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Palaeopathological study of five individuals from the Late Antiquity cemetery at Dravlje

Paleopatološka študija petih skeletov iz poznoantičnega grobišča pri Dravljah

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Abstract

Skeletal remains from archaeological contexts represent a good source of information about the human past. As part of the osteological analysis, palaeopathology plays an important role, significantly complementing the biological profile of an individual and demographic structure of the studied population. Nevertheless, it seems that palaeopathological studies in Slovenia are rather scarce. Thus, the presented results of the osteological and palaeopathological analysis of five skeletons from Late Antiquity cemetery at Dravlje represents a step towards filling this gap.

In addition to basic biological profiles of individuals, the observed pathological changes and other skeletal variations are described and possible diagnoses presented. Despite a small number of analysed skeletal remains, there was an abundance of observed anomalies. This clearly shows how significant palaeopathological studies are for understanding the society, while at the same time confronting researchers with numerous new questions. Besides congenital skeletal variations, such as septal aperture or a high number of pyramidal molars, intentional cranial deformation and numerous pathological changes, from benign tumours and teeth diseases, possible metabolic diseases and bacterial infection to joint diseases, early tissue ossification and unusually high number of torticollis were observed.

The limited number of analysed skeletal remains does not allow the gathered conclusions to be applied to the whole population. Nevertheless, it is obvious that people living in that society had some unusual customs, health issues and/or were of different ethnicity.

Izvleček

Proučevanje skeletnih ostankov v arheološkem kontekstu je izredno bogat vir informacij o človekovi preteklosti. Pri tem igra paleopatologija posebno vlogo, saj pomembno dopolnjuje biološke profile posameznikov in demografsko sliko družbe. Kljub temu se dozdeva, da so paleopatološke študije v Sloveniji še precej redke. Prispevek z rezultati osteološke in paleopatološke analize petih skeletov s poznoantičnega grobišča iz Dravelj je tako korak k zapolnjevanju te vrzeli.

Ob osnovnih bioloških profilih posameznikov raziskovalec opisuje opažene patološke in druge posebnosti na obravnavanih skeletih ter predstavi možne diagnoze. Kljub majhnemu številu analiziranih skeletnih ostankov se je namreč opazilo precej anomalij, ki na eni strani opozarjajo, kako paleopatološke študije prispevajo k razumevanju skupnosti ter hkrati odpirajo številna nova vprašanja. Poleg prirojenih skeletnih variacij, kot je denimo predrti olekranon ali nenavadno veliko število piramidalnih kočnikov, smo ugotovili tudi namensko preoblikovanje lobanje ter številne patološke spremembe, od neškodljivih tumorjev in težav z zobmi, morebitnih presnovnih bolezni in bakterijskih okužb do bolezni sklepov in osifikacije tkiv že v mladosti ter npr. nenavadno velikega števila primerov tortikolisa.

Ker se analiza omejuje le na pet skeletov, ne omogoča prenosa zaključkov na celotno populacijo. Očitno pa je, da so imeli ljudje v obravnavani skupnosti precej nenavadnih običajev, dosti zdravstvenih težav ali pa morda pripadajo različnim »etničnim« skupinam.

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1 Introduction

The human skeleton is a good source of information about an individual or society and plays a particularly important role in the bioarchaeological profession and in understanding the human past (1,2). However, although the study of skeletal remains from historical and prehistoric periods in Slovenia has a relatively long history (1), its sub-branch, palaeopathology, seems to be somewhat neglected.

Palaeopathology studies congenital or acquired diseases and traumas by analysing human remains in an archaeological context, especially in the area of teeth and bones, and occasionally other tissues, and thus focuses on the clinical picture of people from past societies (2,3). Through a multidisciplinary approach to analysing the remains of individuals, populations and diseases on the one hand, and external factors related to lifestyle on the other, it seeks to shed light on the health problems of people in the past and their causes. Health problems have a significant impact on the life of an individual, one's relationships with other people and thus on the development and functioning of society as a whole (2). This is especially evident in the cases of various epidemics (4-6) and at major civilizational transitions, such as the development of agriculture and livestock farming (7-10), the Industrial Revolution (11-14) and modern globalization with the rise of degenerative and infectious diseases (2,15). Awareness of the impact of such conditions on society and the clinical picture helps to understand both the past and the present society and its future (16,17). However, in palaeopathological studies, there are limitations brought by interpretations obtained solely on the basis of the study of the remains and archaeological and historical sources. It is necessary to take into account the osteological paradox when researching the clinical picture of a population based on the deceased, the limited ability of skeletal tissues to respond to diseases and injuries, and it is difficult or even impossible to identify diseases which due to the acuteness or nature of their development did not affect skeletal tissues, to study limitations with the availability of an integrated number of members of a particular society, limitations in age and gender estimation of individuals based on skeletal tissues, taphonomically induced changes, etc. (18-20).

