grouped into categories: teeth with invisible or very small wear facets (Scott scale: 4-9; Smith scale:1-2), teeth with moderately advanced wear facets (Scott scale: 10-22; Smith scale: 3-5), and teeth with highly advanced wear facets (Scott scale: 23-40, Smith scale: 6-8)[19]. The percent of dentine exposure (PDE %) was calculated for the maxillary molars according to the literature[20]. Dental inspection also followed the postmortem and antemortem tooth losses and a special type of dental wear (i.e., chipping). Antemortem chipping was identified based on morphological features such as color and smooth edges[21].

The evaluation of dental traits and scores was carried out following to the Arizona State University Dental Anthropology System (ASUDAS)[22]. Non-metric traits represent phenotypic models of dental enamel that result from morphogenesis processes, and they are regulated by the individual genome. They are stable in time and have a high state of preservation[23]. They can be positive structures (i.e., accessory cusps, tubercles, or crests) and negative (i.e., grooves). Also, features as the number, position and size of the cusps and roots are considered non-metric traits.

2D Geometric morphometric analysis (GM) and Principal Components Analysis (PCA) were used to characterize the upper molars (i.e., UM1, UM2). GM is a method to study the shape variation on basis the landmarks utilizing Cartesian landmark coordinates[24]; it presents the advantage that all spatial relations among landmarks are preserved and can be mapped back into physical space. Two landmarks type 1 on the occlusal surface and 30 semilandmarks on the molar crown periphery were used. Samples of the upper molars (i.e., UM1, UM2) belonging to adult females from the same region (i.e., "Vovidenia Church" and "Sf. Atanasie" sites of Iaşi) and period (i.e., Late Medieval Ages) were used as comparison material.

RESULTS AND DISCUSSION

SKELETON STATE OF PRESERVATION

The skeleton Cx2/13, belonging to a female of 35-40 years old (middle adult), is incomplete, and the preservation status of bones is approximately satisfactory[25]. The cracks that led

[17] MAHONEY 2006: 39-44.

[18] SCOTT 1979: 213-217.

[19] TOMCZYK *et al.* 2014: 103-115; TOMCZYK, ZALEWSKA 2016: 49-57; TENCARIU *et al.* 2022: 1-18.

[20] PETRARU, BEJENARU, POPOVICI 2022: 77-92; GÓRKA, ROMERO, PÉREZ-PÉREZ 2016: 257-264; GALBANY *et al.* 2014.

[21] SCOTT, WINN 2011: 723-731.

[22] TURNER 1991.

[23] MARADO, CAMPANACHO 2013: 24-39.

[24] WEBER, BOOKSTEIN 2011: 423.

[25] BELLO *et al.* 2016: 24-38.

to the fragmentation of some skeletal elements are produced postmortem. At the level of the occipital and the right parietal there are traces of petrified soil (Fig. 3.a).

The neurocranium was partially reconstructed (Fig. 3.a). The facial skull is incomplete, missing the left orbit, left zygomatic and left malar (Fig. 3.b). The dentition is incomplete, with isolated teeth in the alveoli (Fig. 3.b,c).

Postcranial skeleton is incomplete and fragmented due to taphonomic causes, the following bones being preserved: the scapulae (incomplete), sternum, clavicles (Fig. 3.d), coxal bones (incomplete), sacrum (Fig. 3.e), the humeri, radii, ulnae (Fig. 3.f), cervical, thoracic, and lumbar vertebrae (Fig. 3.g), costal fragments (Fig. 3.h), carpals, metacarpals and hand phalanges (Fig. 3.i). The bones of lower limbs were missing.

BONE MORPHOMETRICAL DATA

The maximum cranial breadth presents a very large size (*eu-eu*: 147 mm). The forehead is moderately blunt. Regarding the degree of occipital curvature, the skull presents a bulgy and short occipital. The width of the occipital (*ast-ast*: 113 mm) belongs to the very big-sized category. The occipital-parietal index is medium-sized (77.00 i.u.). The shape of the neurocranium in norma occipitalis is the one of "house".

