III. ANALIZA ČLOVEŠKIH ZOB IN ČELJUSTNIC POKOPOV IZ GOMILE

Iztok Štamfelj

Analizirani so bili človeški zobje in čeljustnice iz grobov iz bronastodobne gomile, ki so jo leta 1956 izkopali na Brezju pod Brinjevo goro.[1] V gradivu so bile čeljustnice skeletov 2, 3 in 5 s skupno 49 stalnimi zobmi. Namen raziskave je bil določiti: (i) oblikovne zobne znake, (ii) starost posameznikov na osnovi rentgenskih posnetkov zob, (iii) obrabo zob, (iv) bolezenske spremembe zob in čeljustnic. Raziskava želi dopolniti izsledke standardne antropološke analize tega gradiva.

METODE

Lokalno in panoramsko rentgensko slikanje zob

Čeljustnice skeletov 2 in 5 smo posneli z digitalnim ortopantomografom *Kodak 8000C Digital Panoramic and Cephalometric System* (71 KV, 12 mA in 13,2 s). Nekatere zobe smo posneli tudi z aparatom za intraoralno rentgensko slikanje *Planmeca Prostyle Intra* (*Planmeca, Helsinki, Finska*) pri nastavitvah 60 kV, 8 mA, 0,160 s.

Računalniška tomografija s stožčastim snopom (RTSS)

Za računalniško tomografijo spodnjih čeljustnic skeletov 2 in 5 smo uporabili aparaturo *Veraviewepocs 3D R100* (*J. Morita Mfg. Corp., Kyoto, Japonska*), delujočo pri 90 kV in 7 mA. Čas ekspozicije je bil 9,4 s, velikost voksla 0,125 mm, debelina rezine pa 1 mm. 2D prereze in 3D rekonstrukcije anatomskih struktur sem pregledoval na zaslonu osebnega računalnika s programom *i-Dixel One Volume Viewer 2.0.0* (*J. Morita, Kyoto, Japonska*).

Ugotavljanje oblikovnih zobnih znakov in obrabe zob

Oblikovne zobne znake sem ugotavljal makroskopsko in z zobozdravniškim mikroskopom (*OPMI Pico, Carl Zeiss AG, Oberkochen, Nemčija*). Pri določitvi števila zobnih korenin vsakega zoba sem si pomagal z rentgenskimi slikovnimi metodami. Stopnjo

[1] Pahič 1962–1963.

III. ANALYSIS OF THE HUMAN TEETH AND YAWS FROM GRAVES FROM THE TUMULUS

Iztok Štamfelj

This paper presents the results of the analysis of human teeth and jaws from the graves from the Bronze Age tumulus excavated in 1956 at Brezje below Brinjeva gora.[1] The analysed material included jaws from Skeletons 2, 3 and 5, with 49 permanent teeth altogether. The aim of this research was to determine: (i) the morphological dental traits; (ii) the chronological age of the individuals based on the radiographic images of their teeth; (iii) the dental wear; (iv) and the pathological changes of the teeth and jaws. This research seeks to complement findings of the standard anthropological analyses of this material.

METHODS

Periapical and panoramic radiographic imaging of teeth

The jaws from Skeletons 2 and 5 were recorded using digital orthopantomograph *Kodak 8000C Digital Panoramic and Cephalometric System* (71 KV, 12 mA in 13.2 s). Additionally, some of the teeth were recorded using apparatus for the intraoral radiographic imaging *Planmeca Prostyle Intra* (*Planmeca, Helsinki, Finland*) with the following settings: 60 kV, 8 mA, 0.160 s.

Cone beam computed tomography (CBCT)

Computed tomography of the mandibles from Skeletons 2 and 5 was performed using apparatus *Veraviewepocs 3D R100* (*J. Morita Mfg. Corp., Kyoto, Japan*) with the following settings: 90 kV and 7 mA. Time of the exposure was 9.4 s, voxel size 0.125 mm, and slice thickness 1 mm. 2D cross-sections and 3D reconstruction of the anatomical structures were analysed on the personal computer using *i-Dixel One Volume Viewer 2.0.0* (*J. Morita, Kyoto, Japan*).

Assessment of morphological dental traits and dental wear

Morphological dental traits were analysed both macroscopically and using a dental microscope (*OPMI Pico, Carl Zeiss AG, Oberkochen, Germany*).

[1] Pahič 1962–1963.

okluzalne obrabe zob sem določil po 8-stopenjski Molnarjevi lestvici (1–8).[2]

Izračun kronološke starosti posameznikov

S programom *Adobe Photoshop 5.0* sem na digitaliziranih lokalnih rentgenskih posnetkih izbranih zob določil relativno obsežnost pulpine votline in izračunal starost posameznika po metodi, ki so jo razvili Kvaal in sodelavci[3].

Ugotavljanje bolezenskih sprememb zob in čeljustnic

Skladno s priporočili iz literature je bila merilo prisotnosti kariesa s prostim očesom vidna kavitirana kariozna sprememba.[4] Izgubo marginalne kosti, ki je eden od znakov parodontalne bolezni, sem vrednotil na dva načina: i) po absolutni (direktni) metodi, pri kateri merimo razdaljo med skleninsko-cementno mejo (SCM) in robom alveolne kosti (RAK) v mm in ii) po relativni (proporcionalni) metodi, pri kateri izražamo višino alveolne kosti, ki obdaja zob, kot odstotni delež dolžine zoba.[5] V tej raziskavi je bilo merilo prisotnosti parodontalne bolezni povečana razdalja SCM-RAK (≥ 4 mm) z znaki vnetne razgradnje kosti, kamor spadajo spremenjena oblika alveolnega roba, ki ne posnema oblike SCM, manjkajoča povrhnja kompakta in vidni številni razširjeni nutritivni foramni.[6]

REZULTATI

Pri preteklih analizah je bila v treh primerih napačno določena vrsta zoba, v dveh primerih pa so bile napačno opisane ploskve zoba. Zobje so bili tako pridani napačnemu skeletu, v čeljustnico vstavljeni na napačno mesto ali pa so bili napačno obrnjeni. Pravilna identifikacija je podana na *sliki 1*.

Skelet 2

Opis čeljustnic: Ohranjeni sta obe zgornji čeljustnici s sedmimi stalnimi zobmi *in situ* in leva nebnica ter spodnja čeljustnica s 14 stalnimi zobmi *in situ.* Po smrti so bili izgubljeni $^{2,1}I^{1}$, $^{2}P^{2}$, $^{3}M^{3}$, $_{1}I_{1}$. V nasprotju s tem sta bila $^{1}M^{1}$ izgubljena za časa življenja, njuni alveoli sta se preoblikovali in zapolnili s kostnino.

[2] Molnar 1971.
[3] Kvaal et al. 1995.
[4] Caselitz 1998.
[5] Snoj-Cvetko et al. 1994.
[6] Strohm, Alt 1998.

Radiographic imaging methods were additionally implemented to determine the number of roots per tooth. The degree of occlusal dental wear was determined based on the 8-stage Molnar's dental wear scale (1–8).[2]

Calculating chronological age of individuals

Periapical radiographs of the selected teeth were inspected in *Adobe Photoshop 5.0* to determine the relative size of the dental pulp cavity and to calculate the individual's age as proposed by Kvaal and colleagues[3].

Identifying pathological changes of teeth and jaws

Following standard protocols, cavitated carious lesions observable with the naked eye served as a criterion for determining the presence of caries.[4] Loss of marginal bone, which is one of the signs of periodontal disease, was evaluated by two complementing methods: i) the absolute (or direct) method, where the distance between the cementoenamel junction (CEJ) and the alveolar bone crest (AC) is measured; and ii) the relative (or proportional) method, where the height of the alveolar bone surrounding the tooth is expressed as a percentage of tooth's length.[5] In this research, the criteria for diagnosing periodontal disease included the extended CEJ-AC distance (≥ 4 mm) and signs of inflammatory bone loss. The latter include contour changes of the alveolar crest, so the crest ceases to follow the CEJ; missing upper layers of cortical bone; and increased incidence of expanded nutrient canals. [6]

RESULTS

During previous research, three teeth were incorrectly identified, and two tooth surfaces were incorrectly described. As a result, these teeth were either paired with the incorrect skeleton, put in the incorrect place in the jaws, or incorrectly orientated when put back into the jaws. The correct identifications are given in *Figure 1*.

Skeleton 2

Description of the jaws: Both parts of the maxillae with the left palatine bone and seven permanent teeth *in situ,* and the mandible with 14 permanent teeth *in situ,* were preserved. Teeth $^{2,1}I^{1}$, $^{2}P^{2}$, $^{3}M^{3}$, $_{1}I_{1}$ were lost postmortem. The resorbed alveoli of the $^{1}M^{1}$ indicate antemortem loss of these teeth.

[2] Molnar 1971.
[3] Kvaal *et al.* 1995.
[4] Caselitz 1998.
[5] Snoj-Cvetko *et al.* 1994.
[6] Strohm, Alt 1998.

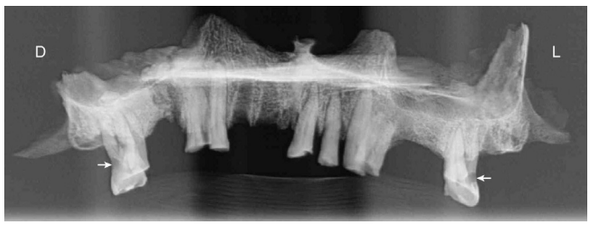
Nepravilna določitev / Incorrect identification		Pravilna določitev / Correct identification		Opombe / Comments
Skelet / Skeleton	Vrsta zoba / Tooth type	Skelet / Skeleton	Vrsta zoba / Tooth type	
2	I^1	3	^1C	Poleg tega zamenjane ploskve pri I^2. / Also, the I^2 was reorientated.
3	^1I	?	^2I	Ne pripada nobenemu od analiziranih skeletov. / Does not belong to any of the analysed skeletons.
	C^1	3	C_1	Alveola zoba C_1 ni ohranjena. / The alveolus of C_1 is not preserved.
5	M^1	?	^1M	Ne pripada nobenemu od analiziranih skeletov. / Does not belong to any of the analysed skeletons.

