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Rad predstavlja preliminarne rezultate bioarheološke analize provedene na koštanim ostacima 46 osoba pronađenih u kasnoavarskoj nekropoli u Šarengradu u istočnoj Hrvatskoj. Dobiveni rezultati ukazuju da populaciju iz Šarengrada karakterizira visoka smrtnost djece prouzročena lošim zdravljem u ranome djetinjstvu što se očituje u visokim učestalostima pokazatelja subadultnoga stresa (cribra orbitalia i linearna hipoplazija zubne cakline) i periostitisa kao i slučajevima skorbuta. Paleodontološka analiza snažno ukazuje kako je veliki udio prehrane bio baziran na ugljikohidratima, tj. na poljodjelstvu kao glavnoj privrednoj grani. Odsustvo perimortalnih ozljeda snažno ukazuje na činjenicu da su članovi ove zajednice bili izloženi niskim stopama namjernoga nasilja te da su primarni uzroci uočenih ozljeda nesretni slučajevi. Tri slučaja maksilarnoga sinusitisa mogu se povezati s postupkom grijanja/kuhanja (peći i otvorena vatrišta) gdje je produljeno izlaganje dimu moglo dovesti do različitih bolesti dišnih puteva kao što je sinusitis. Naposljetku, usporedba šarengradskoga uzorka s drugim istovremenim uzorcima nije pokazala značajnije razlike, ukazujući na relativno slične uvjete života u široj regiji tijekom 8. stoljeća.

Ključne riječi: 8. stoljeće, istočna Hrvatska, koštani ostaci, paleopatologija, uvjeti života

The paper presents the preliminary results of bioarchaeological analysis conducted on the skeletal remains of 46 individuals recovered from the Late Avar cemetery in Šarengrad, eastern Croatia. The obtained results indicate that the Šarengrad population was characterized by relatively high subadult mortality caused by very poor childhood health, which is reflected in the high frequency of subadult stress indicators (cribra orbitalia and linear enamel hypoplasia) and sub-periosteal new bone formation, but also in the occurrence of subadult cases of scurvy. Paleodontological analysis strongly suggests that a large portion of the diet of these people was based on carbohydrates which points to subsistence mostly based on agriculture. A complete absence of perimortem injuries in Šarengrad strongly points to the fact that the inhabitants of this community were exposed to a low level of intentional violence, and that the injuries primarily occurred as a result of accidents. Three cases of maxillary sinusitis could be related to the heating/cooking system (ovens and open fire pits) where prolonged direct exposure to smoke could have led to various respiratory tract diseases such as sinusitis. Finally, the comparison of the Šarengrad sample with other contemporaneous assemblages did not show any major differences, suggesting similar living conditions in the region during the 8th cent.

Keywords: 8th century, eastern Croatia, skeletal remains, paleopathology, lifestyle

UVOD

Iako su mnoga germanska plemena poput Gepida i Langobarda svojatali vlast nad južnom Panonijom tijekom 5. i prve polovice 6. stoljeća, tek je po dolasku Avara utjecaj Istočnoga rimskog carstva u tom dijelu Europe potpuno nestao (Gračanin 2009). Stavši na stranu Langobarda, Avari su sudjelovali u uništenju Gepidskoga kraljevstva, prisvojivši nakon toga teritorij u istočnome dijelu Karpatske kotline i na kraju su postali jedina vojna sila u Panoniji nakon odlaska Langobarda 568. godine (Gračanin 2009). Invazija Avara na teritorij Carstva 573. godine te naknadni dogovor s carom Justinijanom II osigurala je avarsku prevlast nad južnom Panonijom (Gračanin 2011). Avari su naposljetku silom osvojili Sirmij 581. godine i na taj način učvrstili svoju poziciju kao jedini gospodari regije (Gračanin 2011). No, nakon neuspjeloga osvajanja Konstantinopola 626. godine, avarska se moć u Karpatskoj kotlini pretvorila u pasivnu hegemoniju, dok su se njihove vojne ambicije usredotočile na zapad (Gračanin 2009). Početak kraja avarske države počeo je formiranjem raznolikoga etničkog štita protiv prijetnji na granicama kaganata krajem 7. i početkom 8. stoljeća, što je na kraju dovelo do sjedilačkoga načina života, uključujući stočarstvo i poljodjelstvo (Gračanin 2009). Ove društvene promjene, koje se vežu uz stvaranje franačke države, imale su fatalne posljedice po kaganat. Nakon franačkih osvajanja područja oko granice kaganata, Avari su ponudili mirovni

INTRODUCTION

Although various Germanic tribes such as the Gepids and the Longobards claimed sovereignty over the south Pannonian region during the 5th and the first half of 6th cent., it was not until the arrival of Avars that the East Roman Empires influence in that part of Europe was completely eradicated (Gračanin 2009). Siding with the Longobards, the Avars participated in the complete destruction of the Gepid kingdom, subsequently claiming territory in the eastern part of the Carpathian Basin and ultimately becoming the sole military power in Pannonia after the departure of the Longobards in 568 (Gračanin 2009). The invasion of the Avars into the Empires territory in 573 and the subsequent agreement with Emperor Justin II secured Avar rule over south Pannonia (Gračanin 2011). The Avars finally took Sirmium by force in 581, and with its conquest they sealed their position as the true masters of the region (Gračanin 2011). However, after the failure of the siege of Constantinople in 626, the Avar power in the Carpathian Basin had transformed into a passive hegemony, while their military concentration was directed toward the west (Gračanin 2009). The beginning of the end of the Avar state began with the formation of a more diverse ethnic shield against the threats on the khaganate borders at the end of the 7th and the beginning of the 8th cent., a step which resulted in the adoption of the sedentary way of life, including farming and agriculture (Gračanin 2009). These social changes, associated with the rise of the Frankish state, proved to have fatal consequences for the

sporazum kralju Karlu Velikom. No, sporazum nije uspio, pa su uslijedili vojni pohodi na Furlaniju i Bavarsku 788. godine (Gračanin 2009). Rezultat tih napada bio je direktan rat između Franaka i Avara 791. godine (Gračanin 2009). Nakon nekoliko godina borbi, avarski su vođe prihvatili kršćanstvo i predali se Francima 796. godine (Schutz 2004). Posljednja pobjeda nad Avarima u Panoniji dogodila se 803. kada je ugušena i zadnja pobuna, a regija je naposljetku priključena Franačkome carstvu (Gračanin 2009).

Avari su ostavili vrlo bogatu arheološku ostavštinu u srednjoj Europi. Ta ostavština većinom se ogleda u brojnim grobljima i artefaktima pronađenima u grobovima koja se primarno vežu uz područje današnje Mađarske, no ima ih i u Austriji, Hrvatskoj, Rumunjskoj, Srbiji i Slovačkoj. Prema novijim istraživanjima, ukupno je registrirano preko 2000 avarodobnih nalazišta s više od 60000 ukopa (Pohl 2018). Zbog velikoga broja avarodobnih grobova, provedene su brojne bioarheološke analize ljudskih ostataka. Većinu istraživanja proveli su mađarski antropolozi (npr. Ferencz 1982/1983; 1992; Szikossy, Bernert 1996; Bernert 2003; Hajdu 2009; Szenicey et al. 2013; detaljan pregled mađarskih nalazišta dala je Fóthi 2000); no, većina tih studija izdana je na mađarskome jeziku što ograničuje mogućnost usporedbe različitih demografskih i bioloških profila s drugim nemađarskim uzorcima. Na području bivše Jugoslavije, bioarheološke studije bile su ograničene na prostor istočne Hrvatske i sjeverne Srbije (Vojvodina). U Vojvodini bioarheološke analize provedene su na avarodobnim uzorcima iz Bačkog Petrovog Sela (Éry 1988; Đukić, Pavlović 2016; Đukić 2017; Đukić et al. 2018), Bačkog Sokolca (Cekuš 2008), Bačke Topole (Farkas, Marcsik 1979; 1984), Bečeja (Đukić et al. 2015; 2018), Čelareva (Živanović, Marković 1989/1990), Čičova (Nikolić 2015), Martonoša (Cekuš 2004), Stare Moravice (Cekuš 1991) i Vojke (Živanović 1962/1963a; 1962/1963b; 1964). U usporedbi, iz istočne Hrvatske slične analize provedene su na svega nekoliko nalazišta: Nuštar (Premužić et al. 2016; 2017; Vidal-Ronchas et al. 2018), Privlaka (Šlaus 1993; 1996; 2002; 2008) i Stari Jankovci (Šlaus 1993; 2008). Većina spomenutih istraživanja koristila je konvencionalne bioarheološke tehnike (makroskopsko određivanje starosti i spola, metričke vrijednosti, paleopatološka analiza), no neke su koristile inter- i multidisciplinarni pristup kombinirajući konvencionalne i suvremene metode (e.g. Đukić et al. 2015; Vidal-Ronchas et al. 2018).

Odlična prilika za uporabom takvoga pristupa ukazala se 2016. godine nakon prve sezone iskopavanja kasnoavarodobne nekropole u Šarengradu. Arheološko nalazište Šarengrad – Klopare nalazi se u Vukovarsko-srijemskoj županiji u istočnome dijelu Hrvatske (Sl. 1). Samo nalazište smješteno je na strmom nagibu praporske visoravni iznad Dunava na istočnome rubu Šarengrada, blizu grada Iloka (Dizdar et al. 2017; Rapan Papeša et al. 2018). Ovo je područ-

strength of the Avar khaganate. After the Frankish conquests of the regions bordering the khaganate the Avars offered a peace treaty to the Frankish king Charlemagne. However, the treaty proved to be unsuccessful, and military assaults on the Frankish lands of Furlania and Bavaria started in 788 (Gračanin 2009). As a result of these attacks, a direct war between the Franks and the Avar khaganate followed in 791 (Gračanin 2009). After several years of fighting, Avar leaders accepted Christianity and surrendered to the Franks in 796 (Schutz 2004). The final victory over the Avars in Pannonia occurred in 803 when the last rebellion attempt was suppressed and the region was finally incorporated into the Frankish Empire (Gračanin 2009).

The Avars left a very rich archaeological heritage in Central Europe. This heritage is mostly characterized by numerous cemeteries and artifacts found in graves, primarily located in the territory of present-day Hungary, but also found in Austria, Croatia, Romania, Serbia, and Slovakia. According to recent studies there have been over 2000 Avar period sites identified with more than 60000 burials in total (Pohl 2018). Due to the large number of Avar period graves, extensive bioarchaeological studies of the human remains recovered from these burials have been conducted. Most of the research has been performed by Hungarian anthropologists (e.g. Ferencz 1982/1983; 1992; Szikossy, Bernert 1996; Bernert 2003; Hajdu 2009; Szenicey et al. 2013; an extensive review of Hungarian sites has been provided by Fóthi 2000); however, the fact that the majority of these studies have been published in Hungarian limits the possibility of a comparison of the various demographic and biological profiles with other non-Hungarian samples. In the territory of the former Yugoslavia bioarchaeological studies have been limited to the region of eastern Croatia and northern Serbia (Vojvodina). In Vojvodina, bioarchaeological analyses have been conducted for the Avar period samples from Bačko Petrovo Selo (Éry 1988; Đukić, Pavlović 2016; Đukić 2017; Đukić et al. 2018), Bački Sokolac (Cekuš 2008), Bačka Topola (Farkas, Marcsik 1979; 1984), Bečej (Đukić et al. 2015; 2018), Čelarevo (Živanović, Marković 1989/1990), Čičovi (Nikolić 2015), Martonoš (Cekuš 2004), Stara Moravica (Cekuš 1991), and Vojka (Živanović 1962/1963a; 1962/1963b; 1964). In contrast, there are only a few sites from eastern Croatia where similar studies have been carried out so far: Nuštar (Premužić et al. 2016; 2017; Vidal-Ronchas et al. 2018), Privlaka (Šlaus 1993; 1996; 2002; 2008), and Stari Jankovci (Šlaus 1993; 2008). Most of the mentioned studies applied conventional bioarchaeological techniques (macroscopic ageing, sexing, metrics and paleopathological analyses), however, some have used inter- and multi-disciplinary approach combining conventional and state-of-the-art methods (e.g. Đukić et al. 2015; Vidal-Ronchas et al. 2018).