The zygomatic (right) have moderate dimensions. The mastoid process is not voluminous. The nose is small in width and height (al-al: 21.5 mm; n-ns: 47 mm) belonging to the leptorrhine category (45.74 i.u.), with pyriform aperture, with a slight prenasal fossa; the right orbit is of hypsiconch type – 92.31 i.u. (the width of the orbit – mf-ek: 39 mm; the height of the orbit: 36 mm).

The upper jaw has a deep palate (brachystaphyline – 63/62: 97.46 i.u.), with a paraboloid-divergent dental arch.

The mandible, with a high and thick horizontal ramus ($69_{(1)}$: 26 mm; $69_{(3)}$: 12 mm), presents a high robustness index ($69_{(3)}/69_{(1)}$: 46.15 i.u.); the mentum, with a button shape, is marked, the gonions are slightly outlined, in the same plane as the ramus.

The postcranial skeleton is gracile with poorly marked muscular insertion surfaces; the humeri, based on the section index, belong to the eurybrachic type (right bone – 78.57 i.u., and left bone – 77.19 i.u.).

The stature, estimated by considering the length of the humeri, radii and ulnae is of about 151 cm, which corresponds to the sub-middle female category. The anthropological type could not be determined.

Fig. 3. Skeleton Cx2/13, ♀, 35-40 years old: a. neurocranium (incomplete) – occipital view; petrified soil on occipital and right parietal; b. facial skull (incomplete); c. mandible with isolated teeth; d. scapulae (incomplete), sternum, clavicles; e. coxal bones (incomplete) and sacrum; f. humeri, radii, ulnae; g. cervical, thoracic and lumbar vertebrae; h. costal fragments; i. carpals, metacarpals and hand phalanges.

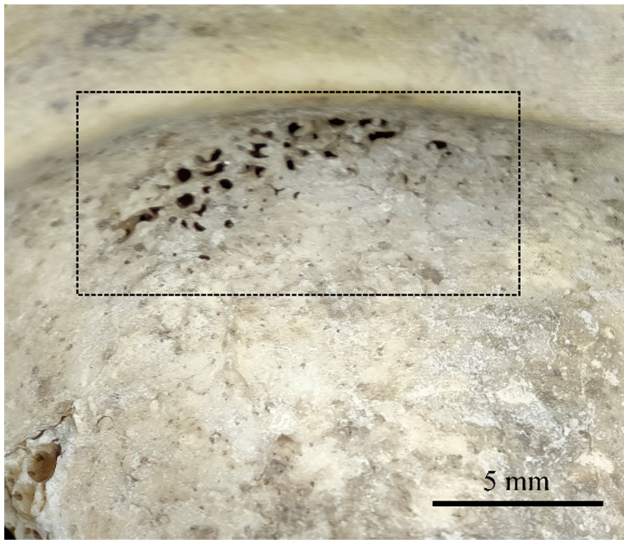

Fig. 4. Cribra orbitalia (1st degree) on the right orbit.

Fig. 5. Sternum – xiphisternal junction.

Bone pathologies/abnormalities

Cribra orbitalia (exocranian orbital porosity) appears as a point-like corrosion of the external compact layer of the orbital roof and the thickening of the spongy bone layer[26]. The presence of this porosity alludes to an iron deficiency in the organism, due to insufficient dietary intake of iron or an environment laden with pathogenic agents[27]. In the case in which there is no additional proof to support this deficiency (such as an histological survey), experts recommend caution when establishing a final diagnosis of iron deficiency anemia. Thus, in the absence of exact diagnosis methods, other than simple morphoscopic examination, cribra orbitalia is a non-specific indicator of diseases[28]. In this case, the cribra orbitalia (1st degree) was identified at the right orbit (Fig. 4).