Although the results of bioarchaeological and palaeopathological studies can contribute to a better knowledge of the past and thus influence the understanding of the development of disease, man and society (21,22), systematic palaeopathological studies are rare in our country. However, in order to start filling these gaps, we present the results of an osteological and palaeopathological study of the remains of five people from the Dravlje cemetery during the Migration Period. A study carried out for the purpose of presenting the Migration Period in Ljubljana at the new permanent exhibition of the City Museum of Ljubljana, called Ljubljana. History. City. showed many peculiarities and pathological changes on the examined skeletons. At the same time, it is good to present how even a small research, limited to a few individuals can offer an insight into the clinical picture and thus into the way of life of a community, while opening many new questions and opportunities for research.

2 Archaeological context

In the spring of 1968, a cemetery from the end of the 5th and the beginning of the 6th century was accidentally discovered in the hamlet of *Lakotence* near Dravlje. Archaeological excavations began in 1968 and lasted until the spring of 1969. A total of 49 graves were examined, although the cemetery is larger. The excavations did not reach the edges of the cemetery, and the limited archaeological research prevents an assessment of its extent.

Judging by the costume buried along with the deceased and the funeral habits, such as placing money into graves, the cemetery is defined as the cemetery of the Eastern Goths and natives (23). Skeletal remains were the subject of physical anthropology analyses in the 1970s. At that time, the damaged skulls were also reconstructed. The analyses of 49 skeletons at that time presented interesting results, for as many as 13 individuals had an intentionally modified skull, and in addition, heterogeneity in stature and skull shape was observed (23). Based on the results of past analyses, the remains of five individuals with allegedly modified skulls from graves 1, 19, 25, 38 and 41 were selected and re-analysed for verification of the results.

In addition to the bone remains, many parts of a costume were discovered in grave no. 1 (23). Remains of a gold thread ribbon were found on the frontal and parietal part of the skull. The iron object under the skull was probably part of a hairpin. On both sides of the neck lay glass and amber beads of a necklace, and at the left elbow lay a silver shackle. At the waist area lay a gilded bronze belt buckle, decorated using the grooving, punching and inlaying techniques, and below it traces of a leather belt. To the left and slightly lower than the belt buckle lay two cast bronze arched fibulae with five prongs, and to the right a heavily worn coin with a drilled hole in it that was minted during the reign of emperor Diocletian. On the finger of his right hand was a gold ring with embedded semi-precious stones - almandines, at the left knee were two pierced amber beads, and at each shin a silver terminal part, a kind of shackle.

In grave no. 19 (23), two iron knives, a torch and a needle were placed. On the skeletal remains, a small iron belt clip lay in the hip area. A single-edged iron sword was placed on the left side, and another iron knife was placed on top of it.

In grave no. 25 (23), a double-sided bone comb was placed. On the right side of the skeleton, at the height of the waist, lay a small silver belt buckle, and slightly below it, bronze tweezers. At the waist lay a rectangular belt buckle with preserved remnants of gilt, silver foil and almandines.

Under the left hip of the skeleton in grave no. 38 (23) there was an iron belt clip, and next to the right shin there was a double-sided bone comb, an iron knife and the remains of an unidentifiable iron object.

Under the skull of skeleton no. 41 (23) lay scattered amber and glass beads of a necklace. Between the body and the left elbow lay an iron belt clip, and close by was a medium-sized bead made of dark blue glass and a cast silver gilded arched fibula with five prongs. Between his knees lay two glass beads.

3 Methodology

Osteological and palaeopathological analyses were performed in accordance with internationally recognized standards

(24). First, data on the integrity (%) of the skeleton and its individual parts and the state of preservation of the skeletal elements were recorded (with a score of 1–5). Metric analyses were performed on well enough preserved skeletal elements (25). The methodology for age assessment at death and for sex assessment was adapted to the skeletal elements present, their state of preservation and the preliminary assessment of an individual's maturity at death. In accordance with the recommendations (26-28), an increased number of degenerative changes observed on the skeleton were taken into account in the age estimates. In the examined skeletons, the age assessment could be given on the basis of the erupted third molar (29), sternal end of the ribs (30-32), acetabulum, (33), pubic symphysis (34), sacroiliac joint surface (35,36) and tooth wear (37). Sex assessment was performed on the pelvis and skull, which are most prone to sexual dimorphism (26). Sex could be assessed on the basis of the shape of the greater sciatic notch and the presence of preauricural sulcus, as well as the prominence of the nuchal crest and glabella, the shape of the supraorbital ridge, the mastoid volume and the mental eminence (25). Due to bone damage the stature during lifetime could only be estimated in four cases. The stature was estimated using regression equations based on the maximum length of the femur and tibia and their combination, in the skeleton from grave 1 only the femur, as the tibia was not preserved well enough and the results give average values of all calculations.