Slika 1. Preglednica napačnih določitev zob pri gradivu iz bronastodobne gomile z Brezja pod Brinjevo goro.
Figure 1. Incorrectly identified teeth of the skeletal remains from the Bronze Age tumulus at Brezje bellow Brinjeva gora.

Oblikovni zobni znaki: Eno korenino imajo $^{1,2}I^{1,2}$, $^1C^1$, $^2P^2$, $_{2,1}I_{1,2}$, $_1C_1$, $_{2,1}P_{1,2}$, dve korenini $^1P^1$, $_{3,2,1}M_{1,2,3}$, tri korenine $^{3,2}M^{2,3}$. $_1P_1$ imata na grizni ploskvi po 2 vršička, $_2P_2$ po 3 in $_{3,2}M_{2,3}$ po 4. Pri zgornjih ličnikih in kočnikih zaradi napredovane obrabe števila vršičkov na grizni ploskvi ni bilo mogoče ugotoviti. $_2M_2$ imata fisurni sistem X oziroma Y, $_3M_3$ pa fisurni sistem + oziroma X.

Obraba zob: Zgornji zobje so zelo močno obrabljeni, okluzalna obraba je od 6. do 8. stopnje po Molnarjevi lestvici. Njihove zobne krone so zaradi obrabe skoraj v celoti uničene. Pri $^1P^1$ je vlogo grizne ploskve prevzela zobna korenina, le na bukalni ploskvi je pri P^1 2 mm, pri ^1P pa 3 mm ohranjene sklenine. Obraba je dosegla zobno korenino tudi na palatinalni strani $^2M^2$. Pri vseh zgornjih zobeh je zaradi obrabe izpostavljen terciarni dentin, pri P^1 pa je odprta pulpina votlina. Pri ohranjenih interkaninih zobeh (I^2, $^1C^1$) je obraba vodoravna, C^1 pa ima na palatinalni strani še poševno zabrušenje, ki bi skupaj z močno obrabljenostjo sosednjega P^1 lahko nastalo zaradi uporabe zob pri določenem opravilu. Ohranjeni zgornji transkanini zobje ($^1P^1$, $^2M^2$) imajo grizne ploskve obrabljene poševno v palatinalni smeri pod kotom približno 30°.

Pri skeletu 2 je obrabljenost spodnjih zob precej manjša v primerjavi z zgornjimi zobmi; okluzalna obraba spodnjih zob je od 3. do 6. stopnje po Molnarjevi lestvici. Najbolj obrabljena spodnja zoba sta $_1M_1$. Okluzijska ravnina v predelu spodnjih kočnikov je poševna, vendar bistveno manj kot pri $^2M^2$. Grizne ploskve spodnjih kočnikov so čašasto oblikovane, ker so predeli z izpostavljenim dentinom obrabljeni bolj od okolne sklenine. Povprečna

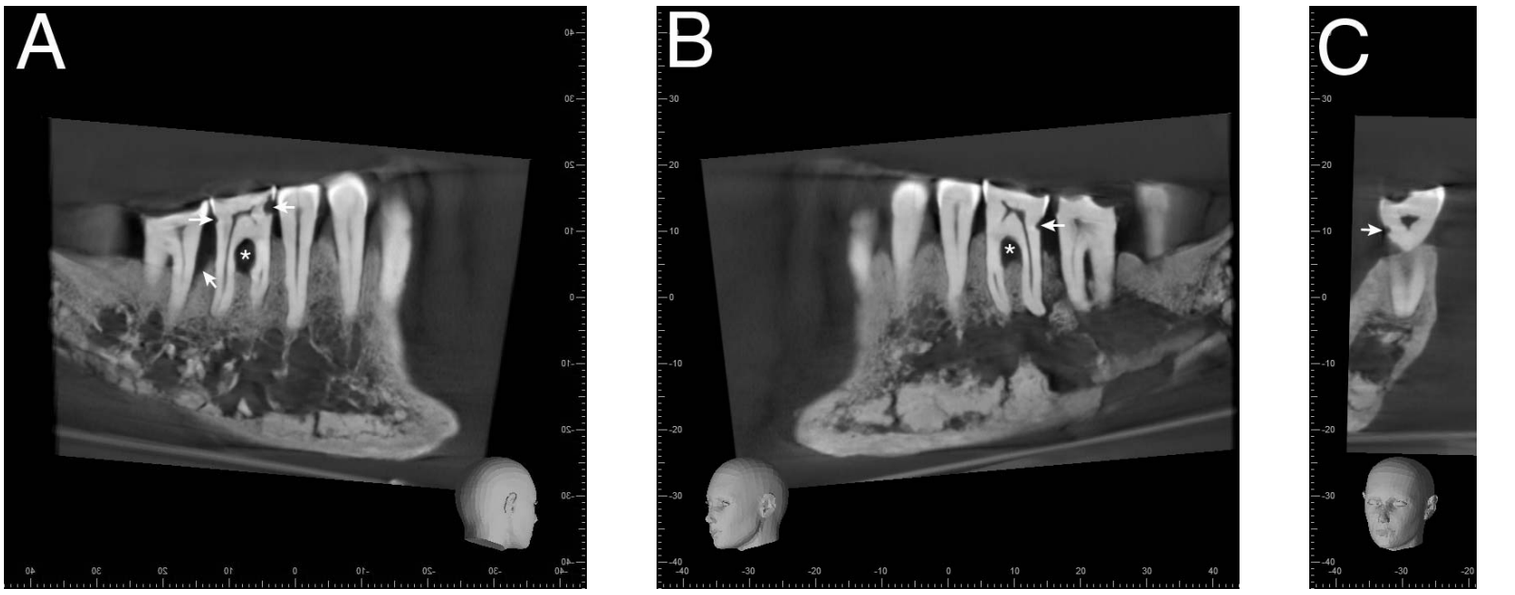


Morphological dental traits: The $^{1,2}I^{1,2}$, $^1C^1$, $^2P^2$, $_{2,1}I_{1,2}$, $_1C_1$, $_{2,1}P_{1,2}$ are single-rooted; the $^1P^1$ have two roots; and the $^{3,2}M^{2,3}$ have three roots each. On the occlusal surface, the $_1P_1$ each have two cusps; the $_2P_2$ three; and the $_{3,2}M_{2,3}$ four. The number of cusps on the upper premolars and molars could not be determined due to the advanced tooth wear. The fissure system of the $_2M_2$ has an X- and Y-shaped configuration, while the fissure system of the $_3M_3$ has a +- and X-shaped configuration.

Dental wear: The upper teeth are severely abraded, presenting the 6th to 8th stage of occlusal dental wear on Molnar's scale. Due to the wear, the crowns are almost completely missing. The roots of $^1P^1$ functioned as a chewing surface, with only 2 mm of enamel preserved on the buccal surface of P^1 and 3 mm on the buccal surface of ^1P. Dental wear also exposed the roots on the palatal surface of $^2M^2$. The tertiary dentine of all the upper teeth was exposed due to wear, and the pulp cavity of P^1 is open. The tooth wear of the anterior teeth (I^2, $^1C^1$) is horizontal. In addition, the palatal surface of C^1 is abraded obliquely. Considered in conjunction with its severely abraded neighbour, the P^1, this dental wear might be attributable to some specific task. The abraded chewing surfaces of the preserved upper posterior teeth ($^1P^1$, $^2M^2$) are oblique, leaning towards the palate side at an angle of approximately 30°.

The lower teeth of Skeleton 2 are considerably less abraded in comparison to the upper teeth; the lower teeth present the 3rd to 6th stage of occlusal dental wear on Molnar's scale. The most abraded lower teeth are the $_1M_1$. The occlusal wear of the lower molars is oblique; however, it is markedly less discernible when compared to the $^2M^2$. The chewing surfaces of the lower molars are cup-shaped, as areas with the exposed dentine are more abraded than the surrounding enamel. According to Molnar's scale, the average dental wear on the upper teeth is 7.0 (49/7), while on the lower it is 4.2 (59/14).

Slika 2. Panoramski rentgenski posnetek zgornjih čeljustnic skeleta 2. Puščici (→←) označujeta kariozni spremembi na distalni ploskvi zob $^2M^2$. D – desno, L – levo.
Figure 2. A panoramic radiographic image of the maxilla of Skeleton 2. Arrows (→←) indicate carious lesions on the distal surface of the $^2M^2$. D – right, L – left.



Slika 3. Prikaz spodnje čeljustnice skeleta 2 z metodo računalniške tomografije s stožčastim snopom. **A** – Meziodistalni vzdolžni prerez predela desnih spodnjih ličnikov in kočnikov. Zob $_1$M ima kariozni spremembi na mezialni (←) in distalni ploskvi (→) ter prizadeto koreninsko razcepišče (*). Ob mezialni korenini zoba $_2$M je vidna poševna razgradnja alveolne kosti (↑). **B** – Meziodistalni vzdolžni prerez predela levih spodnjih ličnikov in kočnikov. Zob M_1 ima kariozno spremembo na distalni ploskvi (←) in prizadeto koreninsko razcepišče (*). **C** – Bukolingvalni vzdolžni prerez zoba $_2$M s kariozno spremembo na bukalni ploskvi (→).

Figure 3. A cone beam computed tomography-based image of the mandible of Skeleton 2. **A** – the mesiodistal longitudinal cross-section of the right lower premolar and molar area. The $_1$M has carious lesions on the mesial (←) and distal surface (→), and an affected root furcation (*). At the mesial root of the $_2$M, oblique alveolar bone loss is visible (↑). **B** – the mesiodistal longitudinal cross-section of the left lower premolar and molar area. The M_1 has carious lesions on the distal surface (←) and an affected root furcation (*). **C** – the buccolingual longitudinal cross-section of the $_2$M with the carious lesion on the buccal surface (→).

stopnja obrabe po Molnarjevi lestvici je pri zgornjih zobeh 7,0 (49/7), pri spodnjih zobeh pa 4,2 (59/14).