Xiphisternal junction. The xiphoid process is the narrowest part of the sternum and represents the unossified mesosternum which projects from the posterior border. It is a single midline process with tapering lower end, can be deviated to any one side, it can be either incurved or curved outside, it can be bifid or with an opening. It articulates with the lower end of the mesosternum. First chondrosternal joint is an unusual variety of synarthroses. The xiphis cartilaginous joint, undergoes synostosis at a later age i.e., above 40 years or remains separate throughout life[29].

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[26] KOZAK, KRENZ-NIEBAŁA 2002: 75-82.
[27] STUART-MACADAM 1992: 39-47.
[28] WAPLER, CRUBEZY, SCHULTZ 2004: 333-339.
[29] PRATHAP KUMAR, KULKARNI, KULKARNI 2014: 7159-7164.

INVENTORY OF TEETH AND DENTAL WEAR

Dentition of the Cx2/13 skeleton was incomplete. Three teeth were postmortem lost (i.e., right upper canine = C, right second upper incisor = I^2, and the left first upper incisor = I^1), as it is suggested by presence of dental alveoli. The antemortem tooth loss (AMTL) was marked when the alveolar bone was clearly resorbed until the complete closure of the alveolar socket. Several teeth were lost during the life of the individual, especially posterior ones on the right arcade of the mandible. Teeth lost during life were localized also on the upper jaw (right first incisor = I^1). A special case of antemortem tooth missing is of the right first upper molar (M^1) (Figure 6), and we assume two factors causing that: the tooth agenesis or its loss early during life; this case is detailed in the section describing the dental morphology.

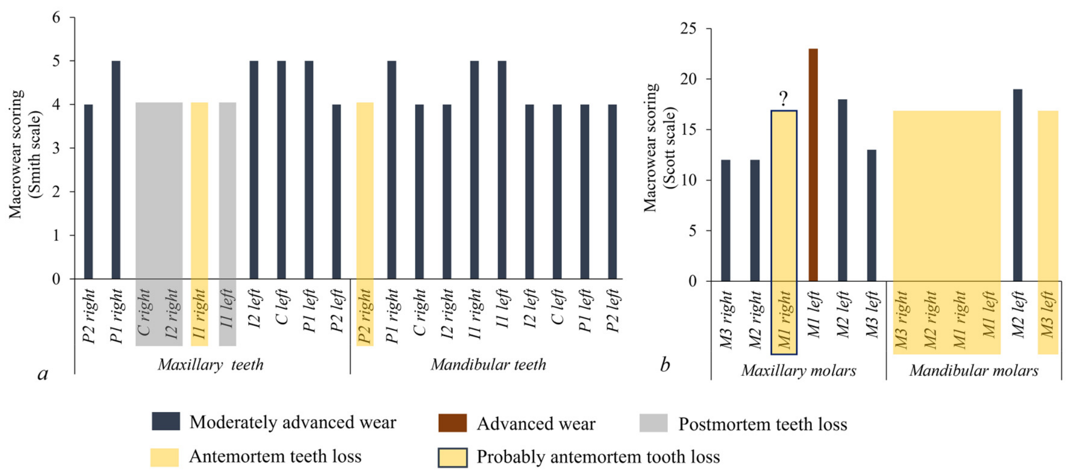

Fig. 6. Inventory of teeth and dental wear in Cx13/2 female skeleton.

The macrowear scoring results show that two grades of wear are identified in the analysed skeleton dentition (i.e., moderately advanced wear, and advanced one). Except for the left first upper molar (M^1), all maxillary and mandibular teeth exhibit a moderately advanced wear (Smith scores: 4-5, Scott scores: 12-19). The left first upper molar (M^1) shows an advanced occlusal wear (Scott score: 23). The left second upper molar (M^2) is characterized by a higher dentine exposure in comparison with his antimeres. The left second upper molar (M^2) has a percentage of dentine exposure of 2.38%, while his antimere has no dentine exposure. This is probably associated with the early loss of all three right mandibular molars, which represent the antagonistic teeth for the right maxillary molars.