An excellent opportunity to use such an approach arose in 2016 after the first season of the excavations of the Late Avar cemetery in Šarengrad. The archaeological site of Šarengrad – Klopare is situated in the Vukovar-Syrmia County in the eastern part of Croatia (Fig. 1). The site is located on a steep slope of the high loess plateau above the Danube

Sl. 1 Karta Hrvatske s položajem Šarengrada (izradio: M. Novak)
Fig. 1 Map of Croatia showing the location of Šarengrad (map: M. Novak)

je bilo naseljavano tijekom povijesti; u blizini su dokumentirani mnogi arheološki nalazi, uključujući prapovijesne, rimske i srednjovjekovne fragmente keramike (Dizdar et al. 2004). Na nalazištu Gradac, gdje rimski *limes* prolazi duž Dunava, ostaci kamene utvrde koja se vrlo vjerojatno može smjestiti u kasnorimsko razdoblje bili su vidljivi sve do kraja 19. stoljeća (Balen-Letunić, Radman Livaja 2008).

Zaštitna iskopavanja groblja datiranog u kasnoavarski period (8. stoljeće) provedena su na lokaciji Klopare 2016. i 2017., iako je nalazište bilo poznato od 2006. kada je eksploatacija tla uništila nepoznat broj ukopa, a samo su dvije keramičke posude spašene (Dizdar et al. 2017). Iskopavanja su vođena od strane arheologa s Instituta za arheologiju (M. Dizdar), Muzeja grada Iloka (A. Rimpf) i Gradskoga muzeja Vinkovci (A. Rapan Papeša). Svi istraženi grobovi predstavljaju kosturne ukope u kojima su individue ležale na leđima u ispruženome položaju i s rukama uz tijelo. Pokojnici su ukapani u duboke jame orijentacije zapad – istok s glavom prema zapadnoj strani groba, a tijela su vjerojatno zamatana u mrtvački pokrov. Nekoliko ostataka drva potvrđuje korištenje lijesova (Dizdar et al. 2017; Rapan Papeša et al. 2018). Dokumentirano je sedam ukopa s ostacima konja i konjanika zajedno s konjskom opremom (Dizdar et al. 2017; Rapan Papeša et al. 2018). Većina ukopa sadržavala je priloge poput predmeta iz svakodnevnoga života, nakit, itd.

River on the eastern edge of Šarengrad, close to the town of Ilok (Dizdar et al. 2017; Rapan Papeša et al. 2018). This area has been populated throughout history; in the near vicinity many archaeological finds, including some prehistoric, Roman, and medieval pottery sherds were documented (Dizdar et al. 2004). At the site of Gradac, where the Roman *limes* runs along the river Danube, some remains of a stone fort were still visible at the end of the 19th century, the fort probably dating to the Late Roman times (Balen-Letunić, Radman Livaja 2008).

The rescue excavations of a cemetery dated to the Late Avar period (8th cent.), took place at the Klopare site in 2016 and 2017, although the site was already known from 2006 when soil exploitation destroyed an unknown number of burials, and only two ceramic pots were saved (Dizdar et al. 2017). The excavations were led by the archaeologists from the Institute of Archaeology (M. Dizdar), the Ilok Town Museum (A. Rimpf), and the Vinkovci Municipal Museum (A. Rapan Papeša). All the excavated graves were skeletal inhumations with individuals lying on their backs in extended positions with arms beside their bodies. The recovered individuals were buried in deep pits in west-east orientation with their heads positioned on the western side of the grave, and the bodies were probably wrapped in a shroud. The few wooden remains confirm the use of coffins (Dizdar et al. 2017; Rapan Papeša et al. 2018). Seven burials containing the remains of horsemen and horses along with riders

Nadalje, većina grobova sadržavala je keramičke posude i životinjske kosti, time ukazujući na postojanje pogrebnoga rituala (Dizdar et al. 2017; Rapan Papeša et al. 2018). Ovo nalazište ima izuzetnu važnost za daljnja arheološka istraživanja zbog svoga položaja i pozicije unutar južne Panonije, čineći ga prvim istraživanim kasnoavarodobnim grobljem na području hrvatskoga Podunavlja (Dizdar et al. 2017).

Glavni cilj ovoga istraživanja jest prezentirati odabrane biološke podatke o kasnoavarodobnoj populaciji iz Šarengrada u istočnoj Hrvatskoj koristeći se konvencionalnim bioarheološkim pristupom. Kao dodatak tomu, ovi podaci usporedit će se sa sličnim podacima dobivenim iz drugih istrovremenih uzoraka s područja južnopanonske nizine. Naposljetku, kada ostale analize ostataka iz Šarengrada poput analize stabilnih izotopa ugljika i dušika kao i analize drevne DNK budu završene, dobit ćemo mnogo jasniju sliku o promjenama načina života tijekom kasnoavarodobnoga razdoblja na lokalnoj i regionalnoj razini.

METODE

Analiza je provedena u bioarheološkom laboratoriju Instituta za antropologiju u Zagrebu. Spol analiziranih individua određen je na temelju makroskopskoga pregleda usredotočenog na razlike u morfologiji zdjelice i lubanje između odraslih muškaraca i žena (Krogman, Işcan 1986; Buikstra, Ubelaker 1994; Bass 1995). Odrasle individue čiji spol nije mogao biti ustanovljen sa sigurnošću označene su sa vjerojatno muškarci, vjerojatno žene i neodrediv spol. Odrasle individue označene kao vjerojatno muškarci i vjerojatno žene pridružene su svojim spolnim grupama, to jest vjerojatno muškarci s muškarcima i vjerojatno žene sa ženama. Dob u trenutku smrti određena je na temelju morfologije pubične simfize (Brooks, Suchey 1990) i aurikularne plohe (Lovejoy et al. 1985; Buckberry, Chamberlain 2002), promjena na sternalnom kraju rebara (Işcan et al. 1984; 1985), srastanja ektokranijalnih šavova (Meindl, Lovejoy 1985) i stupnja istrošenosti grizne površine zuba (Brothwell 1981; Lovejoy 1985). Dob djece određena je na temelju promjena koje se događaju tijekom razvoja i stvaranja mliječnih i trajnih zuba (Moorrees et al. 1963a; 1963b; Gustafson, Koch 1974; AlQahtani et al. 2009), stupnja koštane osifikacije i dužine dijafize dugih kostiju (Maresh 1970; Scheuer, Black 2000; Schaefer et al. 2009). Sva djeca podijeljena su u četiri dobne skupine prema preporukama Powers (2008) s manjim modifikacijama u najmlađoj dobnoj skupini. Navedene skupine su: novorođenčad (<4 tjedna do 11 mjeseci), mlađa djeca (1 do 5 godina), starija djeca (6 do 11 godina) i adolescenti (12 do 17 godina). Odrasli su podijeljeni u jednu od tri skupine: mlađi odrasli (18 do 35 godina), srednji odrasli (36 do 50 godina) i stariji odrasli (iznad 50 godina). Procjena visine izračunata je za odrasle osobe koristeći se regresijskim formulama koje je razvila Trotter (1970) na temelju najveće duljine bedrene kosti.

belongings were documented as well (Dizdar et al. 2017; Rapan Papeša et al. 2018). Most of the burials contained grave goods, such as objects for everyday use, jewellery, etc. Furthermore, the majority of graves contained ceramic vessels and animal bones, thus indicating the existence of a funeral ritual (Dizdar et al. 2017; Rapan Papeša et al. 2018). This site has crucial significance for further archaeological studies due to its location and position in southern Pannonia, being the first investigated Late Avar cemetery in the Croatian Danube region (Dizdar et al. 2017).

The main aim of this study is to obtain and present a selection of biological information on the Late Avar population from Šarengrad in eastern Croatia by using conventional bioarchaeological approach. Additionally, we will compare this information with similar data obtained from other contemporaneous skeletal samples from the region of the southern Pannonian Plain. Finally, once other studies concerning Šarengrad such as carbon and nitrogen stable isotopes and ancient DNA analyses are completed, we will obtain an unprecedented insight into the changes in lifestyle and living conditions during the Late Avar period at both a local and regional scale.

METHODS

The analysis was carried out in bioarchaeological laboratory of the Institute for Anthropological Research in Zagreb, Croatia. The biological sex of the studied individuals was established based on the macroscopic examination focusing on the differences in pelvic and cranial morphology between adult males and females (Krogman, Işcan 1986; Buikstra, Ubelaker 1994; Bass 1995). Those adults whose sex could not be established with any certainty were labelled probably male, probably female, and unsexed adult. For the purpose of this study, adult individuals labelled probably male and probably female were pooled together with their respective sex groups, i.e. probably males with males and probably female with females. The age-at-death of adults was estimated by using the pubic symphysis (Brooks, Suchey 1990) and auricular surface morphology (Lovejoy et al. 1985; Buckberry, Chamberlain 2002), sternal rib end changes (Işcan et al. 1984; 1985), ectocranial suture fusion (Meindl, Lovejoy 1985), and the degree of dental occlusal surface wear (Brothwell 1981; Lovejoy 1985). The age of subadults was assessed based on the changes occurring during the development and formation of deciduous and permanent teeth (Moorrees et al. 1963a; 1963b; Gustafson, Koch 1974; AlQahtani et al. 2009), the degree of bone ossification and the length of the diaphysis of long bones (Maresh 1970; Scheuer, Black 2000; Schaefer et al. 2009). All subadults were divided into four age groups according to the recommendations proposed by Powers (2008), with some modifications in the youngest age category. These categories are: intrauterine/neonates/infants (<4 weeks to 11 months), younger children (1 to 5 years), older children (6 to 11 years) and adolescents (12 to 17 years). Adults were assigned to one of the three age categories: young adults (18 to 35 years), middle adults (36 to 50 years) and old adults (over

Svi kosturi analizirani su za moguću prisutnost patoloških promjena koje se obično pronalaze u arheološkim uzorcima. Sve zabilježene promjene dokumentirane su prema kriterijima koje su opisali Ortner (2003) te Aufderheide i Rodríguez-Martín (1998). Većina patoloških promjena je izračunata i prezentirana po elementu (npr. zub, alveola, kralježak), a ne po kosturu zbog različitoga stupnja očuvanosti koštanih ostataka. No, neke patologije poput periostitisa i/ili skorbuta su izračunate i prezentirane po osobi/kosturu.

