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BIOARCHAEOLOGICAL ANALYSIS OF THE HUMAN SKELETAL REMAINS FROM THE LATE ANTIQUE KUĆA ANDRIĆ AND HRVOJEVA ULICA SITES IN SPLIT

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Bioarchaeological investigations of indicators of subadult stress, oral health, physical stress and trauma were conducted on the skeletal material from the kuća Andrić and Hrvojeva ulica sites, late antique cemeteries situated in the Diocletian's Palace in Split. These indicators include several pathological conditions: *cribra orbitalia*, dental enamel hypoplasia, non-specific periostitis, caries, alveolar abscess, antemortem tooth loss, vertebral and joint osteoarthritis, Schmorl's nodes and traumas. The sample includes 33 skeletons from 17 graves – 12 adults and 21 subadults. Results indicate a higher ratio of subadults in the sample, relatively low frequencies of indicators of subadult stress, caries, and trauma and a higher frequency of alveolar bone disease and Schmorl's nodes, especially in males. In comparison to other late antique samples from the eastern Adriatic coast, the sample from the kuća Andrić and Hrvojeva ulica shows similar or even better living conditions in some aspects.

Key words: Late Antiquity, bioarchaeology, kuća Andrić and Hrvojeva ulica sites / *Ključne riječi: kasna antika, bioarheologija, nalazišta kuća Andrić i Hrvojeva ulica*

Introduction

The Roman province of Dalmatia, spreading along the almost entire eastern Adriatic coast and its hinterland, was established during the reign of Augustus (27 BC–AD 14), a Roman statesman and military leader, the first emperor of the

Roman Empire. The province encompassed several different regions – from highly urbanised areas to mountainous, mostly rural hinterland. These different geomorphologic features (of both regions) had a significant influence on the way of life and death through centuries.[1]

There were a lot of changes in different life spheres during the final centuries of the Roman Empire, among the most significant ones being the rise of Christianity and the arrival of new populations introducing new customs.[2] Life in towns along the eastern Adriatic coast has been present for more than two millennia, and in many places it has continued since the prehistoric period. Split belongs to a group of towns which only started forming their urban structures in Late Antiquity.[3] Each Roman province had a governor, who had civil and military authority. During Diocletian's reign, a special military and a separate civilian commander was named.[4] The Roman emperor Diocletian abdicated from the throne in 295 and went to Dalmatia where he built a magnificent palace, which was a stronghold, a town, and a villa. In other words, the Diocletian's Palace, built between 295 and 305 by Emperor Diocletian (284–305), presents the most important late antique monument in Dalmatia and the core of present-day Split.[5] It is well known that after the death of Diocletian the Palace, as state property, had housed rulers and state officials of various statuses. In order to save the Palace from decline, the Church issued a decree in 471 or 513 that is preserved in the *Codex Justinianus*, ordering the palaces in cities to be used as a residence for governors.[6]

The finds of pottery testify about the intensity of life in the Palace after Diocletian's death and the written sources tell us about the new residents inhabiting its certain parts and thus changing its original use. From this, it can be concluded that the Palace was partially readjusted and divided into smaller parts. In the 7th century, the Palace housed refugees from Salona and become the nucleus from which the medieval Split developed.[7] The attention of the first researchers of Classical Antiquity heritage of present-day Dalmatia was mostly directed at individual monuments and structures, among which Diocletian's Palace certainly held a leading position.[8] In the period between 1994 and 2009, a total of 21

1 Kurilić, Serventi 2014.

2 Kurilić, Serventi 2014.

3 Jović, Gazić 2010.

4 Antoljak 1996.

5 Marinković 2010.

6 Karaman 1940.

7 Perojević *et al.* 2009.

8 Jović, Gazić 2011.

archaeological excavations have been recorded within the Palace,[9] while so far there are no published anthropological studies of the skeletal material found in it.