The antemortem tooth loss (AMTL) can be triggered by several factors including odontopathies, excessive wear, trauma[30]. According to MOUNTAIN *et al.* 2021[31], due to female reproductive biology, females are more prone to AMTL than males. In our study, AMTL mainly affects the mandibular posterior teeth (i.e., molars and the right P_2 premolar). In the posterior teeth,

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[30] MOUNTAIN *et al.* 2021: 716-726; TROMBLEY *et al.* 2019: 253-269.

[31] MOUNTAIN *et al.* 2021: 716-726.

the AMTL is corelated with high dental wear and caries[32]. The dentition in Cx2/13 skeleton is characterized by the AMTL of anterior teeth (i.e., first right incisor I^1), and, according to MOLNAR (2011)[33], the loss of anterior teeth is linked to extramasticatory activity and less to dental caries. Also, on the first right lower incisor (I_1) crown a special type of wear (i.e., chipping) was identified (Fig. 7). This type of enamel fracture is formed when a high pressure is applied on tooth, in our case on the mandibular first incisor, which could be more correlated with the non-masticatory activities also considering the absence of his antagonist tooth[34].

Fig. 7. Dental chipping (arrow) on the first right lower incisor (I_1) of the Cx13/2 skeleton.

The occlusal/ incisal dental wear is an age-dependent process, being influenced by several factors including diet, and it takes place over an individual's life[35]. The dentine exposure patterns represent an important research tool for paleoanthropologists to provide indirect information about paleodiet, more accurate regarding the diet abrasiveness and hardness and food processing[36]. The dentition in Cx2/13 skeleton is described by moderately advanced wear and an advanced wear considering the estimated age at death (i.e., 35-40 years old).

DENTAL NON-METRIC TRAITS

Upper and lower anterior teeth (including incisors and canines) are not scored for any non-metric trait, they are having a simple morphology. Instead, in the posterior dentition (upper and lower, including premolars and molars), several traits could be visualized.

The upper and lower premolars are of typical morphology in terms of accessory cusps or ridges. The upper molars have morphology with 4 cusps and with a hypocone reduced.

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[32] MOLNAR 2011: 681-689.

[33] MOLNAR 2011: 681-689.

[34] BELCASTRO *et al.* 2018: 96-108; NIKITA 2016.

[35] PETRARU, BEJENARU, POPOVICI 2022: 77-92; FIORENZA *et al.* 2018: 153-161.

[36] GÓRKA, ROMERO, PÉREZ-PÉREZ 2016: 257-264; PETRARU, GROZA, BEJENARU 2018: 45-54.

We notice the difference in the shape of the molars on the two arches of the maxilla (i.e., left and right). In our opinion, on the right, the molar following UP2 (second upper premolar) resembles the morphology of an UM2 (second upper molar) rather than an UM1 (first upper molar). To support this idea, the shape of this molar was compared with those of UM1 (upper first molar) and UM2 (second upper molar) belonging to medieval adult females from other samples in the same region. The use of geometry morphometrics allowed the comparison and visualization of the dental shape, confirming our hypothesis. This tooth fits in size and shape with UM2 (second upper molar) found in other female skeletons of the same age and period.

As can be visualized on the PCA graph (Fig. 8), the model described by the tooth named ***UM2?*** (second upper molar?) is a mesiodistal flattened one, with protocone and paracone elongated lingually and buccally, respectively. Also, this tooth has a reduced hypocone.

Modifications in the positioning of UM2 (second upper molar) in the dental arch can also be found in specialized literature[37]. Changes reported as resulting from the loss of permanent first molars are represented by inclination of adjacent teeth to the area of loss[38], midline deviation[39], distal migration of lower canines with incisor migration[40], lingual inclination of lower incisors[41] etc. So, placing of *UM2?* (second upper molar?) after UP2 (second upper premolar) may be due to the lack of the adjacent tooth (UM1, first upper molar) that allowed it to occupy more space by turning and placing itself more horizontally (torsion of the tooth in the socket). Also, the interdental spaces obvious on the right side can be the result of these displacements of the teeth (Fig. 9).