Sljedeće patološke promjene uočene su u koštanom uzorku iz Šarengrada:

1) Zaživotni gubitak zuba dobar je pokazatelj zdravlja u arheološkim populacijama. Različiti čimbenici utječu na zaživotni gubitak zuba: promjene u konzistenciji prehrane, bolesti koje su rezultat poremećaja u prehrani, fizičke traume te kulturalno ili ritualno odstranjivanje zuba (Lukacs 2007). Zaživotni gubitak zuba može također biti prouzročen različitim alveolarnim bolestima, najčešće upalom desni (gingivitis) (Ortner 2003). Zaživotni gubitak zuba definiran je kao progresivno resorptivno uništenje alveole (Lukacs 1989) i prisustvo remodelirane alveolarne kosti.

2) Karijes je bolest koja se najlakše prepoznaje kao otvor u zubu koji je rezultat progresivne dekalcifikacije cakline i dentina (White, Folkens 2005) prouzročene bakterijama i otopinama iz oralnih tekućina (Aufderheide, Rodriguez-Martin 1998). Prisustvo karijesa dijagnosticirano je makroskopski, pod snažnim osvjetljenjem, s pomoću dentalne sonde. Karijes je klasificiran u četiri kategorije prema parametrima koje su predložili Metress i Conway (1975).

3) Kalkulus ili plak je nakupina kalcificiranih naslaga na zubima (Mays 1998; White, Folkens 2005). Zubne naslage mogu pospješiti nastanak i razvoj gingivitisa te dovesti do različitih periodontalnih bolesti i alveolarne resorpcije (Lukacs 2007). Detaljan makroskopski pregled zubnih naslaga pomogao je pri razabiranju pravih kalcificiranih zubnih naslaga od postmortalnih nakupina kao što su pijesak ili zemlja. Kalcificirane zubne naslage su dokumentirane prema kriterijima koje je predložio Brothwell (1981).

4) Istrošenost griznih ploha zuba jedna je od nekoliko regresivnih promjena koje se u pretežno vežu uz starenje (Aufderheide, Rodriguez-Martin 1998; White, Folkens 2005). To je fiziološki proces trošenja zubnog tkiva koji nastaje kao rezultat kontakta između zuba koji se događa prilikom mastikacije i gutanja (Aufderheide, Rodriguez-Martin 1998). Istrošenost griznih ploha zuba je dokumentirana prema sistemu koji je predložio Smith (1984). No, ovaj je sistem ponešto izmijenjen zato što su samo rezultati za jaču istrošenost (Smithovi stupnjevi 5–8) predstavljeni u ovome radu.

5) *Cribra orbitalia* je pokazatelj subadultnoga stresa. Manifestira se u obliku lezija na nadočnim krovovima (orbitama), obično kao obostrani porozitet na nadočnome dijelu čeone kosti (Mittler, van Gerven 1994; White, Folkens 2005). Lezija u svom najjačem obliku u pravilu nastaje tijekom ranoga djetinjstva (ne prilikom rođenja) (Aufderheide, Ro-

50 years). The height estimation was calculated for adult individuals by using formulae proposed by Trotter (1970) based on maximum femur length.

All individuals were analysed for the possible presence of various pathological changes usually seen in archaeological samples. All observed conditions were documented according to criteria described by Ortner (2003), and Aufderheide and Rodríguez-Martín (1998). Most of the pathological changes were calculated and summed by the element (e.g. tooth, tooth socket, vertebra), and not by the individual due to the different degree of preservation of the skeletal remains. However, some pathologies such as subperiosteal new bone formation and/or scurvy were calculated and presented by the individual.

The following pathological conditions were observed in the Šarengrad skeletal assemblage:

1) Premature loss of teeth or antemortem tooth loss (AMTL) is a good indicator of health in archaeological populations. There are various factors that contribute to AMTL, such as changes in dietary consistency, diseases as a result of nutritional deficiency, trauma, and cultural or ritual removal of teeth (Lukacs 2007). AMTL could also occur as a result of different alveolar diseases, most commonly the inflammation of gums (gingivitis) (Ortner 2003). AMTL was diagnosed by the progressive resorptive destruction of the alveolus (Lukacs 1989) and by the presence of remodelling of the alveolar bone.

2) Caries is a disease that is most recognizable by the hole in a tooth that is a result of the progressive decalcification of enamel or dentine (White, Folkens 2005) caused by the bacteria and solutes of the oral fluids (Aufderheide, Rodriguez-Martin 1998). The presence of caries was diagnosed macroscopically, under strong illumination, with the help of a dental probe. Caries size was classified into four categories according to Metress and Conway (1975).

3) Calculus or plaque is a deposit of calcified dental plaque on teeth (Mays 1998; White, Folkens 2005). Large calculus accumulations can serve as gingival irritants which could result in various periodontal diseases and alveolar recession (Lukacs 2007). A detailed macroscopic examination of the teeth deposits distinguished true dental calculus from post-mortem deposits such as sand or soil. Dental calculus was recorded using the criteria proposed by Brothwell (1981).

4) Dental wear or attrition of the enamel is one of the several regressive changes that are generally associated with the progressive age (Aufderheide, Rodriguez-Martin 1998; White, Folkens 2005). It is a physiological process of wearing a way of tooth tissue which is a result of tooth-to-tooth contact that occurs during mastication and swallowing (Aufderheide, Rodriguez-Martin 1998). Dental wear was recorded according to the system proposed by Smith (1984). However, this system was slightly modified because only the results for heavy wear (Smiths degrees 5–8) are presented in this paper.

5) *Cribra orbitalia* is an indicator of subadult stress. It manifests in a form of lesions on the orbital roof, generally in

driguez-Martin 1998) te se najčešće veže uz različite vrste anemija i pothranjenost u djetinjstvu (Mensforth et al. 1978; Walker et al. 2009).

6) Linearna hipoplazija zubne cakline javlja se u obliku vodoravnih linija na površini krune zuba. Takve deformacije predstavljaju defekte u dentalnome razvoju (Goodman, Rose 1990; White, Folkens 2005) i kao takve dobri su pokazatelji subadultnoga stresa (metabolički stres tijekom dužeg vremena i/ili stresan događaj koji ih je uzrokovao) (Aufderheide, Rodriguez-Martin 1998).

7) Periostitis je nespecifična promjena u kosti koja je vidljiva na *periosteumu* – membrani koja prekriva vanjsku površinu kostiju osim na zglobovima (White, Folkens 2005). Bilo kakva iritacija *periosteuma* može rezultirati stvaranjem novoga sloja kosti nad postojećim slojem, a to može biti uzrokovano ne samo infekcijom ili upalom već i drugim faktorima poput trauma; stanje može biti akutno ili kronično (White, Folkens 2005). Prema Wheeleru (2012), učestalost ove patološke promjene može biti vezana uz čimbenike kao što su traume prilikom rođenja, metabolički poremećaji, hipervitaminoza A, leukemija i infantilna kortikalna hiperostoza.

8) Skorbut je bolest uzrokovana nedostatnim unosom vitamina C (askorbinska kiselina) kroz duže vremensko razdoblje. Vitamin C je neophodan za stvaranje kolagena, a nedostatne količine u organizmu dovode do stanjivanja i slabljenja kosti (White, Folkens 2005). Skorbut se na kostima javlja u obliku poroznih, hipertrofičnih lezija na lubanji, posebice na klinastoj, čeonoj i tjemenim kostima, iako i gornja i donja čeljust mogu biti zahvaćene (Ortner 2003).

9) Prisustvo koštanih ozljeda (frakture) je ustanovljeno makroskopskom analizom koja je uključivala prisustvo bilateralne asimetrije, kutnih deformiteta, koštanih kalusa i zacijeljenih depresijskih fraktura kao i trauma uzrokovanih tupim predmetima, tragova posjekotina i/ili ozljeda projektilom.

10) Osteoartritis je jedan od najčešćih tipova artritisa, poznat i kao degenerativna bolest zglobova (White, Folkens 2005). Vertebralni osteoartritis je karakteriziran uništenjem hrskavice u zglobu i diskovima u vratu i leđima, uz stvaranje novih koštanih tkiva (osteofita) te izbočinskih formacija kod zglobova (White, Folkens 2005).

11) Schmorlov defekt je hernijacija međukralježnoga diska koji je penetrirao u tijelo kralješka; može se pojaviti na bilo kojem kralješku, no obično je nalazi na prsnim i slabinskim područjima (Ortner 2003). Najčešće se javlja kao udubina na sredini superiorne i/ili inferiorne plohe tijela kralješka.

12) Leptirasti kralježak je rijetka kongenitalna anomalija kralježnice koja je najčešće benigna (Hopkins, Abbott 2015). Stvara se *in utero* i manifestira se kao nespajanje dvije polovine tijela kralješka (Hopkins, Abbott 2015).

13) Dok staračka osteoporoza predstavlja stanje značajnog smanjenja mase kostiju nastaloga uslijed dugotrajne

the form of bilateral pitting of the orbital part of the frontal bone (Mittler, van Gerven 1994; White, Folkens 2005). The lesion usually develops in fullest during infancy (not at birth) (Aufderheide, Rodriguez-Martin 1998) and is most commonly associated with anemia and malnutrition in childhood (Mensforth et al. 1978; Walker et al. 2009).

6) Linear enamel hypoplasia occurs in a form of transversal lines on the surface of tooth crowns. Such deformities are defects in dental development (Goodman, Rose 1990; White, Folkens 2005) and as such are good indicators of subadult stress (long-term metabolic stress, and/or a stressful event that caused it) (Aufderheide, Rodriguez-Martin 1998).

7) Sub-periosteal new bone formation is a non-specific change in the bone which is visible on the *periosteum* – a membrane that covers the outer surface of bones except in areas of articulation (White, Folkens 2005). Any irritation of the *periosteum* may result in new bone formation on the underlying bone, and this may be caused by not only infection or inflammation but also by other factors such as trauma; it can be acute or chronic (White, Folkens 2005). According to Wheeler (2012), the occurrence of this pathological change can be also associated with conditions like birth trauma, metabolic disorders, hypervitaminosis A, leukemia, and infantile cortical hyperostosis.

8) Scurvy is a disease caused by prolonged inadequate intake of vitamin C (ascorbic acid), essential for the production of collagen, resulting in the thinning—and thus weakening—of bone (White 2005). It is displayed in the form of porous, hypertrophic lesions of the skull vault, particularly affecting the frontal and parietal bones, although the maxilla and mandible may be involved as well (Ortner 2003).

9) The presence of skeletal injury (fracture) was established by macroscopic analysis that included certification of bilateral asymmetry, angular deformities, the presence of bone calluses and healed depressions, blunt force trauma, cutting and/or projectile injuries.

10) Osteoarthritis is one of the most common types of arthritis, also known as degenerative joint disease (White, Folkens 2005). Vertebral osteoarthritis is characterized by the destruction of the articular cartilage in a joint and discs in the neck and lower back, accompanied by bony lipping (osteophytes) and spur formation adjacent to the joint (White, Folkens 2005).

11) Schmorls node is a herniation of the intervertebral disc penetrating into the vertebral body; it can appear on any vertebra but tends to concentrate in the lower thoracic and lumbar regions (Ortner 2003). It mostly appears as an indentation around the midline of the vertebral plate.