Analyses focused on skeletal variations and pathological changes in the bones. The basic descriptions and possible diagnoses are based on the findings of Ortner (38) and Aufderheide and Rodriguez-Martin (39) and are supported by other literature cited in the examined case. We also performed standard measurements on the skulls (25), which are unreliable due to taphonomic damage and skull reconstruction. The reasons for the variations in the shape of the examined skulls are thus based mainly on the observation that the shape of the skulls visually differ from the normal shape, and the differences exceed the usual variability.

4 Results

Osteological analysis of five skeletons from Dravlje showed (Table 1) that two skeletons were male and two were female. In the case of the skeleton from grave 38, due to the discrepancy in morphological characteristics, it is unclear whether the skull really belongs to the postcranial skeleton, or whether a mistake was made (a mix-up) while stacking the material and therefore the skull belongs to a woman and the rest of the skeleton to a man. All five individuals were quite young, having died between the ages of 20 and 35. The stature of men was estimated at 172–180 cm ± 2.5 cm, and that of women at 167–171 cm ± 2.5 cm.

In all analysed skeletal remains skeletal variations and pathological changes on the skeleton were observed.

4.1 Grave 1

Probably a woman aged 20–25 years at the time of death and 168 ± 3 cm tall.

4.1.1 Skeletal variations

All the lower and upper molars present are single-rooted. The condition is not pathological, but it is a skeletal variation, as the lower molars usually have two and the upper even three roots.

The anterior surface of the distal part of the right tibial shaft is smoothed. The surface is not pronounced, but it is recognizable and indicates squatting facets, a consequences of prolonged squatting. When squatting, there is an extraordinary dorsiflexion and direct contact between the distal part of the tibia and the talar neck (Figure 1). Due to the pressure on the bone, it transforms over time (40).

Table 1: Review of results obtained by analysis of skeletal remains.

GRAVE	INTEGRITY	CONSERVATION	SEX	AGE	STATURE	PATHOLOGY	POSSIBLE PATHOLOGY	SKELETAL VARIATIONS
1	60%	4	F	23–25	168 ± 3 cm	undersized maxilla, tooth decay, ante-mortem tooth loss, sinusitis	scurvy	pyramidal molars, squatting facets
19	75%	4	M	23–25	179 ± 3 cm		torticollis, nonspecific inflammation of maxilla or scurvy	skeletal variations on the skull and humerus
25	70%	4	M	25–35	180 ± 3 cm	dental calculus, tooth decay, cyst, degenerative joint disease, inflammation of the femoral ligament	torticollis, scurvy	ossified thyroid cartilage and yellow ligament, asymmetry of the humeri and femurs
38	70%	4	?	29–35	171 ± 3 cm	tooth decay, periodontal disease	scurvy, tuberculosis	pyramidal molar, intentional modification of the skull, metopism
41	70%	4	F	23–25	preservation of long bones is too poor	button osteoma, degenerative joint disease	torticollis	skeletal variations on teeth and vertebrae

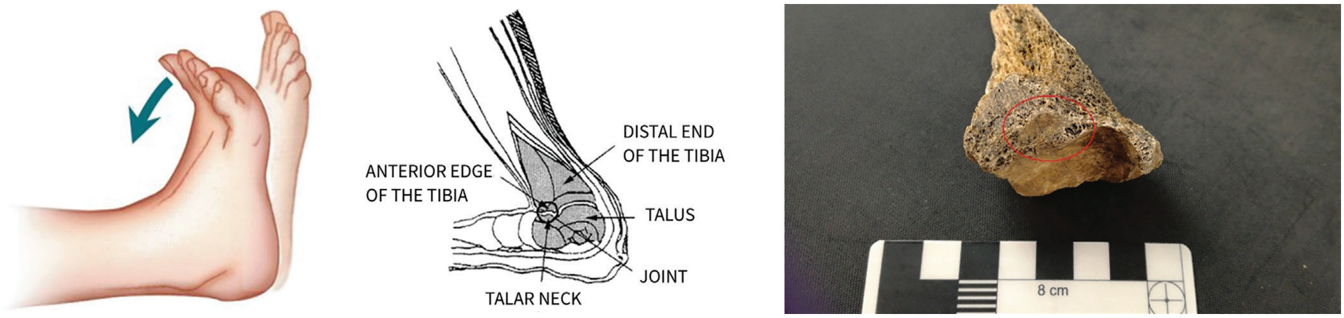

Figure 1: Dorsiflexion (left); the contact between individual skeletal elements (centre) (40); the smoothed surface on the tibia (right).