The UM2 (second upper molar) could have taken the place of UM1 (first upper molar) in the following situations: a) the UM1 (first upper molar) tooth was lost antemortem, and in this case it would have to happen in childhood and before the eruption of the second molar (which occurs at age 12); b) an agenesis of UM1 (first upper molar) was occurred, but we have no evidence for this. A dental x-ray is necessary, but this time it is not the subject of our study.

In the mandible we notice an antemortem loss of most the posterior teeth; there are find only fragments of the right LP1 (first lower premolar) and left LM2 (second lower molar).

The anterior fovea is a trait expressed on the mesial aspect of the trigonid of the lower molars. This trait, observed on LM2 (second lower molar), is presented in the form of essential ridges on trigonid better developed, as is marginal ridge (score 2, according to TURNER 1991)[42].

The groove pattern is defined by how the cusps contact in the lower molar central fossa[43] and it is determined by the relative sizes of cusps[44]. The pattern of the cusps, the contact between the protoconid and the entoconid corresponds to the *x* groove pattern.

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[37] CARDOSO, MECENAS, NORMANDO 2022: 32.

[38] NORMANDO, CAVACAMI 2010: 100-106; TELLI, AYTAN 1989: 138-143; SABRI 2021: 682-692.

[39] NORMANDO *et al.* 2003: 15-23.

[40] NORMANDO *et al.* 2003: 15-23.

[41] NORMANDO, CAVACAMI 2010: 100-106.

[42] TURNER 1991.

[43] TURNER 1991.

[44] DAHLBERG 1963: 149-177.

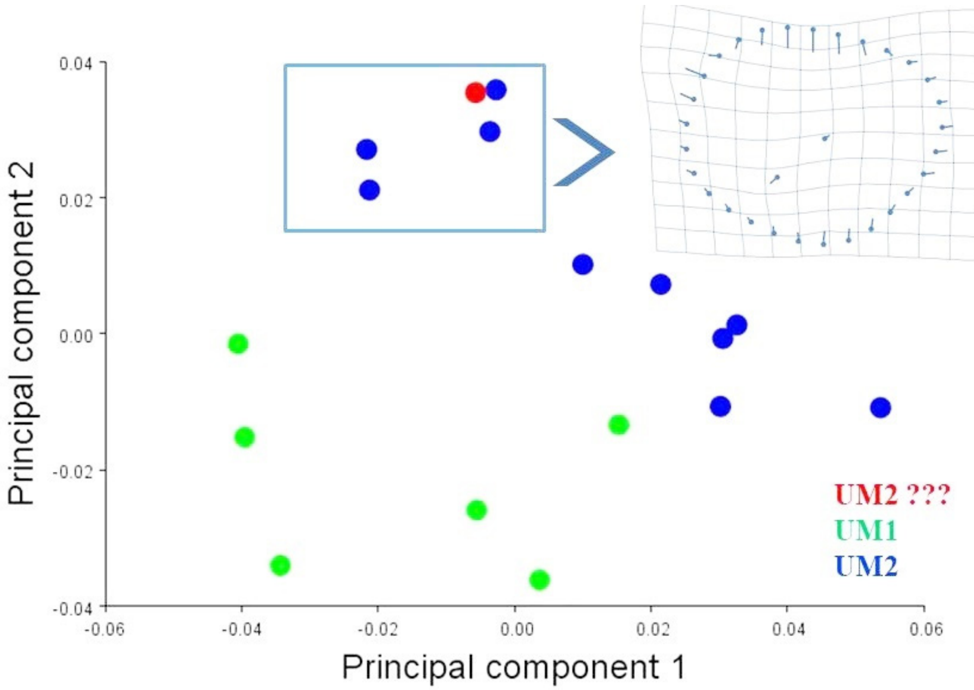

Fig. 8. Patterns of UM1 (first upper molar) and UM2 (second upper molar) variation in the morphospace derived from PCA, based on covariance matrices of Procrustes Coordonates.