The purpose of this research is to get a clearer picture of life and death in late antique urban Dalmatia and to compare this newly acquired information with the previously investigated late antique populations from Dalmatia. The bioarchaeological characteristics of the late antique sample from Split, comprising the skeletons found in Hrvojeva ulica and kuća Andrić sites will be compared with the late antique samples from Zadar–Relja, Krk–Baška, Narona–*Augusteum*, Gardun, and Solin–Smiljanovac.

The following pathologies were analysed: indicators of subadult stress (*cribra orbitalia*, dental enamel hypoplasia, and non-specific periostitis), oral pathologies (caries, antemortem tooth loss, and alveolar abscess) degenerative osteoarthritis, Schmorl's nodes, and bone fractures. These pathological conditions are common in archaeological skeletal series and create an insight into general health and life-quality of a certain population.

Materials and methods

The skeletal remains that were subject to anthropological analysis for the purpose of this paper originate from two small late antique archaeological sites from Split (Hrvojeva ulica excavated in 2005–2006 and kuća Andrić in 2006).

The results of the archaeological excavations in Hrvojeva ulica conducted in 2005–2006 revealed a burial ground of Late Antiquity along the eastern wall of the Palace that can be linked to the early Christian patron saint St Catherine of Alexandria in the nearby monastery and church of St Dominic, as well as with the Roman burial ground dated in the period from the 1st to the 6th century, discovered in 1905.[10] Archaeological excavations of the ground floor of the classicist house (kuća Andrić), on the inside of the eastern wall of the Diocletian's palace, include the remains of the graves of Late Antiquity situated alongside the wall of the Roman *tabernae*, and numerous significant immovable and movable archaeological finds.[11] The excavations revealed a total of 17 burials, containing 33 skeletons that were brought for further anthropological analysis.

Throughout life, the human skeleton undergoes various processes of modelling and remodelling. These processes are also mechanisms by which bone tissue responds to stress – by forming new bone or resorbing old bone.[12] In the

9 Marinković 2010.

10 Rismondo, Šarić 2006.

11 Rismondo, Šarić 2006.

12 Larsen 1997; Ortner 2003.

context of bioarchaeology, these processes are important because they can indicate various medical conditions, from disease and malnutrition to a systemic biological stress. These bone changes are recognisable in skeletal remains and are generally accepted in bioarchaeological literature as indicators of stress in archaeological populations.[13] Sex and age at death were assessed using standard anthropological methods.[14]

Cribra orbitalia is recognized as a porous, slightly bulging bone on the orbital roof. It is usually considered to be anaemia due to iron deficiency caused by several factors as inadequate diet, endemic parasitism, unhygienic living conditions or chronic gastrointestinal ailments.[15] Even though *cribra orbitalia* is commonly caused by megaloblastic and hemolytic anaemia, paleopathological studies argue that these lesions, which cause subperiosteal bleeding, have a more complicated aetiology. These pathological processes are frequently associated with scurvy, rickets, hemangiomas, and traumatic injuries that produce subperiosteal hematomas, and in the end lead to orbital roof lesions.[15]

Dental enamel hypoplasia (DEH) is a disturbance in the creation of an organic matrix of the enamel, which is recognizable in the form of macroscopic defects on the surface of the enamel.[16] It is characterised by a thin enamel, usually presenting as transverse furrows or pits. Enamel hypoplasia is a subadult disorder caused by acute stress and is usually associated with malnutrition, vitamin A, C and/or D deficiency, and presence of anaemia and psychological and/or physical trauma. Maxillary incisors, mandibular and maxillary canines were taken into consideration when recording DEH. Reasons for including only these teeth lay in the fact that incisors and canines are more susceptible to enamel hypoplasia, and that canines take a relatively long time to develop. [17]

Non-specific periostitis is a basic inflammatory response of the periosteum that results from non-specific bacterial infection. Periostitis can also be caused by trauma and specific infectious diseases.[18] Only cases of non-specific periostitis are included in this analysis.