12) The butterfly vertebral defect is a rare congenital anomaly of the spine generally considered benign (Hopkins, Abbott 2015). It forms *in utero* and appears as a failure of the fusion of the two halves of the vertebral body (Hopkins, Abbott 2015).

13) Whereas senile osteoporosis represents a condition of significantly diminished bone mass due to long-standing imbalance between bone resorption and bone formation where the bone mass is evenly lost throughout the bone,

neravnoteže između resorpcije i nastanka kosti pri čemu se masa gubi ravnomjerno kroz kost, osteopenija predstavlja stanje neravnomjernoga gubitka mase kosti. Uzročnici uključuju osteoporozu, osteomalaciju (i rahitis), hiperparatireoidizam i rak (Ortner 2003).

14) Maksilarni sinusitis je upala sluzne membrane jednoga ili više paranazalnih sinusa, a može biti akutna ili kronična. Većina promjena prisutna je na mekim tkivima, no kod kroničnoga sinusitisa moguće je i uništenje kosti i/ili formacija novog sloja kosti (Roberts 2007). U koštanom materijalu, kronični oblik sinusitisa je obično najlakši za prepoznati (Roberts 2007).

Radiografsko snimanje (računalna tomografija) određenih primjeraka provedeno je na Kliničkom zavodu za dijagnostičku i intervencijsku radiologiju Kliničkoga bolničkog centra Zagreb. Snimanje je provedeno koristeći jedinicu za multidetekcijsku računalnu tomografiju (MDCT) (Emotion 16, Siemens AG Medical Solutions, Erlangen, Njemačka). Parametri skeniranja su 16 × 0,75 mm kalibracije i 0,4 rekonstrukcijskog uvećanja (RI) sa 130 kV i 190 mAs. Trodimenzionalna (3D) tehnika zapreminskoga renderiranja (VRT), projekcija maksimalnoga intenziteta (MIP) i mulitplanarska rekonstrukcija (MPR) provedene su uz pomoć OsiriX MD Imaging računalnog sučelja, v 7.0.4 (Pixmeo, Ženeva, Švicarska).

Predstavljeni podaci su statistički analizirani uz pomoć računalnoga sučelja SPSS 17.0 za Windows. Uočena razlika u učestalosti analiziranih patologija između spolnih i dobnih skupina procijenjenja je uz pomoć hi-kvadrata, a statistička značajnost definirana je nivoom vjerojatnosti $p \leq 0,05$.

REZULTATI

Na početku treba napomenuti kako su predstavljeni rezultati samo preliminarni zbog činjenice što koštani ostaci iz 45 ukopa predstavljaju samo dio šarengradske populacije, budući da groblje nije iskopano u cijelosti. Za potrebe ovoga rada analizirano je 46 individua (tab. 1). U analiziranome uzorku prisutno je 16 djece (34,8%), 14 žena (30,4%), 11 muškaraca (23,9%) i pet osoba neodredivoga spola (10,9%) (sl. 2). Najviša smrtnost prisutna je u skupini srednji odrasli, a slijedi ju skupina mlađi odrasli; kod djece, najviša smrtnost prisutna je u skupini mala djeca (Sl. 3). Prosječna dob u trenutku smrti za odrasle individue iznosi 40,3 godine: žene su živjele nešto duže u odnosu na muškarce (41,9 napram 37,3 godine), no ova razlika nije statistički značajna. Prosječna visina za odrasle žene iz Šarengrada iznosi 155,5 cm (N=8; rekonstruirana visina varira između 149 i 160 cm) te 167,1 cm za muškarce (N=7; rekonstruirana visina varira između 156 i 173 cm).

Ukupna učestalost zaživotnoga gubitka zuba u analiziranoj populaciji iznosi 18,8% (145/770). Kod djece ove promjene nisu prisutne (tab. 2), a ukupna učestalost zaživotnoga gubitka zuba kod odraslih je 21,9% (145/662) (sl. 4). Žene iskazuju veću učestalost u odnosu na muškarce (31,3% napram 12,7%) što predstavlja statistički značajnu razliku (χ^2= 30,742, df=1, p<0,001). Prisustvo karijesa zabilježeno je kod

osteopenia is a general descriptive term that identifies the occurrence of a disproportionate loss of bone mass in a particular bone. Osteopenia is caused by osteoporosis, osteomalacia (and rickets), hyperparathyroidism, and cancer (Ortner 2003).

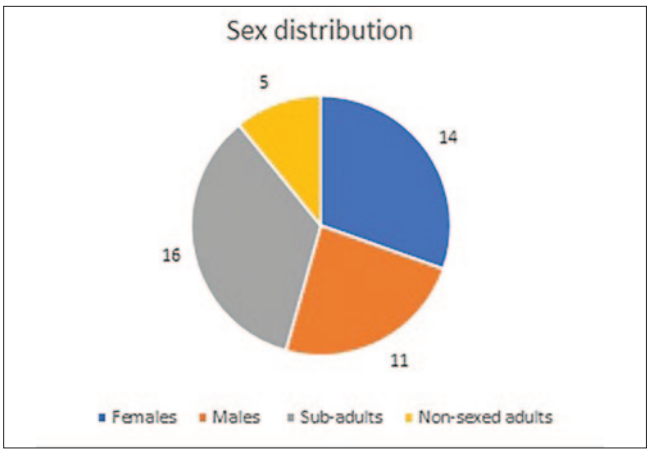
14) Maxillary sinusitis is an inflammation of the mucous membranes of one or more of the paranasal sinuses; it can be acute or chronic. The majority of the tissue change is of the soft tissues, but in chronic sinusitis bone destruction and/or formation may develop (Roberts 2007). In skeletal material, the chronic form of sinusitis is typically the easiest to recognize (Roberts 2007).

Radiographic imaging (CT scanning) of selected specimens was conducted at the Department of Diagnostic and Interventional Radiology, University Hospital Center Zagreb. The imaging was carried out utilizing a Multidetector computerized tomography (MDCT) unit (Emotion 16, Siemens AG Medical Solutions, Erlangen, Germany). The scanning parameters were 16 × 0.75 mm collimation and 0.4 reconstruction increment (RI) with 130 kV and 190 mAs respectively. The three-dimensional (3D) Volume Rendering Technique (VRT), Maximum Intensity Projection (MIP) and Multiplanar Reconstructions (MPR) were done with OsiriX MD Imaging software, v 7.0.4. (Pixmeo, Geneva, Switzerland).

The presented data were statistically analysed using the software package SPSS 17.0 for Windows by IBM. The observed differences in the frequencies of analysed pathologies between the sexes and age groups were evaluated with the chi-square, and statistical significance was defined by the probability levels of $p \leq 0.05$.

RESULTS

From the start, it has to be mentioned that the presented results are only preliminary due to the fact that the skeletal remains from 45 burials represent only a part of the Šarengrad population since the cemetery has not been excavated in its entirety. For the purpose of this paper we analysed a total of 46 individuals (Tab. 1). The sex distribution in the analysed sample is as follows: 16 subadults (34.8%), 14 fe-

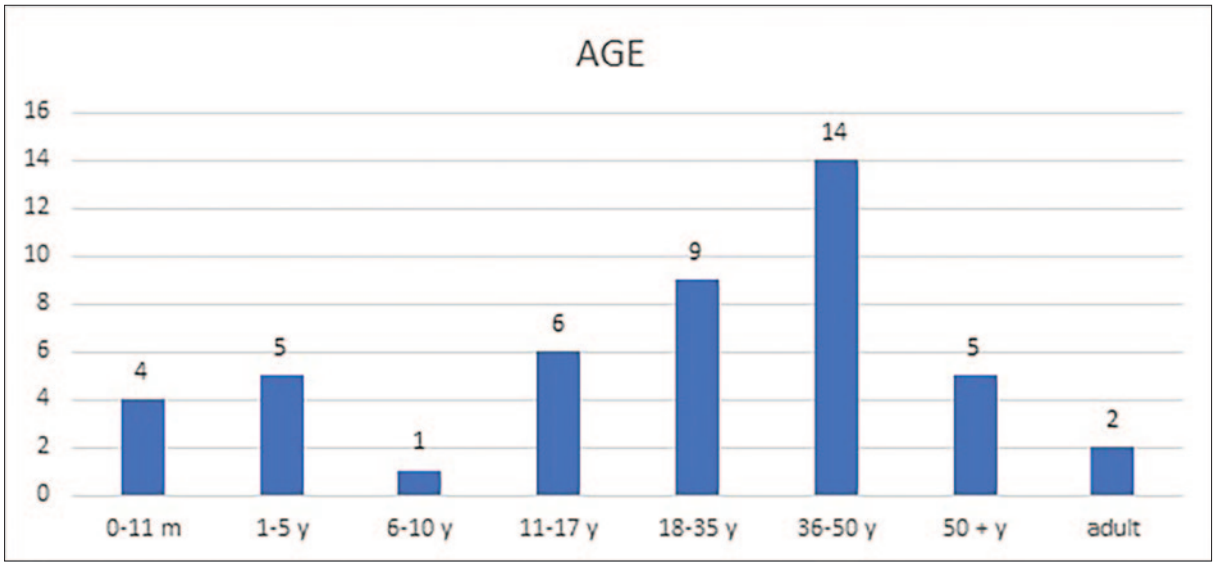


Sl. 2 Distribucija populacije iz Šarengrada po spolu (izradila: B. Zagorc)

Fig. 2 Sex distribution of the Šarengrad population (chart: B. Zagorc)

Grob/Grave	Spol/Sex	Dob (godine)/Age (years)
1	neodrediv/non-sexed	40+
2	vjerojatno žena/probably female	30–40
3	dijete/subadult	12–15
4	muškarac/male	35–45
5	žena/female	50+
6	žena/female	30–36
7	dijete/subadult	11,5–12,5
8	neodrediv/non-sexed	40+
9	žena/female	50+
10	neodrediv/non-sexed	odrasli/adult
11	neodrediv/non-sexed	odrasli/adult
12	žena/female	35–42
13	muškarac/male	18–25
14	dijete/subadult	15–18
15	žena/female	18–22
16	vjerojatno žena/probably female	40+
17	dijete/subadult	12–14
18	dijete/subadult	4,5–5,5
19	neodrediv/non-sexed	20–30
20	dijete/subadult	4,5–5,5
21	dijete/ subadult	16,5–18
22	dijete/ subadult	1,5–2,5
23	muškarac/male	36–42
24	muškarac/male	22–30
25	muškarac/male	40–50
26	muškarac/male	40–50
27	žena/female	18–25
28	vjerojatno žena/probably female	24–28
29	žena/female	45+
31	dijete/subadult	2–3 m
32	muškarac/male	25–35
33	dijete/subadult	12–14
34	žena/female	30–45
35	dijete/subadult	8–12
37	dijete/subadult	1–1,5
38	dijete/subadult	7–9 m
39	muškarac/male	50+
40	žena/female	40–50
41	dijete/subadult	1–1,5
42	muškarac/male	35–45
43	dijete/subadult	4–10 m
44	žena/female	50+
46	žena/female	40–50
50A	muškarac/male	40–50
50B	dijete/subadult	>1
53	vjerojatno muškarac/probably male	17–22