Bolezenske spremembe: Kavitirane kariozne spremembe so na distalnih ploskvah $^2M^2$(*sl. 2*), na mezialni in distalni ploskvi $_1$M (*sl. 3A*), na distalni ploskvi M_1 (*sl. 3B*) ter na bukalni ploskvi $_2$M (*sl. 3C*). Vseh šest karioznih sprememb je na zobnem vratu.

P^1, pri katerem je obraba dosegla pulpino votlino, ima ob konici bukalne korenine makroskopsko vidno razgradnjo kosti premera 3,2 mm (*sl. 4A*). Na rentgenskem posnetku tega zoba sta ob konicah obeh korenin, bukalne in palatinalne, vidni manjši neostro omejeni radiolucenci (*sl. 4B*). Alveoli po smrti izgubljenih zob $^2P^2$ sta v apikalnem delu nepravilno oblikovani, kar dopušča možnost, da gre za vnetni razgradnji kosti. Tudi njun nastanek bi bil vzročno lahko povezan z odprtjem pulpine votline zaradi obrabe.

$_2I_2$ imata v vratni polovici labialne ploskve vsak po dve šibko izraženi vodoravno potekajoči hipoplaziji sklenine. Pri I_2 sta hipoplaziji od SCM oddaljeni 2,6 mm in 3,4 mm, pri $_2$I pa 2,3 mm in 3,4 mm.

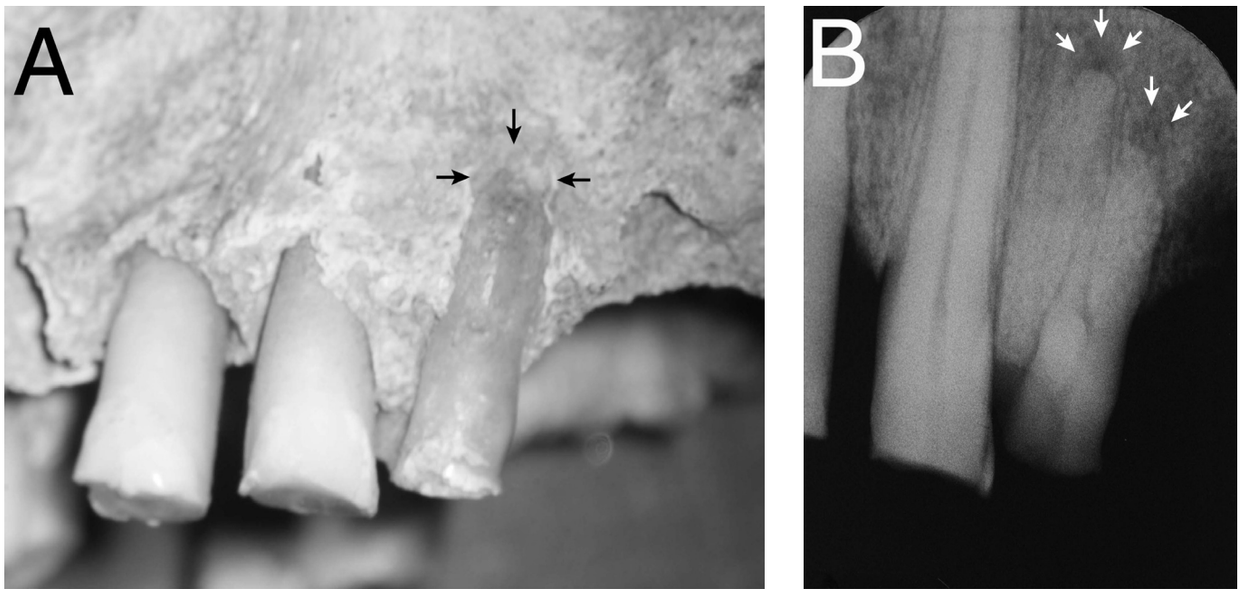
Znaki parodontalne bolezni so prisotni ob 42,9 % (12/28) ocenjenih zob, med katerimi so devet kočnikov ($^{3,2}M^{2,3}$, $_{3,2,1}M_{1,2}$), dva ličnika ($P^{1,2}$) in en sekalec (I^2). Kočniki $_{2,1}M_1$, $^2M^2$ imajo prizadeto

Pathological changes: Cavitated carious lesions are present on the distal surfaces of the $^2M^2$(*fig. 2*); on the mesial and distal surface of the $_1$M (*fig. 3A*); on the distal surface of the M_1 (*fig. 3B*); and on the buccal surface of the $_2$M (*fig. 3C*). All six of the carious lesions appear on the tooth necks.

At the tip of the buccal root of the P^1, which is worn down to the pulp cavity, macroscopically visible bone loss with a diameter of 3.2 mm is present (*fig. 4A*). On the radiographic image of the tooth, two small radiolucent areas without a sharp margin are visible at the tips of both buccal and palatal roots (*fig. 4B*). The alveoli of the $^2P^2$ (lost antemortem) have irregularly shaped apical ends, which could indicate inflammatory bone loss. The bone loss might also be causally related to the opening of the pulp cavity due to the dental wear.

Mild enamel hypoplasia is present as two horizontal lines on the neck of the labial surface $_2I_2$. The distances between the hypoplastic lines and the CEJ are 2.6 mm and 3.4 mm on the I_2, and 2.3 mm and 3.4 mm on the $_2$I respectively.

Signs of periodontal disease are present in 42.9 % (12/28) of the analysed teeth, of which nine are molars ($^{3,2}M^{2,3}$, $_{3,2,1}M_{1,2}$); two premolars ($P^{1,2}$); and one incisor (I^2). The root furcation is affected on the molars $_{2,1}M_1$and $^2M^2$ (*figs. 2, 3A, 3B*). At the mesial root of the $_2$M (*fig. 3A*) and the root of the



Slika 4. Levi zgornji zobje skeleta 2.
A – Pogled z bukalne strani. Apikalna razgradnja kosti (→↓←) ob bukalni koreninni P^1.
B – Puščice na rentgenskem posnetku označujejo periapikalni radiolucenci ob koreninah zoba P^1.
Figure 4. Left upper teeth of Skeleton 2.
A – Buccal view. Apical bone loss (→↓←) at the P^1 buccal root.
B – Arrows on the radiographic image indicate periapical radiolucent areas at the P^1 roots.

koreninsko razcepišče (*sl. 2, 3A, 3B*). Ob mezialni koreninI $_2M$ (*sl. 3A*) in ob koreninI zoba I^2 je razgradnja alveolne kosti poševna, ob ostalih 10 zobeh pa vodoravna. Ob parodontalno prizadetih zobeh je povprečna razdalja SCM-RAK med 4,5 mm in 7,3 mm, ob zobeh brez znakov parodontalne bolezni pa med 3,0 mm in 3,9 mm. Napredovana parodontalna bolezen (višina alveolne kosti < 50 % dolžine zoba in/ali prizadetost koreninskega razcepišča 2. ali 3. stopnje) je bila prisotna pri petih zobeh ($^2M^2$, I^2, $_1M_1$).

Otočki zobnega kamna so prisotni pri 66,7 % (14/21) zob. V zgornji čeljusti ima zobni kamen 28,6 % (2/7) zob, v spodnji čeljusti pa 85,7 % (12/14) zob. Otočki zobnega kamna ležijo na kronah, razen pri $_1M_1$, kjer so na koreninI, in pri $_1P$, kjer so tako na kroni kot na koreninI.

Skelet 3

Opis čeljustnic: Ohranjena sta dva manjša dela obeh zgornjih čeljustnic ob incizivni odprtini in dva stalna zoba (^1P in ^1C). $P^{1,2}$ sta bila odstranjena za časa življenja, njuni alveoli sta zapolnjeni s kostnino. V predelu alveole manjkajočega zoba ^2I je čeljustna kost razgrajena, luknjičasta in brez sledov lamine cribriformis, zato sklepam, da je bil tudi ta zob izgubljen pred smrtjo. Po smrti so bili izgubljeni ^2P, $^1I^{1,2}$, C^1. Ohranjen je manjši brezzobi kos spodnje čeljustnice ob desnem čeljustnem kotu. V njem je alveola zoba $_3M$, ki je bil izgubljen po smrti. $_2M$ in najverjetneje tudi $_1M$ sta bila odstranjena za časa življenja, njune alveole so zapolnjene s kostnino.

Oblikovni zobni znaki in obraba zob: Eno koreninO imajo $^{2,1}I^{1,2}$, $^1C^1$, C_1, dve koreninI pa ^1P. Po Molnarjevi lestvici je obraba edinih dveh ohranjenih

I^2, alveolar bone loss is oblique, while at the rest of the teeth, the loss is horizontal. The average CEJ-AC distance is between 4.5 mm and 7.3 mm on the teeth affected by periodontal diseases, whereas it is between 3.0 mm and 3.9 mm on the unaffected teeth. Advanced periodontal disease (i.e. alveolar bone height < 50% of the tooth length and/or the 2nd or 3rd stage of root furcation damage) was present on five teeth ($^2M^2$, I^2, $_1M_1$).

Discrete formations of dental calculus are present in 66.7% (14/21) of the teeth. Dental calculus is present in 28.6% (2/7) of the maxillary teeth, and in 85.7% (12/14) of the mandibular teeth. Discrete formations of dental calculus appear on the crowns, except on the $_1M_1$, where they are found on the root, and the $_1P$, where they occur on the crown and the root.