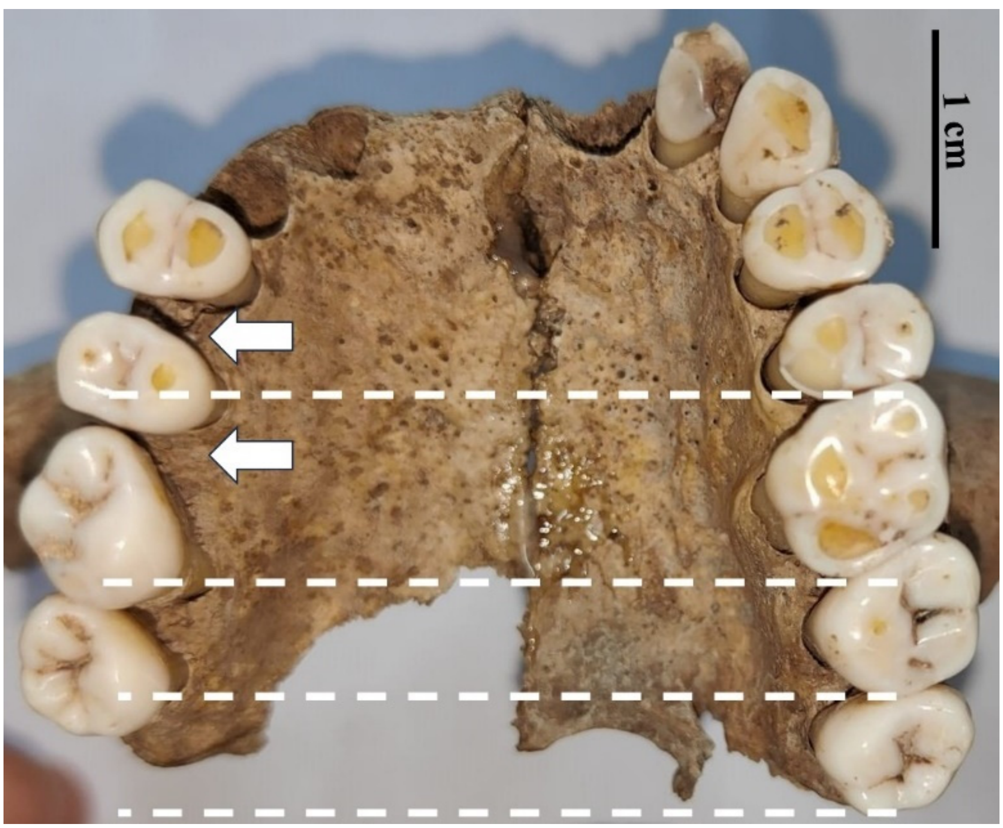

Fig. 9. Maxillary dental arcad: dotted line – asymmetry of molar alignment in the distal plane; white arrow – interdental space.

DENTAL PATHOLOGIES/ABNORMALITIES

Dental calculus or plaque (grey-white mineralized plaque composed primarily of calcium phosphate) is firmly attached to the dental surface. Depending on the positioning on the tooth crowns or exposed roots, dental calculus can be supragingival or subgingival[45] Calculus should be reported as "0" (absent), "1" (small amount), "2" (moderate amount), "3" (large amount)[46]. At the level of the first and second lower incisors - I_1, I_2 (right and left) on the labial and lingual surface is present supragingival dental calculus (moderate amount – "2") (Fig. 10).

Fig. 10. Supragingival dental calculus (moderate amount – "2"): first and second lower incisors (I_1, I_2) (right and left) on the labial and lingual surfaces (isolated teeth).

Dental caries has a multifactor etiology, presenting various degrees of gravity, from opaque stains to large cavities affecting the teeth[47]. Bioarchaeological studies use the frequency of dental caries as a nonspecific indicator of the eating behaviour[48]. POWELL (1985)[49] indicates that the main factors influencing dental caries are environmental factors (oligoelements present in food and water), pathogenic agents (bacteria causing diseases), other exogenous factors (diet, oral hygiene) and endogenous ones (teeth shape and structure). In our case, dental caries affected the right lower canine (Fig. 11.a), second left upper incisor (I^2) (Fig. 11.b) and left upper canine (Fig. 11.c).