Tab. 1 Spolna i dobna distribucija analiziranih osoba po grobovima
Tab. 1 The sex and age of the analyzed individuals by grave



Sl. 3 Distribucija populacije iz Šarengrada po dobi (izradila: B. Zagorc)
Fig. 3 Age distribution of the Šarengrad population (chart: B. Zagorc)

	Djeca/Subadults	Žene/Females	Muškarci/Males	Neodrediv spol/ Non-sexed adults	Ukupno/Total
	n/N %	n/N %	n/N %	n/N %	n/N %
Zaživotni gubitak zuba/ AMTL	0/108 0,0	100/319 31,3	40/314 12,7	5/29 17,2	145/770 18,8
Apsces/Abcess	0/108 0,0	16/319 5,0	17/314 5,4	1/29 3,4	34/770 4,4
Karijes/Caries	7/126 5,5	37/177 20,9	23/264 8,7	3/36 8,3	70/603 11,6
Kalcificirane zubne naslage/Calculus		117/177 66,1	221/264 83,7	9/36 25,0	347/477 72,7
Istrošenost griznih ploha/ Dental wear		28/177 15,8	49/264 18,5	8/36 22,2	85/477 17,8

n = broj zahvaćenih elemenata/n = number of affected elements; N = broj pregledanih elemenata/N = number of observed elements

Tab. 2 Dento-alveolarne patologije u avarodobnom uzorku iz Šarengrada (po zubu i alveoli)
Tab. 2 Dento-alveolar pathologies in the Late Avar period sample from Šarengrad (by tooth and alveolus)

Sl. 4 Zaživotni gubitak zuba i karijes na donjoj čeljusti sredovječnoga muškarca, grob 25 (snimila: B. Zagorc)
Fig. 4 Antemortem tooth loss and caries on the mandible, middle-aged male, grave 25 (photo: B. Zagorc)

males (30.4%), 11 males (23.9%), and five non-sexed adults (10.9%) (Fig. 2). The highest mortality is present in the middle-adult age group, followed by the young-adult category; in subadults, the highest mortality is present in the younger children age group (Fig. 3). The mean age-at-death for adult individuals is 40.3 years: the females lived somewhat longer compared to males (41.9 vs. 37.3 years), but this difference is not statistically significant. The average height for adult females from Šarengrad is 155.5 cm (N=8; the reconstructed height varies between 149 and 160 cm), and 167.1 cm for males (N=7; the height varies between 156 and 173 cm).

The overall frequency of antemortem tooth loss in the studied population is 18.8% (145/770). No traces of this condition were found in subadults (Tab. 2), and the total percentage of AMTL in adults is 21.9% (145/662) (Fig. 4). Females show a much higher prevalence compared to males (31.3% vs. 12.7%), which is statistically significant (χ^2= 30.742, df=1, p<0.001). The presence of caries was documented in 11.6% (70/603) of all teeth. Only 5.5% of subadult teeth from Šarengrad show carious lesions, while in adults this frequency

Zub/Tooth	n	N	%
Maksilarni I1/Maxillary I1	21	28	75,0
Maksilarni I2/Maxillary I2	17	27	63,0
Maksilarni C/Maxillary C	26	36	72,2
Mandibularni I1/Mandibular I1	14	22	63,6
Mandibularni I2/Mandibular I2	21	35	60,0
Mandibularni C/Mandibular C	37	47	78,7

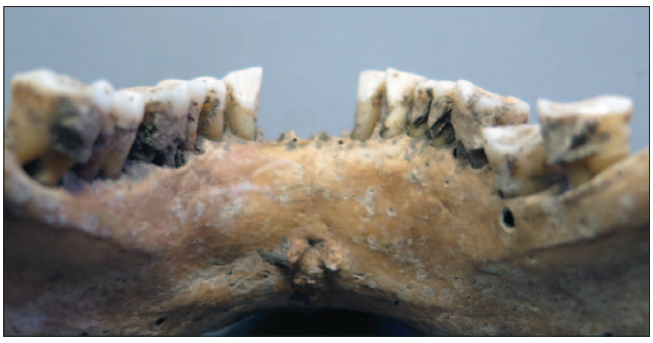
n = broj zahvaćenih zuba/*n = number of affected teeth*; N = broj pregledanih zuba/*N = number of observed teeth*

Tab. 3 Učestalost linearne hipoplazije zubne cakline u šarengradskoj populaciji (po zubu)
Tab. 3 The frequency of linear enamel hypoplasia in the Šarengrad population (by tooth)

11,6% (70/603) analiziranih zuba. Samo 5,5% dječjih zuba iz Šarengrada pokazuju kariozne lezije, dok kod odraslih ova učestalost iznosi 13,2%. Ponovno, žene iskazuju veću učestalost u odnosu na muškarce (20,9 napram 8,7%); ova razlika je također statistički značajna (χ^2=13,399, df=1, p<0,001). Kalcificirane zubne naslage su prisutne na 72,7% (347/477) zuba odraslih osoba (sl. 5), pri čemu muškarci iskazuju veću učestalost u odnosu na žene (83,7 napram 66,1%; χ^2=18,357, df=1, p<0,001). Analiza istrošenosti griznih ploha zuba pokazuje kako je 17,8% (85/477) svih zuba odraslih osoba karakterizirano jakom istrošenošću; nešto veća učestalost zabilježena je kod muškaraca (18,5 napram 16,8%), što ne predstavlja statistički značajnu razliku.

Prisustvo *cribra orbitalia* zabilježeno je kod 24,2% (8/33) osoba s očuvanim čeonim kostima (sl. 6). Kod djece zabilježena je kod šest osoba (60%; od toga su tri slučaja bila aktivna u trenutku smrti), a kod odraslih u 9,5% (2/23) (muškarci 20% ili 2/10; žene 0% ili 0/10; neodrediv spol 0% ili 0/3). Linearna hipoplazija zubne cakline (LEH) je zabilježena na 69,7% (136/195) analiziranih trajnih sjekutića i očnjaka gornjih i donjih čeljusti (tab. 3). LEH je najčešći na očnjacima donje čeljusti (78,7%), nakon čega slijede prvi sjekutići gornje čeljusti (75%) te potom očnjaci gornje čeljusti (72,2%).

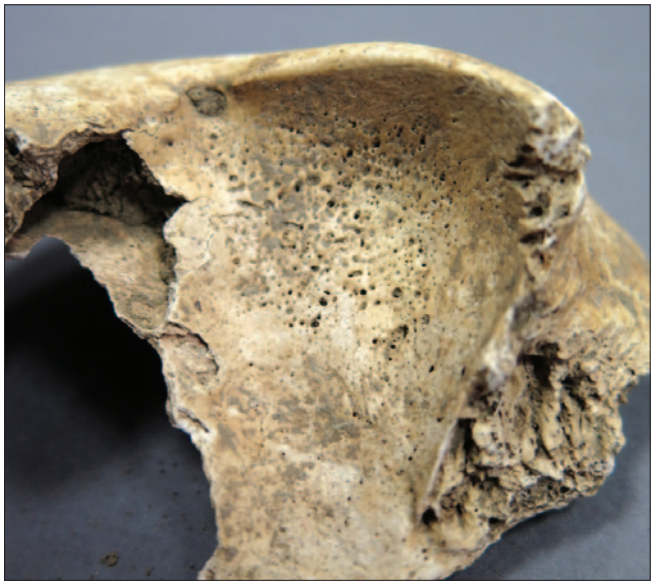
Periostitis je zabilježen kod osam osoba: jedan muškarac, četiri žene i tri djeteta. U polovici slučajeva promjene su lokalizirane i u zaraslom obliku. No, kostur sredovječnoga muškarca (grob 25) pokazuje aktivne promjene na lubanji i



Sl. 5 Kalcificirane zubne naslage na zubima donje čeljusti, sredovječna žena, grob 46 (snimila: B. Zagorc)
Fig. 5 Calculus deposits on mandibular teeth, middle-aged female, grave 46 (photo: B. Zagorc)

is 13.2%. Again, females show a much higher prevalence in comparison to adult males (20.9 vs. 8.7%); this difference is also statistically significant (χ^2=13.399, df=1, p<0.001). Calculus is present in 72.7% (347/477) of all adult teeth (Fig. 5), with males exhibiting significantly higher prevalence in comparison to females (83.7 vs. 66.1%; χ^2=18.357, df=1, p<0.001). Dental wear analysis shows that 17.8% (85/477) of all adult teeth were characterized by high attrition value; a slightly higher prevalence of this condition was recorded in males (18.5 vs. 16.8%), but was not statistically significant.

The presence of *cribra orbitalia* was documented in 24.2% (8/33) of individuals with preserved frontal bones (Fig. 6). In subadults, it was found in six individuals (60%; three cases active at the time of death), and in adults in 9.5% (2/23) of individuals (males 20% or 2/10, females 0% or 0/10, non-sexed adults 0% or 0/3). Linear enamel hypoplasia (LEH) was documented in 69.7% (136/195) of all permanent maxillary and mandibular incisors and canines (Tab. 3). LEH was most frequent on the mandibular canines (78.7%), followed by the maxillary first incisors (75%), and the maxi-



Sl. 6 Zarasla cribra orbitalia u lijevoj orbiti, adolescent, grob 33 (snimila: B. Zagorc)
Fig. 6 Healed cribra orbitalia in the left orbit, adolescent, grave 33 (photo: B. Zagorc)

nekoliko dugih kostiju, dok su na kosturu mlađe žene (grob 27) prisutne aktivne promjene na ključnim kostima, lijevom nepcu i pet lijevih rebara. Kod djece, jedan adolescent (grob 33) pokazuje kombinaciju zaraslih i aktivnih promjena na nekoliko dugih kostiju i rebara; jedno novorođenče (grob 38) ima aktivne lezije na obje sljepoočne kosti te na klinastoj kosti, dok su kod drugoga novorođenčeta prisutne aktivne lezije na lijevoj sljepoočnoj kosti (grob 50B).

Promjene koje odgovaraju skorbutu prisutne su na kosturu adolescenta (grob 33) u obliku poroziteta na sljepoočnim kostima i lijevoj klinastoj kosti; slične promjene praćene aktivnim periostitisom prisutne su na lijevoj sljepoočnoj kosti djeteta (grob 50B).

Četiri odrasle osobe iz Šarengrada (dva muškarca, jedna žena i jedna odrasla osoba neodredivoga spola) pokazuju znakove ozljeda zadobivenih za vrijeme života. Na kosturu mlađeg muškarca (grob 24) prisutna je zaživotna fraktura desne ključne kosti s remodeliranim kalusom; ozljeda je rezultirala skraćenjem ključne kosti (D=147, L=154 mm). Kostur sredovječnog muškarca (grob 25) pokazuje znakove kompresijske frakture 12. prsnoga kralješka, dok su na kosturu starije žene (grob 29) prisutne frakture 9. i 10. prsnoga kralješka; u oba slučaja ozljede su prisutne na anterosuperiornim dijelovima tijela kralježaka. I na kraju, na kosturu odrasle osobe neodrediva spola (grob 11) prisutne su dvije zaživotne ozljede: i) fraktura distalne dijafize desne lisne kosti koja je rezultirala sraštanjem s goljeničnom kosti; ii) zarasle frakture prvih članaka desnoga stopala (proksimalni i distalni članci su zahvaćeni prijelomom) (sl. 7).

llary canines (72.2%).