Skeleton 3

Description of the jaws: Two small sections of the area around the incisive foramen of the maxilla and two permanent teeth (the ^1P and ^1C) are preserved. The $P^{1,2}$ were lost antemortem, and the alveoli are filled with new bone. The area around the alveolus of the missing ^2I presents alveolar bone loss, pitting and lack of cribriform plate, all indicating that the tooth was lost antemortem. The ^2P, $^1I^{1,2}$, C^1 were lost postmortem. Also preserved is a small toothless fragment of the right mandibular angle with the alveolus of $_3M$, which was lost postmortem. The $_2M$, and most likely the $_1M$ were lost antemortem, as their alveoli are filled with new bone.

Morphological dental traits and dental wear: the $^{2,1}I^{1,2}$, $^1C^1$, C_1 are single-rooted, while the ^1P has two roots. According to Molnar's scale, the dental wear

zgornjih zob (^{1}P, ^{1}C) stopnje 5, obraba edinega ohranjenega spodnjega zoba (C_1) pa stopnje 4.

Bolezenske spremembe: Zob ^{1}P ima kavitirano kariozno spremembo na mezialni ploskvi v predelu zobnega vratu. Ostala dva zoba (^{1}C in C_1) nimata kariesa. Alveola po smrti izgubljenega $_{3}$M kaže znake vodoravne razgradnje alveolne kosti, ob ostalih zobeh pa je čeljustna kost tako slabo ohranjena, da ni bilo mogoče oceniti prisotnosti/odsotnosti parodontalne bolezni. ^{1}C ima otoček zobnega kamna na distalni ploskvi anatomske krone, ostala dva zoba (^{1}P in C_1) nimata zobnega kamna.

Skelet 5

Opis čeljustnic: Obe zgornji čeljustnici sta deloma ohranjeni in imata devet stalnih zob *in situ*. Delno ali v celoti ohranjene alveole zob ^{3}M, ^{1}P^{1}, kažejo, da so ti zobje izpadli po smrti. Zobiščni odrastek z zobmi P^{2}, M^{1,2,3} ni ohranjen, vendar bi iz normalnega položaja grizne ravnine v predelu levih spodnjih transkaninih zob (antagonistov) lahko sklepali, da so bili tudi ti zobje izgubljeni šele po smrti. Za časa življenja pri tem posamezniku najverjetneje ni bil izgubljen noben stalni zob. Palatinalni torus ima obliko 2–3 mm visoke podolgovate kostne izbokline vzdolž sredinskega nebnega šiva. Spodnja čeljustnica je ohranjena v celoti skupaj s 14 stalnimi zobmi *in situ*. I_2 in P_1 sta se izgubila po smrti. Mandibulni torus ima obliko vozličastih kostnih izboklin na lingvalni strani C_1 in $PM_{1,2}$.

Oblikovni zobni znaki: ^{2}I^{2} imata na palatinalni ploskvi slepo jamico. Pri ^{2,1}M ter $_{1}M_1$ število vršičkov na grizni ploskvi zaradi napredovane obrabe ni določljivo, $_{2}M_2$ imata po štiri vršičke, $_{3}M_3$ pa po pet. Fisurni sistem ima pri $_{2}M_2$ in M_3 verjetno obliko X, pri $_{3}$M pa verjetno obliko +. $_{2,1}M_{1,2}$ imajo na bukalni ploskvi približno 2 mm dolg skleninski jezik. Eno korenino imajo ^{2,1}I^{1,2}, $_{2,1}I_{1,2}$, ^{1}C^{1}, $_{1}C_1$, ^{2,1}P, $_{2,1}P_{1,2}$, ^{3}M, dve korenini $_{3,2,1}M_{1,2}$, tri pa ^{2,1}M in M_3. Posnetki z RTSS so pokazali, da ima M_3 poleg dveh rednih korenin (mezialne in distalne korenine) še nadštevilno korenino *radix entomolaris* (RE) (*sl. 4A* in *4B*). RE izhaja iz koreninskega debla na lingvalni strani med obema rednima koreninama, je skoraj ravna in 2–3 mm krajša od obeh rednih korenin.

Obraba zob: Zobje skeleta 5 so močno obrabljeni, okluzalna obraba je 3. do 7. stopnje po Molnarjevi lestvici. Najbolj obrabljeni zobje so zgornji in spodnji prvi kočniki (^{1}M, $_{1}M_1$). Po Molnarjevi lestvici je

on the only two upper teeth preserved (^{1}P, ^{1}C) is stage 5, and it is stage 4 on the only lower tooth preserved (C_1).

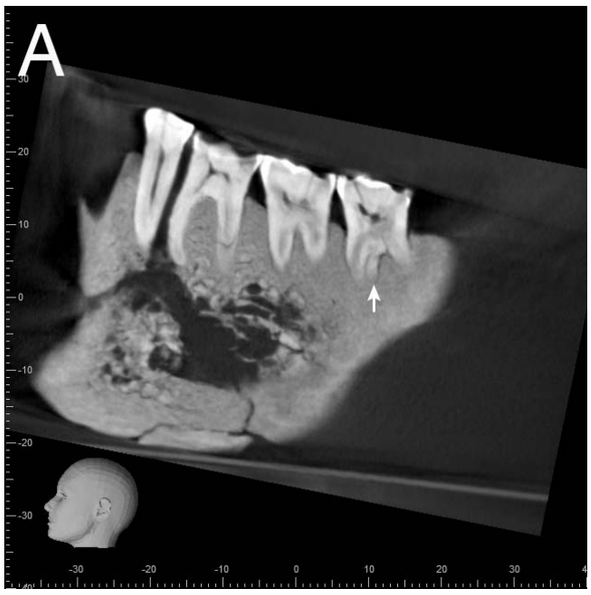
Pathological changes: ^{1}P has a cavitated carious lesion on the mesial surface of the tooth neck. The rest of the teeth (the ^{1}C and C_1) are caries-free. Horizontal alveolar bone loss occurred in the alveolus of the $_{3}$M (lost postmortem). The rest of the mandible is too poorly preserved for the assessment of the presence/absence of periodontal disease. On the distal surface of the anatomical crown of the ^{1}C, a discrete formation of the dental calculus is present, whereas the rest of the teeth (the ^{1}P and C_1) are calculus-free.

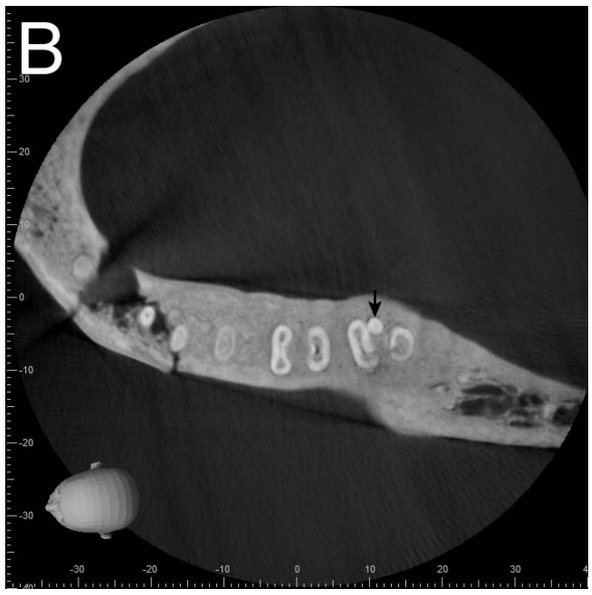
Skeleton 5

Description of the jaws: The maxilla is partially preserved and has nine permanent teeth *in situ*. Partially or completely preserved alveoli of the ^{3}M and ^{1}P^{1} indicate postmortem loss of these teeth. Even though the alveolar bone of the P^{2} and M^{1,2,3} is not preserved, the normally positioned chewing surface of the left lower anterior teeth (antagonists) also indicates the postmortem loss of teeth. It is likely that this individual never experienced antemortem loss of any permanent teeth. The palatal torus has a shape of a 2–3 mm high elongated bony protrusion along the palatine suture. The mandible is completely preserved, together with 14 permanent teeth *in situ*. The I_2 and P_1 were lost postmortem. The mandibular torus has a shape of a nodular bony protrusions on the lingual side of the C_1 and $PM_{1,2}$.

Morphological dental traits: On the palatal surface of ^{2}I^{2}, a blind cavity is present. Due to the advanced dental wear, the number of cusps on the ^{2,1}M and $_{1}M_1$ is undeterminable. The $_{2}M_2$ have four and the $_{3}M_3$ have five cusps each. The fissure system configuration of the $_{2}M_2$ and M_3 is probably X-shaped, while the configuration of the $_{3}$M is +-shaped. The $_{2,1}M_{1,2}$ have approximately 2 mm long enamel pearls on the buccal surfaces. The ^{2,1}I^{1,2}, $_{2,1}I_{1,2}$, ^{1}C^{1}, $_{1}C_1$, ^{2,1}P, $_{2,1}P_{1,2}$, and ^{3}M are single-rooted; the $_{3,2,1}M_{1,2}$ have two roots each; and the ^{2,1}M and M_3 each have three roots. The CBCT showed that the M_3 possesses, in addition to the two regular roots (the mesial and the distal), a supernumerary root *radix entomolaris* (RE; *figs. 4A* and *4B*). The RE originates from the root trunk on the lingual side between both roots, is almost straight, and 2–3 mm shorter than both regular roots.

Dental wear: Dental wear on the teeth of Skeleton 5 is advanced, presenting the 3rd to 7th stage of occlusal





Slika 5. Računalniški tomogrami spodnje čeljustnice skeleta 5. **A** – meziodistalni vzdolžni prerez zoba M_3. **B** – vodoravni prerez zoba M_3. Nadštevilna korenina *radix entomolaris* je označena s puščico. **C** – predel levih spodnjih kočnikov z lingvalne strani. **D** – predel desnih spodnjih kočnikov z lingvalne strani. Puščice (↑↑) označujejo mizasto oblikovan, luknjičav alveolni rob na lingvalni ploskvi zob $_3M_3$. Na zobnem vratu M_2 je debelejša plast zobnega kamna, označena z zvezdico (*).