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[45] WALDRON 2009.

[46] BROTHWELL 1981.

[47] ROBERTS, MANCHESTER 1995: 45-47.

[48] TEMPLE 2011: 107-117.

[49] POWELL 1985: 307-338.

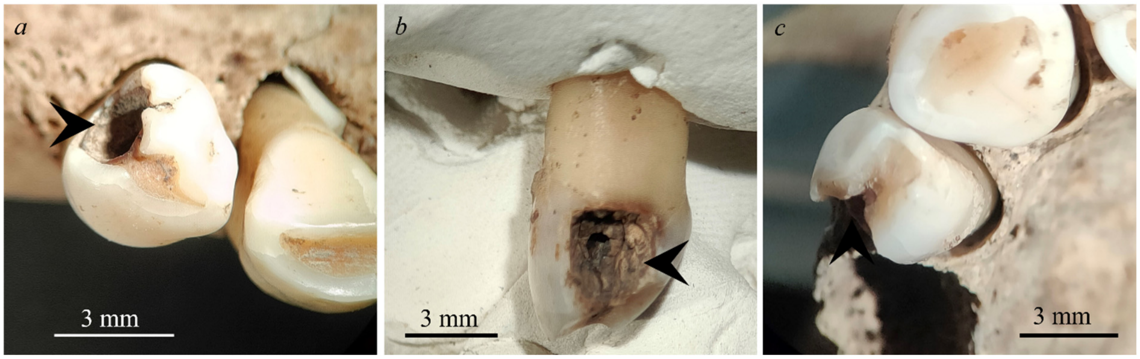

Fig. 11. Dental caries – interproximal (2nd degree): a. in the right lower canine (2nd degree); b. second left upper incisor (I^2); c. left upper canine.

Edentia refers to the partial or total absence of teeth in the oral cavity, caused by their falling after eruption due to several factors. The main cause for edentia is represented by the dental caries and its complications. There are also other disorders, such as infections of the soft tissues or bone tissues (osteomyelitis), tumors or facial traumas which can cause edentia[50]. Edentia can be frontal (missing incisors and canines, with interlaced spaces), lateral (missing premolars and molars, where the spaces can be unilateral or bilateral), terminal (uniterminal or biterminal), mixed (interlaced and terminal spaces), subtotal (with 1-2 remaining teeth), or complete affecting both the upper and the lower jaw[51]. In this case edentia was discovered at the level of mandible and it is of unilateral type (Fig. 12).

Fig. 12. Mandible with unilateral edentia.

[50] IONESCU 2005.

[51] ŞTEFĂNESCU 2007.

CONCLUSIONS

This study provides information concerning the age at death, sex, size and morphology, dental wear, non-metric dental traits, pathologies/abnormalities on a human skeleton of 17th century discovered in the site "Rosenstein House" ("Palat" 4 street, Iaşi City, Romania). This skeleton (Cx2/13) was attributed to a female of 35-40 years old, with a height of about 151 cm. The morphometric data are few and the anthropological type could not be determined.

The Cx2/13 dentition is characterized by moderately advanced and advanced wears, with several antemortem tooth loss, and chipping in the anterior teeth.

The high degree of dental wear and missing teeth did not allow the accurate visualization and evaluation of all non-metric characters. A simple morphology in terms of accessory cusps and forms can be assumed. This female individual stands out for an asymmetry in the disposition of the posterior teeth on the maxilla, due to a possible agenesis of the 1st upper right molar or to a loss of it from very early childhood.

Supragingival and subgingival dental calculs are present at the level of the first and second lower incisors (I_1, I_2), on the labial and lingual surfaces. Dental caries are signalled in the right lower canine, second left upper incisor (I^2) and left upper canine. Also, unilateral edentia, cribra orbitalia on the right orbit, and xiphisternal junction were identified on the Cx2/13 skeleton.

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