Sub-periosteal new bone formation was recorded in eight individuals: one adult male, four females and three subadults. In half of the cases periosteal changes are localized and in healed condition. However, the skeleton of a middle-aged male (grave 25) exhibits active periosteal changes on the cranium and several long bones while the skeleton of a young female (grave 27) shows evidence of active changes on both clavicles, the left palatine and five left ribs. In subadults, one adolescent (grave 33) exhibits a combination of healed and active changes on several long bones and the ribs; one infant (grave 38) exhibits active lesions on both temporal bones and the sphenoid bone, while another infant shows active lesions on the left temporal bone (grave 50B).

Changes corresponding to scurvy are present on the skeleton of an adolescent (grave 33) in the form of porosity on both temporal bones and on the left sphenoid bone; similar changes accompanied by active sub-periosteal new bone formation were observed on the left temporal bone of an infant (grave 50B).

Four adult individuals from the Šarengrad skeletal assemblage (two males, one female, and one non-sexed adult) show evidence of antemortem injuries. A young male (grave 24) displays an antemortem fracture of the right clavicle with a remodelled callus; the injury resulted in the shortening of the clavicle (R=147, L=154 mm). A middle-aged male (grave 25) exhibits a compression fracture of the 12th thoracic vertebra, while an older female (grave 29)

Sl. 7 Zaživotna fraktura prvog članka desnog stopala, odrasla osoba neodrediva spola, grob 11 (snimio: M. Carić)
Fig. 7 Antemortem fractures of the right first pedal phalanges, non-sexed adult, grave 11 (photo: M. Carić)

Vertebralni osteoartritis zabilježen je na svim dijelovima kralježnice (tab. 4): najčešće na slabinskim (37,4%), zatim na prsnim (26%) te na vratnim kralješcima (9,8%). Žene iskazuju nešto višu učestalost osteoartritisa (26,2 napram 22,2%), no ova razlika nije statistički značajna. Schmorlovi defekti pojavljuju se na jednoj četvrtini (25%) svih analiziranih kralježaka odraslih osoba iz Šarengrada (tab. 5); češći su na prsnim kralješcima (26,5% ili 47/177) u odnosu na slabinske (22% ili 20/91). Muškarci iz Šarengrada iskazuju bitno veću učestalost Schmorlovih defekata u odnosu na žene (32,8 napram 19,3%; χ^2=6,255, df=1, p=0,0183).

Dva slučaja kongenitalne anomalije kralježnice poznate kao leptirasti kralježak zabilježena su kod dvije odrasle oso-

displays compression fractures of the 9th and 10th thoracic vertebrae; in both cases the injuries affected the antero-superior parts of the vertebral bodies. Finally, the skeleton of a non-sexed adult (grave 11) shows two antemortem injuries: i) the fracture of the distal diaphysis of the right fibula resulting in the ankylosis with the tibia; ii) healed fractures of the right first pedal phalanges (both proximal and distal phalanges are affected) (Fig 7).

Vertebral osteoarthritis was recorded on all spinal segments (Tab. 4). The condition is most frequent on the lumbar spine (37.4%), followed by the thoracic segment (26%), and finally the cervical spine (9.8%). Females show a slightly higher prevalence of vertebral osteoarthritis (26.2 vs.

	Vratni/Cervical		Prsni/Thoracic		Slabinski/Lumbar		Ukupno/Total	
	n/N	%	n/N	%	n/N	%	n/N	%
Žene/Females	5/57	8,7	28/95	29,4	20/50	40,0	53/202	26,2
Muškarci/Males	6/52	11,5	18/78	23,0	14/41	34,1	38/171	22,2
Neodrediv spol/Non-sexed adults	0/3	0,0	0/4	0,0	0/0	0,0	0/7	0,0

n = broj zahvaćenih kralježaka/*n = number of affected vertebrae*; N = broj pregledanih kralježaka/*N = number of observed vertebrae*

Tab. 4 Učestalost vertebralnog osteoartritisa u šarengradskoj populaciji (po kralješku)
Tab. 4 The frequency of vertebral osteoarthritis in the Šarengrad population (by vertebra)

	Prsni/Thoracic		Slabinski/Lumbar		Ukupno/Total	
	n/N	%	n/N	%	n/N	%
Žene/Females	20/95	21,0	8/50	16,0	28/145	19,3
Muškarci/Males	27/78	34,6	12/41	29,2	39/119	32,8
Neodrediv spol/Non-sexed adults	0/4	0,0	0/0	0,0	0/4	0,0

n = broj zahvaćenih kralježaka/*n = number of affected vertebrae*; N = broj pregledanih kralježaka/*N = number of observed vertebrae*

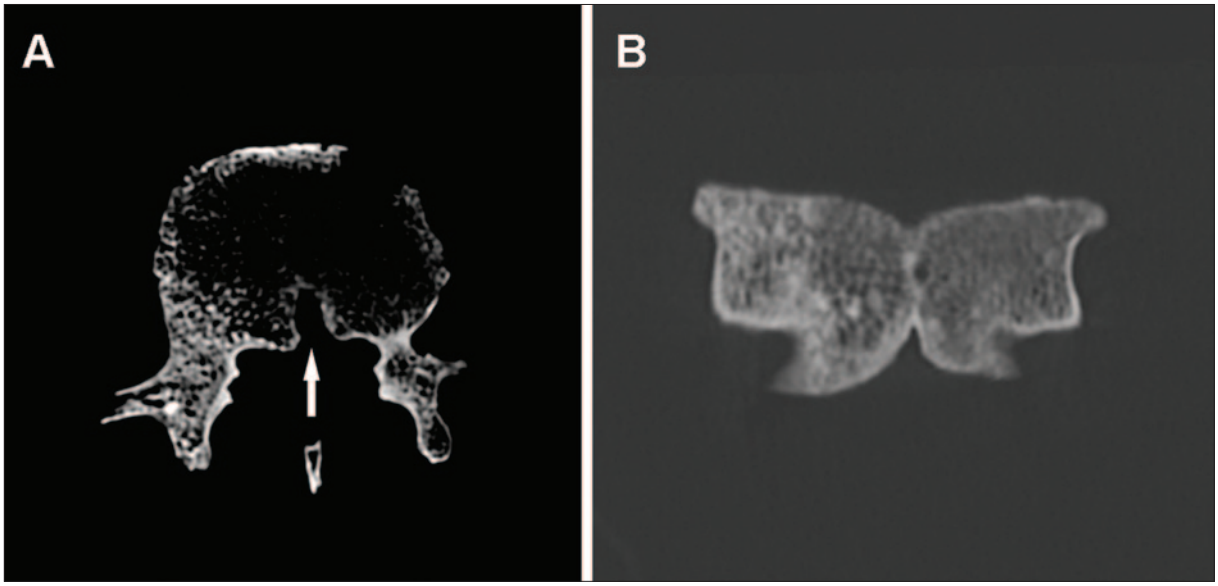
Tab. 5 Učestalost Schmorlovih defekata u šarengradskoj populaciji (po kralješku)
Tab. 5 The frequency of Schmorls nodes in the Šarengrad population (by vertebra)

be, oba na 4. slabinskom kralješku. Prvi je prisutan na kosturu adolescenta (grob 21), a drugi na kosturu sredovječnoga muškarca (grob 25). U oba slučaja lateralne polovice tijela kralježaka su spojene osim okomitoga usjeka na posteriornoj strani tijela gdje spajanje nije dovršeno (sl. 8).

Moguć slučaj osteopenije prisutan je na kosturu sredovječne žene (grob 34) kod koje su sve očuvane kranijalne i postkranijalne kosti značajno atrofirane i iznimno lagane: i) niska gustoća i šupljikavost dugih kostiju je makroskopski vidljiva; ii) rekonstruirana visina individue iznosi 147 cm, da-

22.2%), but this difference is not significant. Schmorls nodes appear in one quarter (25%) of all studied adult vertebrae from Šarengrad (Tab. 5); they are more frequent on the thoracic spine (26.5% or 47/177) than the lumbar segment (22% or 20/91). Males from Šarengrad exhibit significantly higher prevalence of Schmorls nodes compared to females from the same site (32.8 vs. 19.3%; χ^2=6.255, df=1, p=0.0183).

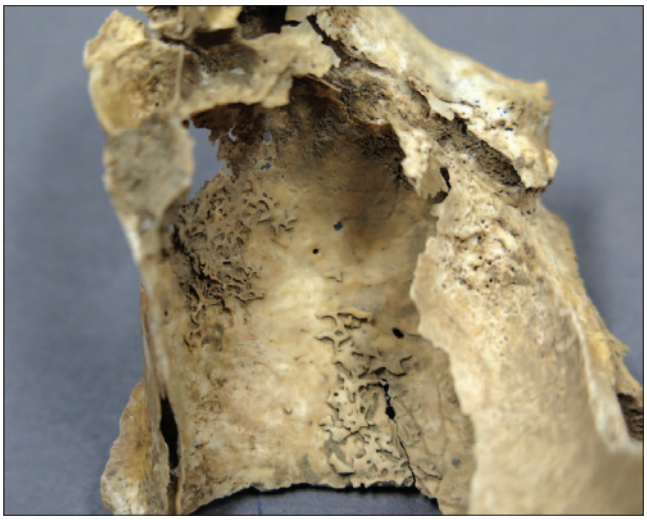
Two cases of congenital spinal anomaly also known as butterfly vertebrae were recorded in two adults, both on the 4th lumbar vertebrae. The first is present in an adoles-



Sl. 8 CT snimka leptirastog kralješka, sredovječni muškarac, grob 25. A) superiorni pogled, defekt je jasno vidljiv; B) posteriorni pogled, primjetno je tijelo kralješka u obliku leptira (snimio: M. Čavka)
Fig. 8 CT scans of butterfly vertebrae, middle-aged male, grave 25. A) superior view, the defect is clearly visible; B) posterior view, notice the butterfly-shaped vertebral body (CT scans: M. Čavka)

leko ispod prosječne visine žena u uzorku; iii) lubanja pokazuje značajno stanjivanje kosti na svim dijelovima.

Naposljetku, zabilježena su i tri moguća slučaja maksilarnog sinusitisa: i) aktivni periostitis zabilježen je na oba maksilarna sinusa sredovječnog muškarca (grob 26); ii) slične promjene praćene pojavom nove sklerotične kosti prisutne su na lijevom maksilarnom sinusu mlađe žene (grob 27); iii) treći slučaj zabilježen je na desnom maksilarnom sinusu sredovječne žene (grob 34) gdje su upalne promjene također praćene pojavom nove sklerotičnom kosti (sl. 9).