Figure 5. Computed tomograms of the mandible of Skeleton 5. **A** –the mesiodistal longitudinal cross-section of the M_3. **B** –the horizontal cross-section of the M_3. The arrow indicates a supernumerary root *radix entomolaris*. **C** – area of left lower molars from the lingual side. **D** – area of right lower molars from the lingual side. Arrows (↑↑) indicate the boardlike, pitted alveolar crest at the lingual surface of the $_3M_3$. The asterisk (*) marks a thick layer of dental calculus present on the tooth neck of the M_2.

povprečna stopnja obrabe zgornjih zob 5,2 (47/9), spodnjih zob 4,3 (60/14). Okluzijska ravnina v predelu kočnikov je poševna. Grizne ploskve kočnikov so čašasto oblikovane, ker so predeli z izpostavljenim dentinom obrabljeni bolj od okolne sklenine.

Bolezenske spremembe: Zobovje skeleta 5 je brez kavitiranih karioznih sprememb in apikalnih razgradenj kosti. Marginalna alveolna kost ob 19 ocenjenih zobeh z izjemo obeh spodnjih modrostnih zob ne kaže sprememb, ki so značilne za parodontalno bolezen. Alveolni rob je oster in posnema obliko SCM. V nasprotju s tem je na lingvalni ploskvi spodnjih modrostnih zob alveolni rob širok (3 mm), mizasto oblikovan in ima luknjičavo površino (*sl. 5C, 5D*). Takšna oblika alveolnega roba je znak prisotnosti parodontalne bolezni in se pojavlja zlasti ob kočnikih. V angleški literaturi jo označujejo z izrazom mizasti rob (*boardlike border*).[7] Na lingvalni ploskvi spodnjih tretjih kočnikov je razdalja med SCM in RAK 4 mm, koreninska razcepišča niso prizadeta. Zobni kamen je prisoten pri 87,0 % (20/23) zob. V zgornji čeljusti ima zobni kamen 88,9 % (8/9) zob,

wear on Molnar's scale. The upper and lower first molars (^1M, $_1M_1$) are most abraded. According to Molnar's scale, the average dental wear is 5.2 (47/9) on the upper teeth and 4.3 (60/14) on the lower teeth. In the molars, occlusal surface is oblique. Chewing surfaces of the molars are cup-shaped, as areas with the exposed dentine are more abraded than the surrounding enamel.

Pathological changes: The teeth have no cavitated carious lesions or apical bone loss. Except for both lower wisdom teeth, the marginal alveolar bone at the 19 analysed teeth does not present changes characteristic of the periodontal disease. The alveolar crest is sharp and follows the CEJ. In contrast, the alveolar crest at the lingual surface of the lower wisdom teeth is wide (3 mm), board-like, with pitting on the surface (*figs. 5C and 5D*). These characteristics of the alveolar crest are a sign of periodontal disease and occur, in particular, at the molars. In English literature, such an alveolar crest is characterised as a *boardlike border*.[7] The distance between the CEJ and the AC on the lingual surface of the lower third

[7] Strohm, Alt 1998.

[7] Strohm, Alt 1998.

v spodnji čeljusti pa 85,7 % (12/14) zob. Pri vseh 20 zobeh leži zobni kamen na kroni. Gre za otočke zobnega kamna, le na lingvalni ploskvi M_2 (*sl. 5C*) in na palatinalnih ploskvah $^1C^1$, I^2 je prisoten v debelejši plasti vzdolž SCM.

V gradivu sta bila dva zoba (^{2}I in ^{1}M), ki ne pripadata nobenemu od analiziranih treh skeletov (*sl. 1*). ^{2}I ima eno korenino, na zobni kroni pa kronsko-koreninsko palatinalno brazdo. ^{1}M ima tri korenine, na obrabljeni grizni ploskvi pa so vidna razgaljena dentinska jedra štirih vršičkov. Grizna ploskev ^{1}M je obrabljena poševno v palatinalni smeri pod kotom približno 15°. Po Molnarjevi lestvici je obraba ^{1}M 5. stopnje, obraba ^{2}I pa 3. stopnje. ^{1}M ima kavitirani kariozni spremembi na obeh aproksimalnih ploskvah v predelu zobnega vratu. Oba zoba imata na kroni manjšo količino zobnega kamna.

SPLOŠNE ZNAČILNOSTI IN RAZPRAVA

Izračun starosti posameznikov

Pri skeletu 2 sem starost izračunal iz rentgenskih meritev pri drugem zgornjem sekalcu (53 ± 10 let), pri skeletu 3 iz meritev pri spodnjem podočniku (33 ± 11,5 let), pri skeletu 5 pa iz meritev pri vseh šestih zobeh (58 ± 8,6 let). Zob ^{2}I, ki ne pripada nobenemu od treh analiziranih skeletov, je glede na relativno obsežnost pulpine votline pripadal človeku, staremu 27 ± 10 let, kar se sklada z majhno obrabljenostjo tega zoba (3. stopnja po Molnarjevi lestvici).

Oblikovni zobni znaki

Oblikovni zobni znaki analiziranih skeletov so značilni za kavkazijsko prebivalstveno skupino. Presenetila pa je ugotovitev, da ima M_3 skeleta 5 poleg dveh rednih korenin (mezialne in distalne) še nadštevilno korenino *radix entomolaris* (RE). Analiza lokalnih rentgenskih posnetkov je pokazala, da ima pri sedanjih prebivalcih Slovenije tri korenine 1,32 % (18/1361) prvih, 0,25 % (4/1573) drugih in 1,77 % (13/734) tretjih spodnjih stalnih kočnikov.[8] Raziskava na ekstrahiranih zobeh pri Nizozemcih je pokazala, da ima RE 1,07 % prvih, 0,14 % drugih in 0,85 % tretjih spodnjih stalnih kočnikov.[9] Opisi spodnjih kočnikov z RE pri ljudeh iz predzgodovinskih obdobij so v literaturi maloštevilni, kar je povezano tudi z dejstvom, da so v večini raziskav število

[8] Strmšek, Štamfelj 2019.
[9] Visser 1948.

molars is 4 mm; the root furcations are not affected. Dental calculus is present in 87.0% (20/23) of the teeth. 88.9% (8/9) of the upper teeth and 85.7% (12/14) of the lower have dental calculus. On all 20 teeth, dental calculus occurs on the crown. It is present in discrete formations; only the lingual surface of the M_2 (*fig. 5C*) and palatal surfaces of the $^1C^1$ and I^2 have a thicker layer along the CEJ.

Two teeth among the examined material (the ^{2}I and the ^{1}M) do not belong to any of the three analysed skeletons (*fig. 1*). The ^{2}I is single-rooted and has a palato-radicular groove on its crown. The ^{1}M has three roots and exposed dentine cores of four cusps on the abraded chewing surface. The abraded chewing surface of the ^{1}M is oblique, leaning towards the palate side at an angle of approximately 15°. According to Molnar's scale, the dental wear of the ^{1}M is stage 5, and the dental wear of the ^{2}I is stage 3. On both approximal surfaces of the tooth neck of the ^{1}M, cavitated carious lesions are present. Both teeth have small amounts of dental calculus on their crowns.

COMMON CHARACTERISTICS AND A DISCUSSION

Calculations of the individuals' age

Age at death was calculated using radiographical measurements of the second upper incisor of Skeleton 2 (53 ± 10 years); the lower canine of Skeleton 3 (33 ± 11.5 years); and all six teeth of Skeleton 5 (58 ± 8.6 years). Based on the relative size of the pulp cavity, tooth ^{2}I (which was not from any of the analysed skeletons), belonged to a 27 ± 10 years old individual, which is consistent with the early stage of dental wear (stage 3 on Molnar's scale).

Morphological dental traits

Morphological dental traits of the analysed skeletons are characteristic of Caucasian populations. The discovery of a supernumerary root, *radix entomolaris* (RE), in addition to the two regular roots (mesial and distal) on the M_3 of Skeleton 5 is surprising. Analysis of the periapical radiographs of modern Slovenians showed that only 1.32% (18/1361) of the first, 0.25% (4/1573) of the second, and 1.77% (13/734) of the third lower permanent molars are three-rooted.[8] Research on the extracted teeth of Dutch people showed that REs occur on 1.07% of the first, on 0.14% of the second, and on 0.85% of the third lower permanent molars.[9] Lower molars with REs from prehistoric people are rarely mentioned in the

[8] Strmšek, Štamfelj 2019.
[9] Visser 1948.

korenin določali z makroskopskim pregledom gradiva. Tudi pri M_3 skeleta 5 sem makroskopsko in celo z lokalnim rentgenskim posnetkom lahko ugotovil le prisotnost dveh rednih korenin, tretjo korenino (RE) pa je pokazala šele RTSS. Prednost te metode pred klasičnim rentgenskim slikanjem zob je, da omogoča natančen prikaz anatomskih struktur v vseh treh razsežnostih. Najdba spodnjega kočnika z RE posredno dokazuje, da je bil dedni zapis, ki omogoča razvoj te koreninske različice, na območju današnje Slovenije prisoten že v srednji bronasti dobi. V nasprotju s tem v vzhodni Anatoliji še pri skeletih iz železne dobe (1100–600 pr. n. št.) niso ugotovili nobenega mlečnega (0/15) ali stalnega spodnjega kočnika (0/144) z RE, ugotovili pa so jih pri skeletih iz srednjega veka (10. stol. n. št.), in sicer pri obeh skupinah spodnjih kočnikov. Domneva se, da so ustrezni dedni zapis na to območje prinesli migracijski tokovi iz Azije šele v srednjem veku.[10]

Obraba zob

Skeleta 2 in 5 imata skoraj enako povprečno stopnjo obrabe spodnjih zob po Molnarjevi lestvici (*4,2* vs. *4,3*), kar kaže na primerljivo starost obeh posameznikov. Pri skeletu 2 je zelo nenavadna precej večja povprečna stopnja obrabe zgornjih zob v primerjavi s spodnjimi zobmi (*7,0* vs. *4,2*). Nenavaden je tudi večji naklon grizne ravnine pri zgornjih kot pri spodnjih kočnikih. Posledica je okluzijsko neujemanje zgornjih in spodnjih zob. Pri žvečenju hrane se zgornji in spodnji zobje obrabljajo približno enako hitro, zato gre pri skeletu 2 bolj verjetno za posledico neke dodatne dejavnosti, morda uporabe zgornjih zob pri določenem opravilu. Druga možna razlaga je, da se je pri delu s skeletnim gradivom zgodila zamenjava in čeljustnici ne pripadata istemu skeletu.