Dental caries occurs when various bacteria (usually *Streptococcus mutans* and *Lactobacillus acidophilus*) produce acids that decalcify tooth enamel, and if not removed, cause a complete loss of enamel and dentine.[18] In a sense, dental caries

13 Goodman *et al.* 1988; Larsen1997.

14 Phenice 1969; Krogman, Işcan 1986; Meindl, Lovejoy 1985; McKern, Stewart 1957; Lovejoy *et al*. 1985.

15 Hengen 1971; Mensforth *et al.* 1978; Wolter 1979; Griffeth *et al.* 1997.

16 Sarnat, Schour 1941; 1942; Pindborg 1970.

17 Kreshover 1960; Lysell 1962; Goodman *et al*. 1980; Goodman, Armelagos 1985; Goodman, Rose 1990; Goodman, Rose 1991.

18 Larsen 1997; Ortner 2003.

is a contagious disease characterised by a demineralisation of the inorganic part of the tooth, and the destruction of the organic part of the tooth. It is a progressive disease that can cause a complete loss of the tooth enamel.[19] Many authors have studied the aforementioned pathology in relation to studies of various diets, methods of food preparation, and the general quality of life of archaeological populations.[20]A high incidence of caries is connected to high carbohydrate intake, due to microorganisms on teeth that metabolise carbohydrates, which results in a lower pH of the dental cavity (it becomes more acidic), which helps tooth decay.[21] On the other hand, a diet that is high in protein and fats reduces the risk of developing dental caries. Any condition that results in the appearance of an alveolar abscess (granuloma) or antemortem tooth loss (AMTL) can be defined as an alveolar infection. An alveolar abscess is usually caused by bacteria causing tooth decay that spreads to dental alveoli, where the collection of pus, due to pressure, creates an opening in the cortical bone. As a result, the infected tooth falls out, and the dental alveolus remodels with time. Antemortem tooth loss is diagnosed in case of progressive resorption decay of the alveoli, and the remodelling of alveolar bone.[22] In archaeological populations, the most common causes of alveolar abscess are the exposure of dental pulp and tooth cavity due to dental caries, severe tooth wear or trauma.[23] Results for alveolar abscess and antemortem tooth loss (AMTL) were joined in Table 2 for purposes of comparison.

Schmorl's nodules are vertical disc herniations through the vertebral body endplate into the adjacent vertebra, usually the result of a heavy mechanical load to the spinal column.[24] Many studies that investigated the presence of Schmorl's nodules in archaeological populations (regardless of chronological determinants) have noticed a significantly higher frequency of this pathology in males.[25] Most authors agree that the differences in sex distribution are a result of a mechanical compressive load to the spine and degenerative changes connected to constant spinal loading.[26] All of the well-preserved thoracic and lumbar vertebrae of adult individuals were included in the analysis of the frequency and distribution of this pathology. A chronic and progressive process, osteoarthritis is a degenerative joint disease that results in the degradation of articular cartilage and the loss

19 Pindborg 1970.

20 Lukacs 1989; Larsen *et al*. 1991; Hillson 1996; Larsen 1997; Eshed *et al*. 2006.

21 Powell 1985.

22 Lukacs 1988.

23 Littleton, Frochlich 1993; Tayles 1997.

24 Schmorl, Junghanns 1971.

25 Saluja *et al*. 1986; Üstündag 2008.

26 Rathburn 1987; Robb 1994; Üstündag 2008.

of cartilage. Osteoarthritis is characterised by a progressive formation of osteophytes on the edges of the articular surface. Most common causes of osteoarthritis are physical activity and mechanical load to the joints.[27] For the purpose of this study, all major joints which include shoulders, elbows, hips, and knees were analysed. If a joint had at least half of the joint surfaces present (e.g. glenoid fossa or proximal humerus for the shoulders, or at least two out of the three joint surfaces comprising the elbow), it was included in the anthropological analysis. Analysis of the prevalence of osteoarthritis in a certain population can give us insight in the amount of physical work that individuals were exposed to, but it cannot be used for precise conclusions on the type of activity or occupation of individuals.[28]