Sl. 9 Nova sklerotična kost kao posljedica maksilarnoga sinusitisa, sredovječna žena, grob 34 (snimila: B. Zagorc)

Fig. 9 New sclerotic bone associated with maxillary sinusitis, middle-aged female, grave 34 (photo: B. Zagorc)

RASPRAVA

Kako je već ranije napomenuto, do danas je provedena nekolicina sveobuhvatnih bioarheoloških analiza ljudskih koštanih ostataka iz avarodobnih nalazišta. Ta istraživanja uvelike su obogatila naše znanje o različitim biološkim, društvenim i kulturnim procesima koji su se događali u srednjoj Europi između 6. i 9. stoljeća. No, veliki dio tih istraživanja bio je proveden u skladu s metodologijom razdoblja kada su te analize nastale, a koja je većinom bila usredotočena na vanjske morfološke, taksonomske i fenotipske karakteristike, ne uzimajući u obzir druge tipove informacija kao što su paleopatološki podaci. Bez obzira, taj se trend polako mijenja te danas postoji nekoliko detaljnih studija avarodobnih populacija, posebice onih iz južne Panonije koje sadrže pravo bogatstvo paleodemografskih i paleopatoloških informacija. Usporedbom ovih podataka, ali i uvođenjem rezultata dobivenih novim tehnikama, poput analize drevne DNK, dobit će se daleko bolji uvid u mnogobrojne aspekte svakodnevnoga života (npr. prehranu, opće zdravlje, migracije) avarodobnih populacija na mnogo široj razini.

Kosturni uzorak iz Šarengrada karakteriziran je relativno visokom stopom smrtnosti djece, ali i najvišom stopom smrtnosti u srednjovječnoj skupini (prosječna dob u trenutku smrti oko 40 godina). Takva dobna raspodjela karakteristična je za nekolicinu avarodobnih populacija poput onih s nalazišta Kereki – Homokbánya (Bernert 2003), Jászberény – Disznózug (Hajdu 2009) i Nuštar – Dvorac Khuen-Belasi

cent (grave 21) and the second in a middle-aged male (grave 25). In both cases the lateral halves of the vertebral bodies are fused except for the vertical groove on the posterior side of the body where the fusion was not complete (Fig. 8).

A possible case of osteopenia was recorded on the skeleton of a middle-aged female (grave 34) in which all preserved cranial and post-cranial bones are significantly atrophied and lightweight: i) the low density and hollowness of the long bones is macroscopically visible; ii) the reconstructed height for the individual is 147 cm, well below the mean female stature of the sample; iii) the cranium displays considerable cortical thinning in all regions.

And finally, three possible cases of sinusitis were recorded: i) active sub-periosteal new bone formation was attested in both maxillary sinuses of a middle-aged male (grave 26); ii) similar changes accompanied by the occurrence of new sclerotic bone are present in the left maxillary sinus of a younger female (grave 27); iii) the third case is evident on the right maxillary sinus of an middle-aged female (grave 34) where the inflammatory changes are also accompanied by proliferative new sclerotic bone (Fig. 9).

DISCUSSION

As previously mentioned, extensive bioarchaeological studies of human remains recovered from Avar period burials have been conducted so far. These studies have significantly enriched our knowledge about various biological, social and cultural processes occurring in Central Europe between the 6th and 9th cent. However, a large portion of this research was conducted in accordance with the methodology of the time focusing mainly on external morphological characteristics, taxonomic and phenotypic characteristics, and not taking into consideration other types of information such as paleopathological data. Nevertheless, this is slowly changing, and today there are several detailed analyses of Avar period populations, especially those from southern Pannonia, that contain a wealth of paleodemographic and paleopathological information. By comparing these data, but also by introducing the results obtained by new techniques such as aDNA studies, we will be able to achieve a much better insight into numerous aspects of the everyday life (e.g. diet, general health, migrations) of Avar period populations on a more global scale.

The skeletal sample from Šarengrad was characterized by relatively high subadult mortality, but also by the peak mortality occurring in the middle-age group (mean age-at-death of approximately 40 years). Such an age distribution is characteristic of several Avar period populations such as those from Kereki – Homokbánya (Bernert 2003), Jászberény – Disznózug (Hajdu 2009), and Nuštar – Dvorac Khuen-Belasi (Premužić et al. 2017). Similarly, the average height of the population from Šarengrad (females 155.5; males 167.1 cm) falls well within the values recorded at other contemporary sites from the region (in most of the sites the average values for males are between 165 and 170 cm, and for females between 155 and 160 cm (e.g. Ferencz 1982/1983; Bernert 2003; Hajdu 2009). It has to be mentioned that most

(Premužić et al. 2017). Slično tomu, prosječna visina populacije iz Šarengrada (žene 155,5 cm; muškarci 167,1 cm) uklapa se u vrijednosti zabilježene na drugim istovremenim nalazištima s ovoga područja (u većini nalazišta prosječne vrijednosti za muškarce iznose između 165 i 170 cm, a za žene između 155 i 160 cm (npr. Ferencz 1982/1983; Bernert 2003; Hajdu 2009)). Valja napomenuti kako je većina ovih podataka dobivena uz pomoć različitih formula za rekonstrukciju visine te se prema tomu ne mogu izravno usporediti. No, bez obzira na to, one pružaju dobar uvid u prosječnu visinu avarodobnih populacija.

Informacije o dento-alveolarnim patologijama poput karijesa, zaživotnoga gubitka zuba, istrošenosti griznih ploha i kalcificiranih zubnih naslaga svjedoče o prehrani određene populacije. Nažalost, svega je nekoliko (barem prema našim saznanjima) objavljenih istraživanja koja se bave ovom tematikom kod avarodobnih populacija. U ovome kontekstu, vrijednosti koje se tiču karijesa i zaživotnoga gubitka zuba zabilježene u Šarengradu slične su vrijednostima zabilježenim u Privlaci (zaživotni gubitak zuba 14%, karijes 11%) (Šlaus 2002), Kereki – Homokbányi (zaživotni gubitak zuba 24,2%, karijes 8,7%) (Szikossy, Bernert 1996) i Beču (zaživotni gubitak zuba 23,8%, karijes 14,9%) (Meinl et al. 2010). Pojava zaživotnoga gubitka zuba u arheološkim populacijama obično se veže uz lezije prouzrokovane karijesom, no također mogu nastati kao rezultat jake istrošenosti zuba, periodontitisa i trauma (npr. Bonfiglioli et al. 2003; Caglar et al. 2007). U slučaju Šarengrada moguće je da su svi ti faktori zajedno rezultirali visokom učestalošću zaživotnoga gubitka zuba.

Danas se većina paleodontoloških studija slaže s poveznicom između pojave karijesa i tipa prehrane gdje je visoka učestalost karijesa (kao što je slučaj s avarodobnim uzorcima) povezana s pojačanom konzumacijom ugljikohidrata, tj. načinom života temeljenom na poljoprivredi i uzgoju žitarica (Šlaus et al. 2010). Ovakva je pretpostavka iznesena u slučaju avarodobne populaciju iz Beča od strane Meinla i suradnika (2010) koji su sugerirali da se pojava karijesa na tome nalazištu može povezati s pojačanom konzumacijom ugljikohidrata što je rezultat prelaska na sjedilački način života (Meinl et al. 2010: 113). Ovi podaci nadopunjeni su rezultatima analize stabilnih izotopa ugljika i dušika provedene na kasnoavarodobnoj populaciji iz Nuštra (Vidal-Ronchas et al. 2018) koji ukazuju na miješanu kontinentalnu prehranu bogatu C3 i C4 biljkama gdje je većina osoba konzumirala dostatne količine C4 biljaka poput prosa, ali isto tako i na mogućnost da su ljudi konzumirali hranu s niskom razinom životinjskih proteina i/ili da je uzorkovana fauna imala atipičnu prehranu. Bez obzira na to, kako bi se došlo do konkretnih zaključaka, ove pretpostavke moraju se staviti u povijesni kontekst. Prema povijesnim izvorima kao i rezultatima arheoloških istraživanja, nakon poraza kod Konstantinopola 626. godine, avarska je ekonomija prestala ovisiti o upadima, pljačkama i plaćanju danka te je postupno zamijenjena poljoprivredom i sjedilačkim načinom života (Gračanin 2009; Baumer 2014). To je također potvrđeno i rezultatima istraživanja paleookoliša s nekoliko nalazišta u Mađarskoj koji ukazuju na povećanje rasploda stoke kao i

of these data were gathered by using different formulae for height reconstruction, so they cannot be compared directly. Nevertheless, they provide a good insight into the average stature of Avar period populations.

The information on dento-alveolar pathologies such as caries, AMTL, dental attrition and calculus can tell us a lot about the diet of a certain population. Unfortunately, there are only a few (at least to our knowledge) published studies dealing with paleodontological research of Avar period skeletal samples. In this context, the values concerning caries and AMTL recorded in Šarengrad are similar with the values observed in Privlaka (AMTL 14%, caries 11%) (Šlaus 2002), Kereki – Homokbánya (AMTL 24.2%, caries 8.7%) (Szikossy, Bernert 1996), and Vienna (AMTL 23.8%, caries 14.9%) (Meinl et al. 2010). The occurrence of AMTL in archaeological populations is usually associated with carious lesions, but it can be also caused by gross attrition, periodontitis and trauma (e.g. Bonfiglioli et al. 2003; Caglar et al. 2007). In the case of Šarengrad it is quite possible that all of these factors jointly resulted in high AMTL prevalence.

Today, most paleodontological studies agree on the correlation between caries rates and diet where high prevalence of caries (such as seen in Avar period samples) are linked with a greater consumption of carbohydrates, i.e. the lifestyle based on agriculture and crop growing (Šlaus et al. 2010). Such a hypothesis was already proposed for the Avar period population of Vienna by Meinl and colleagues (2010) who suggested that the etiology of caries at this site can be attributed to the consumption of dietary carbohydrates resulting from the shift to a settled mode of life (Meinl et al. 2010: 113). These data are also supplemented by the results of stable isotopes analysis of the Late Avar period population from Nuštar (Vidal-Ronchas et al. 2018) indicating a mixed terrestrial diet containing C3 and C4 resources with most individuals consuming enough C4 plants such as millet, but also a possibility that the humans consumed a diet that contained a very low proportion of animal protein and/or that the sampled fauna had atypical diets. Nevertheless, in order to make more valid conclusions these assumptions have to be considered in historical context. According to historic sources as well as the results of archaeological research, after the defeat at Constantinople in 626, the Avar economy ceased to be based on raids, plunder and tributes being gradually replaced by agriculture and sedentary way of life (Gračanin 2009; Baumer 2014). This is also corroborated by the results of paleoenvironmental research from several sites in Hungary indicating increased stock-breeding activity as well as cereal cultivation from the mid-7th century onwards (Sümegi et al. 2016), and by the results of archaeobotanical study conducted on the nearby Late Avar period cemetery in Nuštar (Rapan Papeša et al. 2015).

The high prevalence of subadult stress indicators (*cribra orbitalia* and linear enamel hypoplasia) recorded in Šarengrad, accompanied by several cases of sub-periosteal new bone formation and two possible cases of subadult scurvy, is again similar to the data observed in other contemporary sites from the region such as Privlaka and Nuštar (Šlaus

pojačan uzgoj žitarica od 7. stoljeća nadalje (Sümegi et al. 2016), te rezultatima arheobotaničkih istraživanja provedenih na kasnoavarodobnome groblju u Nuštru (Rapan Papeša et al. 2015).