4.1.2 Pathological changes

The sockets of the maxilla indicate that the bone was too small, so the first premolar was moved forward and the second premolar slightly twisted. On the teeth, there are changes due to tooth decay at the cemento-enamel junction. The first and second lower molar had fallen out several years before death as the sockets were decomposed and overgrown with mature bone. In addition, new mature and immature bone formations are observed in the left sinus of the maxilla (Figure 2, left), indicating chronic inflammation, still active at the time of death. The reason for the inflammation cannot be determined, but it may be the secondary consequences of tooth decay or the spreading of the inflammation from the teeth to the soft tissue and eventually even to the bone (38).

Porosity and the formation of new, mature bone are observed in the palatal processes of the maxilla and at the transition to the alveolar bone (Figure 2, right). The greater wings of the sphenoid bone have 1-2 mm large macropores on the inner and outer surface. The combination of observed, otherwise very mild changes may indicate scurvy. Based on the absence of immature bone, it can be concluded that the disease was no longer active at the time of death. However, it cannot be ruled out that the changes do not reflect another metabolic disease or merely soft tissue inflammation. Periodontal disease could also be a reason, especially as maxilla is also involved (41).

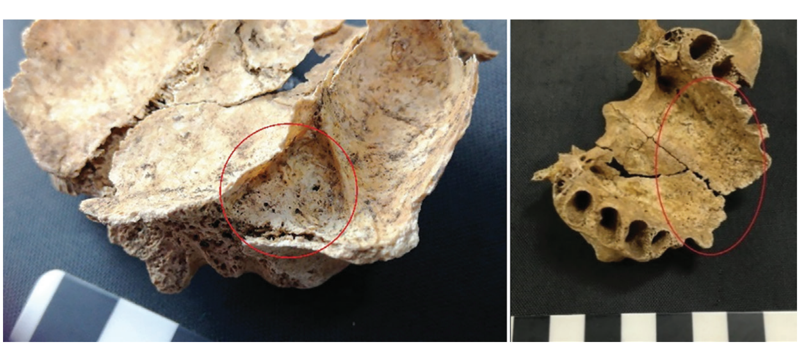

Figure 2: New, porous bone in the sinus of the maxilla (left); new, mature and porous bone on the palatal process of (right).

4.2 Grave 19

Probably a man aged 20–25 years at the time of death and 179 ± 3 cm tall.

4.2.1 Skeletal variations

The skull is slightly sinusoidal at the transition from the frontal bone to the parietal bone (Figure 3, left). Both humeri have perforations in a normally unperforated olecranon fossa (Figure 3, right). The observed skeletal variations are not pathological.

4.2.2 Pathological changes

Porosity and a new, mature bone are present in the palatal process of the maxilla. It may be a soft tissue inflammation that had spread to the bone, but the cause cannot be determined. Due to the absence of immature bone, the pathology was no longer active at the time of death.

Figure 3: Skull profile with a slightly sinusoidal transition from the frontal bone to the parietal bone (left); perforations in the deep recess of the humerus (right).

The skull is asymmetric (Figure 4). In the anterior part of the skull, the right supraorbital ridge is more pronounced than the left, while in the posterior part of the skull the left parietal bone is more pronounced than the right. The right side of the face is slightly higher than the left, and the entire right side of the skull looks as if it has been pushed forward. The wings of the sphenoid bone and cheekbones are shifted to the right. The asymmetry may be due to a wry neck or a so-called torticollis.

4.3 Grave 25

Probably a man, aged 25–35, 180 ± 3 cm tall.

4.3.1 Pathological changes

There is dental calculus on the lower premolar, and on the upper teeth there are changes on the first right incisor and second and third molar at cemento-enamel junction due to tooth decay. The socket of the first right molar is porous, a slight circular extension is visible at the site of the root tip. Probably the tooth was inflamed and the inflammation spread to the soft tissue and bone.

The skull is asymmetrical and broad, the transition from the parietal bones to the occipital bone is convex. The right supraorbital ridge is more massive, rounded, and positioned higher than the left (Figure 5, left). The left parietal bone is more pronounced than the right, while the coronal suture is symmetrical. The right mastoid is 5 mm wider and 2 mm longer than the left (Figure 5, right). The asymmetry may indicate a wry neck or torticollis.

On the inferior surface of the palatal processes of maxilla are the formations of new, mature, and porous bone. On the outer surface of the greater wings of the sphenoid bone, there are round macropores 1–2 mm in size with rounded edges. The combination of observed changes may indicate scurvy, but soft tissue inflammation or other metabolic disease cannot be ruled out.

Figure 4: View of the skull from above, visible displacement of the facial and occipital region forward and to the right (left); view of the skull from behind, an asymmetry is visible in the more convex left parietal bone with respect to the less convex right parietal bone (middle); view of the facial part of the skull from above, an asymmetry is visible in the more convex and forwardly displaced right supraorbital ridge compared to the left (right).