Zobni karies

Zobni karies je razgradnja trdih zobnih tkiv zaradi delovanja kariogenih bakterij. Od treh bronastodobnih skeletov je le eden brez kariesa (moški skelet 5). V analiziranem gradivu je 14,3 % (7/49) karioznih zob: pet zob pri skeletu 2 (5/21), en zob pri skeletu 3 (1/3), nič zob pri skeletu 5 (0/23), poleg tega ima karies še eden od dveh izoliranih zob. Dva zoba imata po dve kariozni spremembi, pet zob pa po eno kariozno spremembo. Med sedmimi karioznimi zobmi so trije prvi kočniki (^1M, $_1M_1$), trije drugi kočniki ($^2M^2$, $_2M$) in en prvi ličnik (^1P). Po rentgenski oceni nobena kariozna sprememba ne sega do pulpine votline. Prevladujoča prizadetost kočnikov ni presenetljiva, saj se je karies v vseh obdobjih najpogosteje pojavljal

literature, which is partially related to the fact that most research only employs macroscopic analyses of the material when determining the number of roots. Macroscopic analysis and periapical radiography of the M_3 of Skeleton 5 allowed for the recognition of just two roots, whereas the third root (the RE) was only identified with CBCT. The advantage of this method over conventional radiographic imaging is the capacity for detailed representation of anatomical structures in all three dimensions. The discovery of the lower molar with an RE indirectly proves that the genotype allowing for the development of this root variation was already present in the area of modern-day Slovenia in the Middle Bronze Age. In contrast, not a single deciduous (0/15) or permanent (0/144) lower molar with an RE was discovered among the Early Iron Age (1100–600 BC) skeletons in Eastern Anatolia; however, REs were present in both groups of the lower molars of the Middle Age (10^{th} century AD) skeletons from this area. It is presumed that the appropriate genotype was only introduced to Eastern Anatolia by the wave of migration from Asia during the Middle Ages.[10]

Dental wear

Lower teeth of Skeletons 2 and 5 present almost the same (*4.2* vs. *4.3*) average dental ware stage on Molnar's scale, which indicates a comparable age at death of both individuals. The significantly more advanced dental wear on the upper teeth of Skeleton 2 compared to its lower teeth (*7.0* vs. *4.2*) is highly unusual. Also unusual is a greater chewing surface inclination of the upper than lower molars. The result is an occlusal discrepancy of the upper and lower teeth. When chewing food, upper and lower teeth are abraded at a similar pace. Thus, the teeth of Skeleton 2 might indicate an additional activity; perhaps the use of upper teeth for a specific task. It is also possible that while handling skeletal material, the remains were commingled and the jaws do not belong to the same skeleton.

Dental caries

Dental caries is a breakdown of hard dental tissues due to the activity of cariogenic bacteria. Out of the three Bronze Age skeletons, only one is caries-free (male Skeleton 5). There are 14.3% (7/49) of carious teeth in the analysed material: five teeth of the male Skeleton 2 (5/21), one tooth of the female Skeleton 3 (1/3), and zero teeth of the male Skeleton 5 (0/23). Additionally, caries is present in one of the unassociated teeth. Two teeth have two carious lesions, and

[10] Erkman, Kaya 2014.

[10] Erkman, Kaya 2014.

pri tej zobni skupini, zlasti pri prvem in drugem kočniku, manj pogosto pri ličnikih, karies na sekalcih in podočnikih pa je bil redkost vse do obdobja po letu 1000 n. š..[11]

Pričujoča paleostomatološka raziskava daje predvsem vpogled v ustno zdravje štirih odraslih posameznikov, rezultatov pa zaradi majhnega vzorca ne moremo neposredno prenesti na celotno prebivalstveno skupino, ki so ji ti posamezniki pripadali. Analiza obsežnejšega skeletnega gradiva bi lahko dala bistveno drugačne podatke. Kakorkoli, če rezultati dejansko predstavljajo vpogled v ustno zdravje prebivalstvene skupine, je ugotovljeni delež karioznih stalnih zob (14,3 %) značilen za način preživljanja, ki temelji na poljedelstvu (2,2–26,9 %),[12] se pa uvršča v zgornji del razpona vrednosti za evropska bronastodobna najdišča (1,1–17,1 %).[13]

Pri zobeh iz Brezij pod Brinjevo goro je vseh devet karioznih sprememb na zobnem vratu (osem na aproksimalnih ploskvah in ena na bukalni ploskvi) in vse so bile omejene na posamezno zobno ploskev. Za razliko od tega se pri sedanjem prebivalstvu karies najpogosteje razvije na zobnih kronah kočnikov in ličnikov, in sicer največkrat v fisurnem sistemu na griznih ploskvah, nato na njihovih aproksimalnih ploskvah. Pojavljanje kariesa na zobnem vratu in koreninah namesto na griznih ploskvah pri predzgodovinskih prebivalstvenih skupinah povezujejo z veliko obrabo zob.[14] Okluzalna obraba je povzročila zgodnje preoblikovanje griznih ploskev kočnikov in ličnikov, predvsem izgubo fisur, ki so predilekcijsko mesto za razvoj okluzalnega kariesa. Poleg tega se je obraba zobnih kron delno izravnavala z izraščanjem zob, kar je razgalilo vratni del zobne korenine, ki ga sicer pokrivajo obzobna tkiva.

Kronični apikalni parodontitis

Apikalni parodontitis je vnetje, ki se razvije ob koreninski konici okuženega avitalnega zoba. Na čeljustni kosti se kaže kot apikalna osteolitična sprememba. Apikalni parodontitis se v večini primerov razvije ob zobeh, pri katerih sta karies ali obraba dosegla zobno pulpo. Apikalno kostno razgradnjo, ki je nastala zaradi kroničnega apikalnega parodontitisa (KAP), sem makroskopsko in rentgensko ugotovil pri skeletu 2 ob koreninah P^1. Nastanek KAP je bil v tem primeru vzročno povezan z odprtjem pulpine votline zaradi močne obrabe, kar je

five teeth have one carious lesion. Among the seven carious teeth are three first molars (^1M, $_1M_1$), three second molars ($^2M^2$, $_2M$), and one first premolar (^1P). According to the radiographic evaluation, none of the carious lesions has extended into the pulp cavity. That molars are predominantly affected is hardly surprising, considering that in all periods caries are most common for this group of teeth. The first and second molars are particularly prone to them, and the premolars less so. Caries of the incisors and canines remained a rarity until post-1000 AD.[11]

This palaeostomatological research predominantly provides an insight into the oral health of four adult individuals. Given the small sample size, the results cannot be directly linked to the entire population to which these individuals belonged. An analysis of a larger skeletal sample might provide significantly different data. Nevertheless, if the sample does reflect the general population trends in oral health, the determined portion of carious permanent teeth (14.3%) would have been characteristic of the agricultural way of life (2.2–26.9%),[12] and would have fallen within the upper range for European Bronze Age sites (1.1–17.1%).[13]

On the teeth from Brezje below Brinjeva gora, all nine carious lesions are on the tooth necks (eight on the approximal surfaces and one on the buccal surface) and limited to a single tooth surface. In contrast, caries in modern populations develop most often on the crowns of molars and premolars, commonly in the fissure system of chewing surfaces, and lees often on their approximal surfaces. The occurrence of caries on the tooth neck and roots instead of on the chewing surfaces in prehistoric populations is related to advanced dental wear.[14] Occlusal dental wear caused early modification of chewing surfaces of molars and premolars, particularly loss of fissures, which would have presented a site of predilection for the development of occlusal caries. Furthermore, the abrasion of dental crowns offset the eruption of teeth, exposing the necks of their roots, which would normally have been covered by the periodontal tissues.

Chronical apical periodontitis

Apical periodontitis is an inflammatory lesion that develops around the apex of a root of an infected avital tooth. On the jawbone, it presents as an apical osteolytic change. Apical periodontitis most often

11 Caselitz 1998.
12 Turner II, 1979.
13 Przystánska et al. 2015; Ubelaker, Pap 1996; Brabant, Cordier 1966; Polo-Cerdá et al. 2007; Nicklisch et al. 2016; Cucina et al. 1999.
14 Maat, Van der Velde 1987; Meinl et al. 2010.