Visoka učestalost pokazatelja subadultnoga stresa (*cribra orbitalia* i linearna hipoplazija zubne cakline) zabilježena u Šarengradu, praćena s nekoliko slučajeva periostitisa i dva moguća slučaja skorbuta, sukladna je podacima zabilježenim na drugim istovremenim nalazištima s toga područja poput Privlake i Nuštra (Šlaus 1996; Premužić et al. 2017). Ovakva slika snažno sugerira kako je većina analiziranih osoba s tih nalazišta bila lošega zdravlja tijekom djetinjstva uzrokovanoga čestim epizodama fiziološkoga stresa što je imalo vrlo negativan učinak na njihov imunološki sustav. Ove epizode fiziološkoga stresa mogle su biti prouzročene sinergističkim učinkom različitih bioloških i sociokulturnih faktora kao što su neadekvatna ishrana, razne bolesti, anemija, nedostatak vitamina C te drugih utjecaja.

U Šarengradu su zabilježene samo zaživotne ozljede; potpuno odsustvo perimortalnih trauma snažno ukazuje na činjenicu kako su žitelji ove zajednice bili izloženi niskoj stopi namjernoga nasilja. To je slično s drugim avarodobnim nalazištima kao što su Nuštar, Privlaka i Kereki – Homokbánya. Bernert (2003) iznosi pretpostavku da su stanovnici Kereki – Homokbánye vodili miran život temeljen na relativno niskome broju traumatskih ozljeda, dok Premužić i suradnici (2017) sugeriraju da je većina ozljeda iz Nuštra mogla biti povezana sa svakodnevnim aktivnostima unutar zajednice koja živi u mirnim vremenima. Jedini nedvosmisleni dokaz međusobnoga nasilja zabilježen je u Čičovima gdje je nekoliko osoba imalo perimortalne posjekotine na donjoj čeljusti, kralješcima i dugim kostima (Nikolić 2015). S druge strane, distribucija i morfologija zaživotnih ozljeda iz Šarengrada snažno ukazuju na nesretne slučajeve kao najvjerojatnije uzroke njihova nastanka. Kompresijske frakture kralježaka koje su zabilježene kod dvije osobe vjerojatno su rezultat hiperfleksijske ozljede prouzročene vertikalnom silom poput skoka s visine (Cooper et al. 1993), no isto tako mogle su biti prouzročene i osteoporozom (Roberts, Manchester 2007). Frakture ključnih kostiju kakva je zabilježena kod jedne osobe iz Šarengrada najčešće su uzrokovane padom na rame, no također mogu nastati i kao rezultat pada na ispruženu ruku (Lovell 1997). Uz to, Judd and Roberts (1999) sugeriraju da su padovi s konja (kao i ozljede nastale uslijed bliskoga rada s velikim domaćim životinjama) važni faktori nastanka takvih fraktura u arheološkom kontekstu. Dvije ozljede zabilježene na osobi neutvrđena spola također su vezane uz nesretne slučajeve: i) frakture distalnoga dijela lisne kosti obično su rezultat poprečne i/ili lateralne rotacije (Lovell 1997); ii) falange stopala, posebice palca, često su podložne ozljedama u obliku usitnjavanja kosti pod utjecajem direktnih trauma, a ista etiologija predložena je za frakture kosti nožja (npr. pad teških stvari na stopalo) (Hansen 1992).

Bolesti dišnih puteva, poput sinusitisa, najčešće se vežu uz lošu kvalitetu zraka; ovi faktori mogu se podijeliti na „unutarnje" i „vanjske" (Roberts 2007). Najčešći vanjski faktori uključuju klimu i vremenske prilike, pelud, izloženost prašini tijekom žetve te dim iz vatrišta, dok unutarnji faktori

1996; Premužić et al. 2017). Such a picture strongly suggests that a majority of the analysed individuals from these sites suffered from poor health during their childhood caused by frequent episodes of physiological stress which had a significant negative impact on their immune system. These episodes of physiological stress could have been caused by a synergistic effect of various biological and socio-cultural factors ranging from malnutrition, infectious and non-infectious diseases, anemia, vitamin C deficiency, and other conditions.

Only antemortem injuries were observed in Šarengrad; a complete absence of perimortem injuries strongly points to the fact that the inhabitants of this community were exposed to a low level of intentional violence. This is similar to other Avar period sites from the region such as Nuštar, Privlaka, and Kereki – Homokbánya. Bernert (2003) even suggested that the inhabitants of Kereki – Homokbánya led a peaceful way of life based on the comparatively low number of traumatic lesions, while Premužić and colleagues (2017) suggested that most of the injuries in Nuštar could have been related to the everyday activities of a community living in peaceful times. The only unambiguous evidence of interpersonal violence was observed in Čičovi where several individuals exhibited perimortem cuts on the mandible, vertebrae and long bones (Nikolić 2015). On the other hand, the distribution and morphology of antemortem trauma in Šarengrad strongly suggest accident-related events as the most probable cause for their occurrence. The vertebral compression fractures that were observed in two individuals may have resulted from a vertical force induced hyperflexion injury, such as jumping from a height onto the feet (Cooper et al. 1993), but they also could have been caused by osteoporosis (Roberts, Manchester 2007). The clavicular fractures such as that recorded in a young male are most often caused by a fall onto the shoulder but can also result from a fall onto an outstretched hand (Lovell 1997); additionally, Judd and Roberts (1999) suggested that equestrian accidents (as well as injuries from close work with other large animals) are an important causative factor for these fractures in an archaeological context. The two injuries observed in an-unsexed individual are also accident-related: i) fractures of the distal fibula usually occur due to either abduction and/or lateral rotation (Lovell 1997); ii) the pedal phalanges, particularly that of the great toe, often suffer comminuted crushing injuries from direct trauma, and the same etiology has been proposed for metatarsal shaft fractures (e.g. dropping items onto the feet) (Hansen 1992).

Respiratory tract diseases, such as sinusitis, are most often associated with poor air quality; these factors can be divided into indoor and outdoor (Roberts 2007). The most common outdoor factors include the climate and weather, pollen, exposure to dust while processing crops, and smoke from outdoor fires, while indoor factors include, among others, dust mites, cold and damp houses, occupations such as mining, textile manufacture, and metalworking, and smoke from open fires (for more details see Roberts 2007). In the case of the Late Avar period inhabitants of Šarengrad

uključuju, između ostaloga, grinje, hladne i vlažne prostorije, poslove poput rudarenja, tekstilne proizvodnje i metalurgije te dim iz otvorenih vatrišta (za više detalja vidi Roberts 2007). U slučaju avarodobnih stanovnika iz Šarengrada unutarnji faktori poput rudarenja i metalurgije najvjerojatnije se mogu isključiti. Međutim, čimbenici poput izloženosti prašini tijekom žetve, dima iz zatvorenih/otvorenih vatrišta i/ili hladne i vlažne nastambe vrlo su mogući. U ovom kontekstu veću pozornost moramo pridodati tipu nastambi koje su korištene tijekom kasnoavarodobnoga razdoblja. Iako je vrlo malo poznatih ranosrednjovjekovnih kuća iz kontinentalne Hrvatske, posljednjih je godina nekoliko primjera pronađeno i istraženo (npr. Sekelj Ivančan 2010; Sekelj Ivančan, Tkalčec 2010; Šmalcelj Novaković, Hršak 2017). Ti nalazi dijele neke zajedničke značajke kao što je činjenica da je riječ o djelomično pravokutnim ukopanim nastambama s kamenim ili glinenim pećima ili pak otvorenim jamama za vatrišta u sredini kuće. Ovakvi su sustavi kuhanja/grijanja, pogotovo otvorena vatrišta, uzrokovali velike količine dima koji je, u slučajevima produljene izravne izloženosti, mogao rezultirati bolestima dišnih puteva kao što je sinusitis. Naravno, u ovome je trenutku prerano spekulirati do koje su mjere ovi faktori pridonijeli pojavi sinusitisa u Šarengradu. No, vjerojatno će buduća arheološka i bioarheološka istraživanja osvijetliti ova, i druga, još uvijek neodgovorena pitanja.

ZAKLJUČAK

Rezultati prezentirani u ovom radu pružili su nove uvide u svakodnevni život ljudi koji su nastanjivali najistočnije dijelove Hrvatske tijekom ranosrednjovjekovnoga razdoblja. Ovi rezultati ukazuju na to da je populacija iz Šarengrada karakterizirana relativno visokom stopom dječje smrtnosti prouzročene lošim zdravljem tijekom djetinjstva što se reflektira u visokim učestalostima pokazatelja subadultnoga stresa (*cribra orbitalia* i linearna hipoplazija zubne cakline) i periostitisa te zabilježenim slučajevima skorbuta. Sveobuhvatna analiza dento-alveolarnih lezija snažno sugerira kako je veliki dio prehrane bio temeljen na ugljikohidratima, a što navodi na način života temeljen na poljodjelstvu. Odsustvo perimortalnih ozljeda iz Šarengrada snažno ukazuje na činjenicu da su članovi ove zajednice bili izloženi niskim stopama namjernoga nasilja te da su primarni uzroci uočenih ozljeda nesretni slučajevi. Tri slučaja maksilarnog sinusitisa mogu se povezati sa sustavom grijanja/kuhanja (peći i otvorena vatrišta) unutar nastambi gdje je produljena izloženost dimu mogla dovesti do različitih bolesti dišnih puteva kao što je sinusitis. Naposljetku, usporedba šarengradskoga uzorka s drugim istovremenim uzorcima nije pokazala bitnije razlike, ukazujući na slične uvjete života u široj regiji tijekom 8. stoljeća.

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indoor factors like mining and metalworking can be excluded. However, the factors such as exposure to dust while processing crops, smoke from indoor/outdoor fires and/or cold and damp houses are quite possible. In this context, we should take a closer look at the dwellings used during the Late Avar period. Although there are very few known early medieval houses from continental Croatia, in the recent years several examples have been excavated and studied (e.g. Sekelj Ivančan 2010; Sekelj Ivančan, Tkalčec 2010; Šmalcelj Novaković, Hršak 2017). They share some common attributes such as the fact that they represent rectangular partially dug in pit-houses with stone or clay ovens or open fire pits in the middle of the house. These heating/cooking systems, especially open fire pits, caused large amounts of smoke that, in case of prolonged direct exposure, could result in respiratory tract diseases such as sinusitis. Of course, at this point it is too early to speculate to what extent did these factors contributed to the occurrence of sinusitis in Šarengrad. Hopefully, future archaeological and bioarchaeological studies of this site will shed more light on this, and other, still unresolved, questions.

CONCLUSION

The results presented in this paper provided us with new insights into the everyday life of people inhabiting the easternmost parts of present-day Croatia during the early medieval period. These results indicate that the Šarengrad population was characterized by a relatively high subadult mortality caused by poor childhood health, which is reflected in high prevalence of subadult stress indicators (*cribra orbitalia* and linear enamel hypoplasia) and sub-periosteal new bone formation, but also in the occurrence of subadult cases of scurvy. The comprehensive analysis of dento-alveolar lesions strongly suggests that a large portion of the diet of this population was based on carbohydrates, which points to a sedentary lifestyle and agriculture. A complete absence of perimortem injuries in Šarengrad strongly points to the fact that the inhabitants of this community were exposed to a low level of intentional violence. Furthermore, all of these injuries were most probably accident-related. Three cases of maxillary sinusitis could be associated with indoor heating/cooking system (ovens and open fire pits) used during this period where prolonged direct exposure to smoke could have led to various respiratory tract diseases. Finally, the comparison of the Šarengrad sample with other contemporaneous assemblages did not show any major differences suggesting similar living conditions in the region during the 8th cent.

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