All of the skeletons in this study were macroscopically examined for the possible presence of trauma. The location, shape, dimension and possible complications were recorded for each injury. Also, a distinction between antemortem and perimortem injuries was made.[29] The presence of fractures in long bones was assessed on the clavicles, humeri, radii, ulnae, femora, tibiae and fibulae with at least 50% of their surfaces preserved. The presence of cranial fractures was assessed on crania in all major bones (frontal, both parietal, both temporal, occipital, facial bones, and mandible) with at least 50% of the bone preserved.

Results

Two samples were joined together because of the close vicinity of the two excavated sites as well as the same dating in the late antique period.

Demography

Altogether 33 skeletons from 17 graves were analysed. Most of the graves contained more than one burial (**table 1**). The demographic distribution showed that almost two thirds of all skeletons (21/33 or 63.6%) belonged to children. This is especially evident in the kuća Andrić site where only one adult was present amongst 17 skeletons. Males and females were evenly distributed in the sample – 6 males and 6 females. The average age at death for the adults is 36 years where males (36.2 years) and females (35.8 years) lived almost the same. The highest mortality rate among subadults was recorded in two age categories: between 2 and 5 years of age (**fig. 1**), and 6 and 10 years of age (8) when 90.5% of all the subadults and 57.6% of the whole sample died.

27 Hough, Sokoloff 1989; McKeag 1992.

28 Waldron 1994.

29 Maples 1986; Lovell 1997; Wakely 1997; Fachini *et al*. 2007; Wheatly 2008.

Table 1. Sex and age of the analysed individuals by grave / *Tabla 1. Spol i dob analiziranih kostura po grobovima*

site	grave	sex	age
Kuća Andrić	1	subadult	5.5-6.5
Kuća Andrić	2, N skeleton	subadult	7.5-8.5
Kuća Andrić	2, S skeleton, ind. A	subadult	1.5-2.5
Kuća Andrić	2, S skeleton, ind. B	subadult	2.5-3.5
Kuća Andrić	3, ind. A	subadult	7.5-8.5
Kuća Andrić	3, ind. B	subadult	1.5-2.5
Kuća Andrić	3, ind. C	subadult	1.5-2.5
Kuća Andrić	4	subadult	3.5-4.5
Kuća Andrić	5	subadult	0-0,5
Kuća Andrić	SE room, ind. A	male	40-50
Kuća Andrić	SE room, ind. B	subadult	5.5-6.5
Kuća Andrić	SE room, ind. C	subadult	1.5-2.5
Kuća Andrić	SE room, ind. D	subadult	3.5-4.5
Kuća Andrić	SE room, ind. E	subadult	1.5-2.5
Kuća Andrić	SE room, ind. F	subadult	1.5-2.5
Kuća Andrić	SE room, ind. G	subadult	3.5-4.5
Kuća Andrić	SE room, 2	subadult	5.5-6.5
Hrvojeva ulica	2	female	30-35
Hrvojeva ulica	3	subadult	6.5-7.5
Hrvojeva ulica	4, ind. A	male	15-17
Hrvojeva ulica	4, ind. B	female	16-18
Hrvojeva ulica	4, ind. C	female	35-40
Hrvojeva ulica	4, ind. D	male	45-50
Hrvojeva ulica	5, ind. A	subadult	6-7
Hrvojeva ulica	5, ind. B	female	15-17
Hrvojeva ulica	5, by the wall of DP*	subadult	4-5
Hrvojeva ulica	5, burial 2	subadult	new born
Hrvojeva ulica	7	male	30-35
Hrvojeva ulica	8	male	30-40
Hrvojeva ulica	9, ind. A	female	50-55
Hrvojeva ulica	9, ind. B	male	35-45
Hrvojeva ulica	10	female	55-60
Hrvojeva ulica	without signature	subadult	6-7