Figure 5: More massive and rounded, higher placed right and thin, sharp and lower placed left supraorbital ridge (left); comparison between the smaller left and the larger right mastoid (right).

The thyroid cartilage and yellow ligament of the posterior two thoracic and first two lumbar vertebrae are ossified (Figure 6).

The superior surfaces of the first three lumbar and the superior and inferior surfaces of the thoracic vertebrae are worn and porous. The pores have slightly rounded edges, in places modest formations of new bone can be seen (Figure 7, left). The articular surfaces of the head and distal end of the humeri, the right head of the radius (Figure 7, middle), the proximal and distal ends of the tibia and the distal end of the fibula are smoothed and porous, and the exposed spongy bone is also smoothed, in places modest formations of new bone are present. The changes indicate wear or degenerative joint disease.

The right humerus is more massive than the left, with a more pronounced insertion for the deltoid muscle (Figure 7, right). On the line between the trochanters of the left femur, formations of new, not yet fully mature bone are visible, indicating inflammation active at the time of death. The pectineal line on the posterior part of the left and right femur is pronounced. The individual appeared to have

Figure 6: Ossified thyroid cartilage (left); comparison between vertebra without ossified yellow ligament and vertebra with ossified yellow ligament (right).

Figure 7: Highly porous surface of the lumbar vertebra body (left); porosity on the head of the radius (middle); comparison between the larger right humerus with a pronounced insertion behind the deltoid muscle and the smaller left humerus with a barely visible insertion behind the muscle (right).

Figure 8: Profile of an elongated skull with a pronounced sinus shape at the transition from the frontal bone to the parietal bone (left); facial part of the skull with fused but clearly visible metopic suture (right).

used the right arm and left leg more. More pronounced use of the left leg also coincides with greater wear of the left auricular surface of the sacroiliac joint.

4.4 Grave 38

Probably a man aged 30–35 years at the time of death, 171 ± 3 cm tall.

4.4.1 Skeletal variations

The preserved upper right molar has only one root. The skull is irregularly shaped, the transition from the frontal bone to the parietal bone is sinusoidal. The posterior part of the frontal bone is slightly raised just before the coronal suture, and the anterior part of the parietal bone just behind the coronary suture is slightly sunken (Figure 8, left). The reverse pattern is seen on the inside of the skull, meaning the bone is not thickened. The metopic suture is fused but clearly visible (Figure 8, right). The skull was probably intentionally modified.

4.4.2 Pathological changes

On the upper first and third right molars, on both right premolars, and on the lower third and second right molars, there are changes at the cemento-enamel junction due to tooth decay. The upper left third molar had fallen out several years before death as the socket is decomposed and overgrown with mature bone. The edge of sockets is rounded and slightly porous, noticeably farther from the crown than usual, indicating the retraction of alveolar bone. In addition to the consequences of tooth decay, it can also be a periodontal disease.

On the first two lumbar and lower eight thoracic vertebrae, there are lytic lesions on the superior and inferior surfaces of the vertebral bodies. They are irregular in shape, up to 2 cm in size, reach up to 1 cm deep into the vertebral body and have rounded edges. With larger ones, there are also minor changes, and the bone is porous. The formation of new, mature bone is minimal, and the fusion of the trabeculae of the spongy bone is visible inside

Figure 9: Lumbar vertebra with lytic lesion (left); lytic lesion in the sacroiliac joint (middle); lytic lesion on the talar neck (right).

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Figure 10: Double perforation for nerves on the cervical vertebra process (left); double left joint surface on the atlas (right).

the vertebral bodies (Figure 9, left). On the right auricular surface of the sacroiliac joint there are oval, up to 1.5 cm large and up to 1 cm deep lesions. Due to taphonomic damage the edges are not preserved, but the fusion of the trabeculae of the spongy bone can be seen inside. The changes also correspond to the right sacroiliac joint surface on the sacrum (Figure 9, middle), as they overlay perfectly when placed in the anatomical position. On the medial posterior part of the articular surface of the talar neck and on the medial side of the calcaneal body, irregularly formed lytic lesions with partly rounded partly sharp edges, and inside fusion of the trabeculae of the spongy bone is seen, surrounded by a thin layer of immature bone (Figure 9, right). Lytic lesions in the affected skeletal elements may indicate tuberculosis.

Figure 11: Button osteoma on the left occipital bone (left); asymmetry between left and right occipital bone (middle); facial part of the skull with the lower placed right supraorbital ridge and the higher placed left suprorbital ridge (right).

4.5 Grave 41

Probably a woman aged 20-25 at the time of death.

4.5.1 Skeletal variations

The two cervical vertebrae have a double opening for the nerves instead of a single one (Figure 10, left), the left articular surface of the atlas is double (Figure 10, right). The premolars have two roots. These observed skeletal variations are not pathological.