11 Caselitz 1998.
12 Turner II, 1979.
13 Przystánska *et al.* 2015; Ubelaker, Pap 1996; Brabant, Cordier 1966; Polo-Cerdá *et al.* 2007; Nicklisch *et al.* 2016; Cucina *et al.* 1999.
14 Maat, Van der Velde 1987; Meinl *et al.* 2010.

mikroorganizmom iz ustne votline omogočilo vstop v notranjost zoba. Pri istem skeletu je bil KAP morda prisoten tudi ob zobeh $^{2}P^{2}$, vendar to zaradi slabe ohranjenosti alveol in izgube zob po smrti ni povsem jasno. V analiziranem bronastodobnem gradivu je 1,5 % (1/67) zob s KAP, kar je upoštevaje majhnost vzorca primerljivo z 0,42 % deležem (17/4032) pri bronastodobnih prebivalcih na območju današnje Madžarske,[15] vendar precej manj od 6,6 % deleža (23/349) pri zgodnjebronastodobnih prebivalcih današnjega Trentina v Italiji.[16]

Parodontalna bolezen

Prisotnost znakov parodontalne bolezni se kaže pri skeletih 2 in 5, pri skeletu 3, pa je ohranjenost čeljustne kosti preslaba. Znaki parodontalne bolezni so prisotni na čeljustni kosti ob 11 kočnikih (štirih zgornjih in sedmih spodnjih), dveh zgornjih ličnikih in enem zgornjem sekalcu. Prevladujoča prizadetost čeljustnice ob kočnikih se ujema z rezultati drugih raziskav, prav tako njihova neenakomerna porazdelitev. Pri moškem s skeletom 5 so znaki parodontalne bolezni prisotni le ob dveh zobeh ($_{3}M_{3}$), pri moškem s skeletom 2 pa ob 12 zobeh in pri skoraj polovici teh zob je bila bolezen napredovana ($^{2}M^{2}$, I^{2}, $_{1}M_{1}$). V gradivu je 75,5 % (37/49) zob z zobnim kamnom. Pri zobovju skeleta 5 je zobni kamen pritrjen na krone (supragingivalni zobni kamen), kar se sklada z zdravo alveolno kostjo pri tem posamezniku. Tudi pri zobovju skeleta 2 je bil zobni kamen pritrjen na krone, le pri $_{1}M_{1}$ in $_{1}P$ je bil (tudi) na korenini (subgingivalni zobni kamen). Znano je, da subgingivalni zobni kamen nastane v predelu parodontalnega žepa kot stranski proizvod vnetja.[17] Prisotnost zobnega kamna olajša kopičenje bakterijskega zobnega plaka, vendar ni neposredni vzročni dejavnik parodontalne bolezni, zato ne preseneča, da sta se moška kljub približno enaki količini supragingivalnega zobnega kamna in primerljivi starosti močno razlikovala glede parodontalnega zdravja.

Linearne hipoplazije sklenine

Linearne hipoplazije sklenine (LHS) so nespecifičen odraz delovanja okoljskih škodljivih dejavnikov na otrokov razvoj.[18] Lahko so posledica neustrezne prehrane pri otroku, sistemskih in infekcijskih bolezni.[19] Pri skeletu 2 imata $_{2}I_{2}$ v sklenini vratne polovice labialne ploskve vsak po dve šibko izraženi linearni hipoplaziji. Vsak par hipoplazij je približno

[15] Ubelaker, Pap 1996.
[16] Cucina et al. 1999.
[17] Lang et al. 2008.
[18] Baume, Crawford 1980.
[19] Schultz et al. 1998.

develops at teeth where the dental pulp has been exposed by caries or dental wear. Apical bone loss caused by chronical apical periodontitis (CAP) was macroscopically and radiographically determined at the roots of the P^{1} of Skeleton 2. In this case, the development of CAP was causally related to the opening of the pulp cavity caused by the advanced dental wear which allowed microorganisms from the oral cavity to enter the interior of the tooth. It is possible that CAP might also be present at the $^{2}P^{2}$ in this skeleton. However, poor preservation of the alveoli and postmortem tooth loss prevents unequivocal diagnosis. In the analysed material, 1.5% (1/67) of teeth has CAP. Whilst acknowledging the small sample size, this is comparable to the 0.42% (17/4032) presence determined for the Bronze Age populations of modern-day Hungary.[15] On the other hand, it is significantly smaller than the 6.6% (23/349) presence in the Early Bronze Age population of modern-day Trentino in Italy.[16]

Periodontal disease

Changes indicating periodontal disease were present on the Skeletons 2 and 5, while the jaws of Skeleton 3 were too poorly preserved for such observations. Signs of periodontal disease were present adjacent to 11 molars (four upper and seven lower), two premolars and one upper incisor. The predominant occurrence of periodontal disease in the molars is consistent with the results of other studies, as is its irregular occurrence amongst the teeth of different individuals. The signs of periodontal disease are only present adjacent to two teeth (the $_{3}M_{3}$) of the male Skeleton 5, whereas bone adjacent to 12 teeth of the male Skeleton 2 is affected, with an advanced stage of the disease identified in almost half of the cases (the $^{2}M^{2}$, I^{2}, $_{1}M_{1}$). Dental calculus is present in 75.5% (37/49) of the examined teeth. On the teeth of Skeleton 5, it is attached to the crowns (i.e. supragingival dental calculus) which is consistent with the healthy alveolar bone of the individual. On the teeth of Skeleton 2, it also appears on the crowns; on the $_{1}M_{1}$ and $_{1}P$, it is also attached to the roots (i.e. subgingival dental calculus). Subgingival calculus is known to develop around the periodontal pocket as a by-product of inflammation.[17] The presence of dental calculus facilitates the accumulation of bacterial dental plaque, although it is not a direct cause of periodontal disease. It is not surprising, then, that the periodontal health of both men was significantly

[15] Ubelaker, Pap 1996.
[16] Cucina *et al.* 1999.
[17] Lang *et al.* 2008.

enako oddaljen od SCM, zato ga lahko povežemo z istim vzročnim dejavnikom. Iz časovnih določil pri razvoju drugega spodnjega stalnega sekalca lahko določim, da je en par LHS nastal pri starosti 2,5 let, drug par pa pri starosti 3 let. Menijo, da je pri preteklih ljudstvih to obdobje sovpadalo s prekinitvijo dojenja in prehodom na mešano prehrano.[20]

Primerjava oralnega zdravja posameznikov

Analiza je pokazala, da je bilo oralno zdravje precej slabše pri moškem s skeletom 2 kot pri moškem s skeletom 5, čeprav sta oba iz iste starostne skupine (50–60 let). Moški s skeletom 5 za časa življenja najverjetneje ni izgubil nobenega zoba, ni imel zobnega kariesa, apikalnega parodontitisa in hipoplazij sklenine. Parodontalna bolezen je bila prisotna le na lingvalni strani obeh spodnjih tretjih kočnikov. Moški s skeletom 2 je za časa življenja izgubil oba zgornja prva kočnika, imel je najmanj pet karioznih zob, najmanj en zob z apikalnim parodontitisom in najmanj dva zoba z LHS. Poleg tega je bila ob 12 zobeh prisotna parodontalna bolezen, ob petih zobeh je bila napredovana. Oba moška sta imela supragingivalni zobni kamen na več kot polovici zob. Nista se razlikovala po povprečni stopnji obrabe spodnjih zob (4,2 vs. 4,3 po Molnarjevi lestvici); v nasprotju s tem je povprečna stopnja obrabe zgornjih zob precej večja pri moškem s skeletom 2 (7,0 po Molnarjevi lestvici) kot pri moškem s skeletom 5 (5,2 po Molnarjevi lestvici).

Zobovje ženske s skeletom 3 je zelo slabo ohranjeno (odlomki čeljustnic s tremi zobmi), razpoložljivi podatki pa navajajo k domnevi, da je bilo njeno ustno zdravje najslabše, čeprav je bila približno 20 let mlajša od obeh moških. Preseneča zlasti to, da je za časa življenja izgubila najmanj pet zob, kar je v nesorazmerju z njeno starostjo (okrog 30 let), pa tudi to, da so med izgubljenimi zobmi dva zgornja ličnika ($P^{1,2}$) in en zgornji sekalec (^{2}I), kar bi zlasti pri slednjem težko pripisali posledicam kariesa. Ugotovljene razlike med žensko in obema moškima bi deloma lahko bile odraz spolnih razlik glede pogostnosti kariesa pri takratnem prebivalstvu. Obstoj takšnih razlik potrjujejo raziskave na številnih arheoloških gradivih, vzroki za večjo pogostnost kariesa pri ženskah kot pri moških pa so verjetno socialne in ne fiziološke narave.[21]

different despite having roughly the same amount of supragingival dental calculus.

Linear enamel hypoplasia

Linear enamel hypoplasia (LEH) is a nonspecific indicator of harmful environmental factors affecting the development of a child.[18] It can be attributed to malnutrition, or systemic and infectious diseases.[19] Skeleton 2 has two mildly expressed hypoplastic lines on the enamel of the neck half of the $_{2}I_{2}$ labial surfaces. Each pair of the hypoplastic lines is approximately equidistant from the CEJ. Thus, it can be attributed to the same cause. Based on the developmental timing of the second lower permanent incisor, the first pair of the LEH developed at 2.5 years of age and the second at 3 years of age. In past populations, this age range generally coincides with the weaning process.[20]

Comparisons of oral health of individuals

The analyses showed that the male Skeleton 2 had significantly poorer oral health compared to the male Skeleton 5, even though both individuals belonged to the same age group (50–60 years). Teeth and jaws of Skeleton 5 indicate that in his lifetime, this male individual did not suffer from tooth loss, dental caries, apical periodontitis or enamel hypoplasia. Periodontal disease was only present on the lingual side of his lower third molars. The teeth and jaws of Skeleton 2 indicate that, during his lifetime, this man lost both upper first molars; had a minimum of five carious teeth; at least one tooth had apical periodontitis; and LEH occurred on at least two teeth. Additionally, periodontal disease was present adjacent to 12 of his teeth, with advanced stages identified in five cases. Both males had supragingival dental calculus on more than half of their teeth. The average dental wear of the lower teeth did not differ between the two males (4.2 vs. 4.3 on Molnar's scale); on the other hand, Skeleton 2 had a significantly higher average dental wear on the upper teeth (7.0 on Molnar's scale) than Skeleton 5 (5.2 on Molnar's scale).

Dentition of the female Skeleton 3 is poorly preserved (i.e. a fragment of the mandible with three teeth), yet the available data suggests the poorest oral hygiene of the three, even though the woman was about 20 years younger than both men. Particularly surprising is the antemortem loss of at least five teeth, which is disproportionate to her age (around 30 years). Furthermore, among the lost teeth are two

[20] Goodman et al. 1980.
[21] Larsen et al. 1991.