4.5.2 Pathological changes

On the posterior part of the left parietal bone, 3.5 cm lateral to the sagittal suture, there is an oval formation of mature, hard and smooth bone 1.5 cm in diameter and a few mm high, representing the button osteoma (Figure 11, left).

The skull is asymmetrical, the convex part of the parietal bone is shifted posteriorly on the right side (Figure 11, middle), the right eye socket is lower than the left (Figure 11, right), the left mastoid is 2 mm longer than the right, the right side of the basilar part of occipital bone is shifted anteriorly, the anterior part with the joint surface behind the sphenoid bone is shifted to the right. The occipital bone immediately rises inferior to the lambdoid suture and creates a slight step at the transition from the parietal bones to the occipital bone. The atlas and axis are also asymmetrical. The asymmetry may indicate a wry neck or torticollis.

The femoral heads and the proximal and distal joint surfaces of the tibia are porous due to wear, it is probably a result of a degenerative joint disease.

5 Discussion

Despite the small number of analysed skeletal remains, we observed many skeletal variations and pathological changes.

Individuals from graves 1, 25 and 38 have decayed teeth. Because the decay is most severe in the cemento-enamel junction, the gum probably receded rapidly during lifetime and the roots were exposed to external influences. In individuals from graves 1 and 38, there are also signs of periodontal disease and ante-mortem tooth loss. In teeth, an unusually large number of pyramidal molars is interesting. They are especially numerous in the individual from grave 1, where all the molars are pyramidal. A single root or pyramidal root is quite rare in the molars of Europeans. Studies of modern populations estimate that 5-10% of Europeans have pyramidal molars, and even this is usually one pair. Pyramidal molars are more typical of East Asian populations, as as many as a third of people are said to have them (42-45).

Furthermore, the ossification of the yellow ligament and thyroid cartilage is interesting, especially because it occurs in the same individual (from grave 25). Ossification of cartilage or ligament is not in itself a rare or special phenomenon, but it represents changes with an as yet unexplained cause. Ossification of thyroid cartilage is more characteristic of men and is most often the result of aging, with complete ossification occurring around age 70. However, since ossification also occurs in younger people, it is also associated with hormonal changes, metabolic and malignant diseases (46-49). Ossification of the yellow ligament is most often due to a combination of growth factors, mechanical stress and/or injury (50,51). The appearance of ossification of different tissues in the same, relatively young and also quite tall individual may thus indicate hormonal problems.

The oval formation on the skull of the skeleton from grave 38 fully corresponds to the characteristics of the button osteoma or a slow-growing hard bone formation that most commonly forms on the outer part of the skull and is more characteristic of men than women (38,39). As it is an innocuous tumour that is on the outside of the skull and relatively small in size, it did not affect the individual's health.

In individuals from graves 25 and 41, joint wear is also visible, probably as a result of degenerative joint disease. Such diseases are characterized by the disappearance of articular cartilage and the rubbing of bone against bone, which causes the bone to recede, porosity, eburnation and cysts. Degenerative diseases of the joints can be the result of activity and sometimes of other pathological changes that additionally burden the joints. The onset of the disease is not entirely clear, as it is not only a factor of aging, but a complex interaction between anatomy, physiology, biochemistry and biomechanical functioning of joints, and probably also genetics (39).

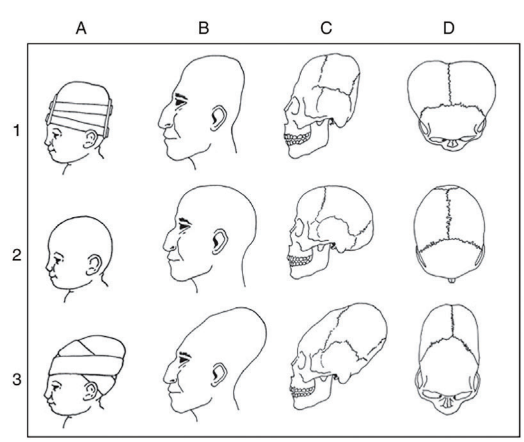
The combination of porosity and new bone formations on the palatal processes of the maxilla and the porosity on the greater wings of the sphenoid bone, which is observed on the skeletons from graves 1 and 25, may indicate a lack of nutrients, specifically vitamin C, so it could be scurvy. However, diagnosing scurvy solely on the basis of bone is quite difficult, especially in vague alterations and in adults (41). In addition, the absence of immature bone indicates that the deficiency at the time of death was probably no longer the case. The indications on these skeletons are very mild and could be due to other health problems, such as inflammation or other metabolic diseases. In the case of scurvy, however, the individuals apparently ingested too little vitamin C or had problems with the body's ability to absorb the vitamin. People usually get vitamin C by eating fruits and vegetables, and secondarily by eating fish, milk and meat. However, vitamin C is stored in the body for only a few months, so it needs to be ingested regularly. Its deficiency affects the formation of collagen, which slows down the development and calcification of bones and weakens soft tissues, e.g., vascular walls and leads to bleeding. The first signs of vitamin C deficiency usually appear 6–12 months after the onset of a deficiency in the body, but recovery after vitamin C intake is very rapid (52).

Numerous lytic lesions in the skeleton from grave 38, most pronounced on the vertebrae but also present on the bones of the pelvis and foot, are probably due to a bacterial infection. The size of the alterations and their rounded edges indicate a chronic condition, while the otherwise modestly preserved immature bone indicates the activity of the infection at the time of death. Given the location of the alterations and the almost complete absence of new bone formation, it is quite possible that it is an infection with *Mycobacterium tuberculosis*, so the individual had tuberculosis. The differential diagnosis also includes brucellosis, an infection with a bacterium of the genus *Brucella*, which is expressed on the skeleton similarly to tuberculosis. It most often attacks the vertebrae, where it causes lytic lesions. Unlike tuberculosis, which primarily erodes the inside of the vertebral body and does not spread to the vertebral processes, brucellosis first affects the anterior part of the vertebrae and eventually spreads to the processes as well. The difference between the two diseases is also in the skipping of the vertebrae and the clear formation of new bone in brucellosis compared with the continuity of lytic lesions and the minimal formation of new bone in tuberculosis. Lytic lesions could also occur due to osteomyelitis or typhus, but more pronounced new bone formation is expected with these two infections. It is also necessary to exclude fungal infection, which, in addition to the vertebral bodies, would also affect the processes (39). Given that tuberculosis most commonly affects the vertebrae, primarily the terminal plate of the vertebral bodies, changes occur on more than one vertebra, bone erosion predominates, while new bone formation is minimal, and the upper lumbar and lower thoracic vertebrae are most commonly affected, tuberculosis in the skeleton from grave 38 is a realistic possibility. According to the diagnosis, there are also lytic lesions on the sacroiliac joint and on the bones of the foot. If it is actually tuberculosis, it was active at the time of death, but moved to the bone shortly before death. A longer presence of the disease would cause more pronounced lytic lesions than the observed.

The skulls and some parts of the postcranium of the skeletons from graves 19, 25, 38 and 41 are of unusual shapes. While the skull from grave 38 has an unusual but symmetrical shape, there is an obvious asymmetry in the remaining three. The observed asymmetries are in accordance with the consequences of a wry neck or torticollis, which may be of neurological or muscular origin. A wry neck is the result of a congenital defect or an acquired anomaly, and asymmetry develops if the curvature is not corrected. The name torticollis comes from the Latin words “tortus” and “collum” (53), and one of the earliest descriptions of the deformation can be found in Plutarch’s descriptions of Alexander the Great (54,55). Neurological torticollis may be due to a tumour or defects in the spine, such as fused vertebrae. Muscular torticollis is congenital and results from idiopathic fibrosis of the sternocleidomastoid muscle. This is shortened, fibrous and deformed, which restricts the movement of the head and pulls the head to the affected side and twists it to the healthy side. The very origin of congenital muscular torticollis is still a matter of discussion. The causes are mechanical in nature, for example, the pressure of the foot on the neck in the uterus, which causes fibrosis and shortening of the muscle, but more often it is a defect or muscle strain during childbirth. Due to asymmetrical posture and movements, it causes pathological changes in other parts of the body, especially on the skull and cervical vertebrae. The defect can be eliminated by massaging and stretching the muscle in the first year of life, while later only with surgery, in which the muscle is transected and the head is fixated with a plaster cast for three weeks.

The already mentioned, unusually but symmetrically shaped skull of the individual from grave 38 was probably a case of an intentional modification. In the past, intentional reshaping of the skull as a cultural practice was present throughout most of the world with the oldest evidence from Iraq dating to 45,000 BC (56). There are many ways to reshape the skull, from manually pressing on the baby's skull bones with minimal changes in shape, to tying various solid objects to the head and thus flattening the skull bones, usually the forehead or occipital bone. Most often, bandaging was used and thus pressing on different parts of the skull in order to lengthen or raise it (Figure 12). Ethnological comparisons show that the skull modification agent is permanently placed on the baby's head soon after birth and removed around the age of three. Recent research suggests that only two basic methods of bandaging can be distinguished, annular and tabular (57). The final shape of the skull depends on the method of modification, as well as on genetics and diet. This already fundamentally affects the variety of shapes of human skulls. The reasons for the modification are different, from the desire for a more intimidating warrior appearance, the belief that this is the desire of the ancestors and/or gods, to demonstrating tribal affiliation or higher social status (56). The consequences of such deformations are mostly cosmetic in nature, do not affect growth and do not cause major health problems. However, pressure on the skull can lead to a periosteal reaction and premature closure of the cranial sutures, which prevents brain growth and can lead to death (39).