[18] Baume, Crawford 1980.
[19] Schultz *et al.* 1998.
[20] Goodman *et al.* 1980.

premolars ($P^{1,2}$) and one upper incisor (^{2}I), which can hardly be attributed to caries, especially in the case of the latter. Differences between the female and both males might partially reflect a distinct gender bias in the prevalence of dental caries within the population, which was confirmed by numerous studies of archaeological material. A higher rate of caries in females was likely a result of social, and not physiological, factors.[21]

ZAKLJUČKI

i) Starost ob smrti, izračunana na osnovi rentgenskih posnetkov zob, je bila najvišja pri moškem s skeletom 5 (58 ± 8,6 let), sledita moški s skeletom 2 (53 ± 10 let) in ženska s skeletom 3 (33 ± 11,5 let).

ii) Računalniška tomografija spodnje čeljustnice skeleta 5 je pokazala, da ima levi modrostni zob poleg dveh rednih korenin (mezialne in distalne) še nadštevilno korenino na lingvalni strani – *radix entomolaris (RE)*. Najdba posredno dokazuje, da je dedni zapis, ki usmerja razvoj te dodatne korenine, na območju današnje Slovenije med prebivalstvom prisoten najmanj 3.500 let.

iii) Močno obrabljenost in razmeroma velik delež karioznih zob v vzorcu (14,3 %) bi lahko povezali z abrazivno prehrano pretežno rastlinskega izvora. Pri skeletu 2 preseneča precej večja obrabljenost zgornjih zob v primerjavi s spodnjimi zobmi, kar bi lahko nastalo kot posledica uporabe zgornjih zob pri določenem opravilu.

iv) Rezultati kažejo, da so se analizirani bronastodobni posamezniki zelo razlikovali glede oralnega zdravja. Zobje in čeljustnici skeleta 5 kažejo, da je moški do konca svojega življenja obdržal popolno in nekariozno zobovje ter z izjemo dveh zob zdravo alveolno kost. Zobje in čeljustnici skeleta 2 kažejo, da je moški za časa življenja izgubil dva kočnika, imel je najmanj pet karioznih zob, najmanj en zob z apikalnim parodontitisom, najmanj dva zoba z linearnimi hipoplazijami sklenine in 12 parodontalno obolelih zob, med katerimi je bilo pet zob z napredovano obliko bolezni. Zobje in čeljustnici skeleta 3 kažejo, da je ženska, ki je umrla približno 20 let mlajša od obeh moških, za časa življenja izgubila najmanj pet zob, med katerimi sta celo en zgornji sekalec in dva zgornja ličnika. Kljub zelo slabi ohranjenosti zobovja in čeljustnic rezultati navajajo k sklepu, da je bilo njeno oralno zdravje najslabše.

CONCLUSIONS

i) Based on the radiographic images, age at death was calculated to be the highest for the male Skeleton 5 (58 ± 8.6 years), followed by the male Skeleton 2 (53 ± 10 years), and the female Skeleton 3 (33 ± 11.5 years).

ii) The computed tomography of the mandible of Skeleton 5 presented a supernumerary root – *radix entomolaris (RE)* on the lingual side of his left wisdom tooth in addition to the two regular roots (the mesial and the distal). The discovery indirectly proves that the genotype that directs supernumerary root development in the area of modern-day Slovenia has been present in the population for at least 3,500 years.

iii) The advanced dental wear and relatively high proportion of carious teeth in the sample (14.3%) might be related to an abrasive, predominantly plant-based diet. The surprising and significantly higher abrasion of the upper teeth of Skeleton 2 might be consequential to the use of upper teeth for some specific task.

iv) Results show that the oral health of the analysed Bronze Age individuals differed significantly. The teeth and jaws of Skeleton 5 indicate that this male individual kept all his caries-free teeth until the end of his life and, apart from two teeth, a healthy alveolar bone. The teeth and jaws of Skeleton 2 indicate that this man lost two molars antemortem; had a minimum of five carious teeth; at least one tooth with the apical periodontitis; at least two teeth with linear enamel hypoplasia; and 12 teeth affected by periodontal disease, five of which presented an advanced stage of the disease. The teeth and jaws of Skeleton 3 indicate that this female individual died about 20 years younger than both male individuals and lost a minimum of five teeth antemortem, including one upper incisor and two upper premolars. Despite the poor preservation of the jaws and dentition, this indicates the poorest oral health of the three individuals.

[21] Larsen *et al.* 1991.

Zahvala

Iskreno se zahvaljujem inženirjem radiologije Boštjanu Frlanu, Mojci Lah, Marjani Longar, Tadeji Salkič in Nataši Torner s Stomatološke klinike Univerzitetnega kliničnega centra Ljubljana za izdelavo rentgenskih posnetkov skeletnega gradiva ter Zobnemu rentgenu Rudnik iz Ljubljane, še posebej inženirju radiologije Urošu Horjaku za računalniško tomografijo spodnjih čeljustnic.

Acknowledgements

I sincerely thank radiology engineers from the Clinic of Stomatology of the Ljubljana University Medical Centre Boštjan Frlan, Mojca Lah, Marjana Logar, Tadeja Salkič, and Nataša Torner for producing the radiographic images of skeletal material and Zobni rentgen Rudnik (*Tooth X-ray Rudnik*), Ljubljana, radiology engineer Uroš Horjak in particular, for the computed tomography of the mandibles.

LITERATURA / REFERENCES

Baume R. M., Crawford M. H. 1980
Discrete dental trait asymmetry in Mexican and Belizean groups. – *American Journal of Physical Anthropology* 52, 315–321.

Brabant H., Cordier G. 1966
Etude des dents et des fragments de maxillaires du dolmen de la Roche, Commune de Manthelan (Inder-et-Loire). – *Bulletin de la Societe Royale Belge d`Anthropologie et de Prehistoire* 77, 5–29.

Caselitz P. 1998
Caries – ancient plague of humankind. – V/In: K. W. Alt, F. W. Rösing, M. Teschler-Nicola (ur./eds.), *Dental Anthropology: fundamentals, limits, and prospects*, Wien, New York, 203–226.

Cucina A., Lucci M., Vargiu R., Coppa A. 1999
Dental evidence of biological affinity and environmental conditions in prehistoric Trentino (Italy) samples from the Neolithic to the Early Bronze Age. – *International Journal of Osteoarchaeology* 9, 404–416.

Erkman A. C., Kaya F. 2014
Morphological variations of three-rooted mandibular molars in ancient Anatolian populations (Dilkaya mound, Van, Turkey): a literature review on world populations. – *Mediterranean Archaeology and Archaeometry* 14, 1–11.

Goodman A. H, Armelagos G. J., Rose J. C. 1980
Enamel hypoplasias as indicators of stress in three prehistoric populations from Illinois. – *Human Biology* 52, 515–528.

Kvaal S. I., Kolltveit K. M., Thomsen I. O., Solheim T. 1995
Age estimation of adults from dental radiographs. – *Forensic Science International* 74, 175–185.

Lang N. P., Mombelli A., Attström R. 2008
Oral biofilms and calculus. – V/In: J. Lindhe, N. P. Lang, T. Karring (ur./eds.), *Clinical periodontology and implant dentistry*, Oxford, 183–206.

Larsen C. S., Shavit R., Griffin M. C. 1991
Dental caries evidence for dietary change: an archaeological context. – V/In: M. A. Kelley, C. S. Larsen (ur./eds.), *Advances in dental anthropology*, New York, 179–202.

Maat G. J. R., Van der Velde E. A. 1987
The caries-attrition competition. – *International Journal of Anthropology* 2, 281–292.

Meinl A., Rottensteiner G. M., Huber C. D., Tangl S., Watzak G., Watzek G. 2010
Caries frequency and distribution in an early medieval Avar population from Austria. – *Oral Diseases* 16, 108–116.

Molnar S. 1971
Human tooth wear, tooth function and cultural variability. – *American Journal of Physical Anthropology* 34, 175–190.

Nicklisch N., Ganslmeier R., Siebert A., Friederich S., Meller H., Alt K. W. 2016
Holes in teeth – dental caries in neolithic and Bronze Age populations in Central Germany. – *Annals of Anatomy* 203, 90–99.

Pahič S.1962–1963
Bronastodobna gomila pod Brinjevo goro. – *Arheološki vestnik* 13–14, 349–373.

Polo-Cerdá M., Romero A., Casabó J., De Juan J. 2007
The Bronze Age burials from Cova Dels Blaus (Vall d'Uixo, Castelló, Spain): an approach to paleodietary reconstruction through dental pathology, occlusal wear, and buccal microwear patterns. – *Homo* 58, 297–307.

Przystańska A., Lorkiewicz-Muszyńska D., Abreu-Głowacka M., Glapiński M., Sroka A., Rewekant A., Hyrchala A., Bartecki B., Žaba C., Kulczyk T. 2015
Analysis of human dentition from Early Bronze Age: 4000-year-old puzzle. – *Odontology* 105, 13–22.

Snoj-Cvetko E., Pernuš F., Skalerič U. 1994
Ocena višine alveolarne kosti iz panoramskih posnetkov. – *Zobozdravstveni Vestnik* 49, 113–116.

Strmšek L., Štamfelj I. 2019
The prevalence of three-rooted permanent mandibular molars in a Slovenian population: A radiographic study. - *Anthropologischer Anzeiger* 76 (2), 121–127.

Strohm T. F., Alt K. W. 1998
Periodontal disease – etiology, classification and diagnosis. – V/In: K. W. Alt, F. W. Rösing, M. Teschler-Nicola (ur./eds.), *Dental Anthropology: fundamentals, limits, and prospects*, Wien, New York, 227–246.

Turner II C. G. 1979
Dental anthropological indications of agriculture among the Jomon people of Central Japan. – *American Journal of Physical Anthropology* 51, 619–636.

Ubelaker D. H., Pap I. 1996
Health profiles of a Bronze Age population from northeastern Hungary. – *Annales Historico-Naturales Musei Nationalis Hungarici* 88, 271–296.

Visser J. B. 1948
Beitrag zur Kenntnis der menschlichen Zahnwurzelformen. – Doktorska disertacija / Ph. D. thesis, Faculty of Medicine, University of Zurich (neobjavljena/unpublished).