A metopic suture was also visible on the skull of the individual from grave 38. It is present at birth and divides the frontal bone into two parts, but in the first years of life it usually fuses and is no longer visible in adults. However, there are cases when the metopic suture does not fuse. The condition is called metopism and is not pathological, as it is only a variation in the human skeleton, which is present in about 9% of Europeans and is slightly more characteristic of men than women. It usually has its origins in genetic factors (59), but it can also be due to intentional modification of the skull, which in addition to premature fusion can also cause delayed fusion of the skull sutures, as is likely in the case of a individual from grave 38 (56).



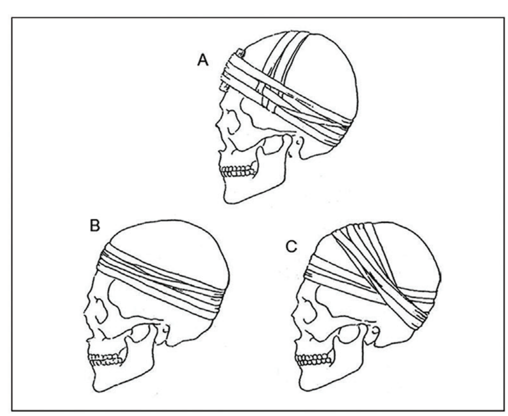


Figure 12: Method of skull bandaging and their consequent shape (left) (57): 1 - tabular bandaging, 2 - without bandaging, 3 – annular bandaging; schematic representation of skull bandaging (right) (58): A - hard object attached to the skull, B - single bandaging, C - double bandaging.

6 Conclusions

The limited number of the analysed skeletal remains does not allow the transmission of conclusions to the entire population, but it seems that they had a number of health problems and/or unusual practices in the considered community. It may even be a cemetery where people of different "ethnic" groups were buried. In addition to intentionally modified skulls, what drew attention were also a high percentage of torticollis, a low age for the appearance of degenerative joint diseases and tuberculosis. The relatively rare occurrence of pyramidal molars in Europe is also interesting, especially in the case of all upper and lower molars, which has not been observed in the literature so far.

The results of the palaeopathological analysis primarily emphasize the need to re-analyse all skeletal remains from the Dravlje cemetery, as it shows that a haste classification of an intentionally modified skull is not always justified, and many pathological changes have been overlooked. However, as the classification has been confirmed in one case, questions arise as to the actual number of individuals with an intentionally modified skull, the identity of these individuals and the reasons for the modification. It is not clear whether this is an original local practice, the adoption of foreign practices in the local environment, or perhaps newcomers with already modified skulls. According to the items found placed into the individual graves in question, it is difficult to conclude that the individual from grave 38 was a local or a newcomer, as he does not differ from the other men buried here, whose skeletons show no signs of an artificially deformed skull. It should be noted, however, that the sample is far too small to draw conclusions about this, and that such conclusions depend on further research, and above all on an in-depth revision of the archaeological and anthropological material from Dravlje.

In the professional community, such discussions have not yet ended, as there are distinct differences between practices in Eastern and Western Europe and in different periods of time. The professional community is thus not uniform in its conclusion. Some are arguing in favour of people migrating, while others are more in favour of the explanation that practices had been adopted from elsewhere (60,61). It is worth mentioning that other cases of modified skulls are also known in Slovenia, namely from the Miren and Kranj *V Lajhu* cemeteries, which also belong to the Migration Period (62,63), and a buried man with a modified skull was discovered in Ptuj (64). The cemetery in Miren is attributed to the Eastern Goths (63). *V Lajhu* is defined as Lombard-East Gothic with Byzantine elements (62), and the deceased discovered in Ptuj, buried in the middle of the 5th century in Roman limestone is considered to be a Hun (65). Similarly, the cemetery in Dravlje was attributed to the Germans, mainly the Eastern Goths, and perhaps the Alamanni (23).

Let us add that it has been clear for some time how very difficult it is to talk about ethnicity in archeology (66). An even greater challenge is the time and space being examined, together with the occurrence of intentional deformations of the skulls. Artificial modification of skulls is a supraregional phenomenon, which may be associated with "ethnos", but perhaps even more likely with the status or belonging to a group linked by kinship, belief or business ties, or, last but not least, belonging to an imagined (in Anderson's sense) (67) group with a common invented tradition, which also includes the modification of skulls. This tradition can spread independently of the spread of its bearers. In short, an artificially modified skull is one of the markers of a specific identity in the time and space in question.

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