*Diocletian's Palace / Dioklecijanova palača

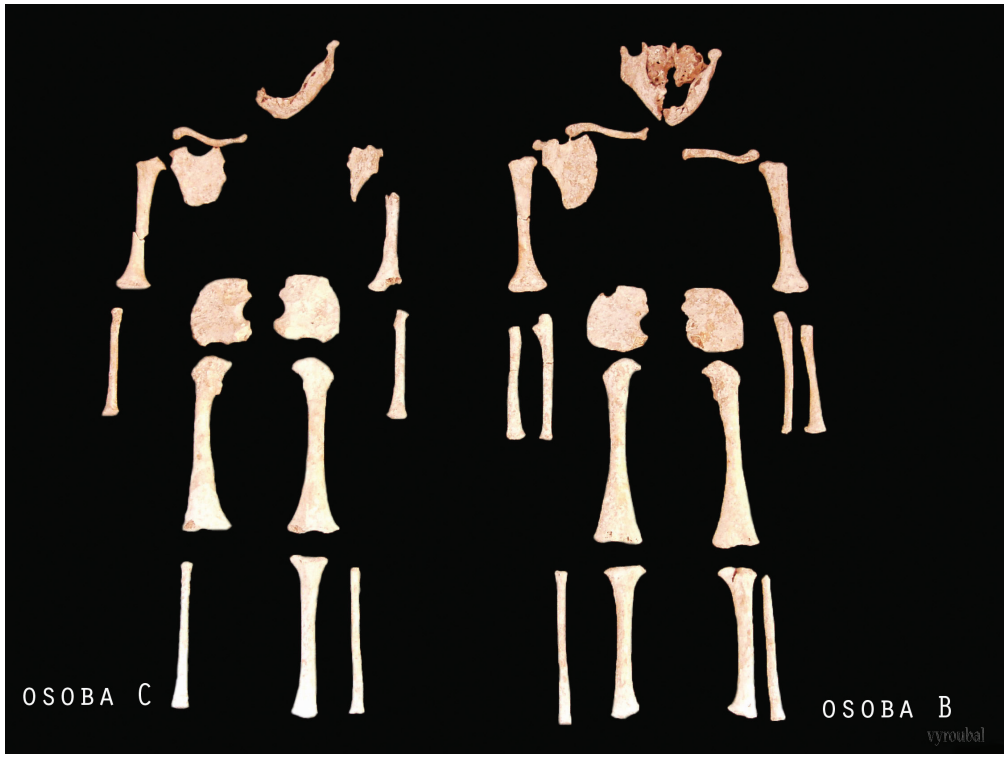

Fig. 1. Two subadult individuals B and C of the same age (1.5–2.5 years). The kuća Andrić site, grave 3 / *Sl. 1. Dva subadulta B i C istog uzrasta (1,5–2,5 godina). Nalazište kuća Andrić, grob 3*

Indicators of subadult stress

In the analysed sample, *cribra orbitalia* (*CO*) was observed in five out of 15 well-preserved eye orbits (33.3%) with two cases of active *CO* at the time of death (40%). When distributed by age, it is clear that almost all cases of *CO* were registered in subadults (4/9 or 44.4%) as well as both active cases (**fig. 2**). The total frequency of dental enamel hypoplasia (DEH) per tooth in adults is 40% (6/15).

Non-specific periostitis in the analysed sample was recorded in four out of 21 (19%) well-preserved individuals, and in half of the cases it was in an active form. Similarly to the frequency of *CO*, non-specific periostitis was found mostly in subadults (3/13 or 23.1%) including two cases in an active form of which one was present on all subadult's long bones, and in another case on both innominate.

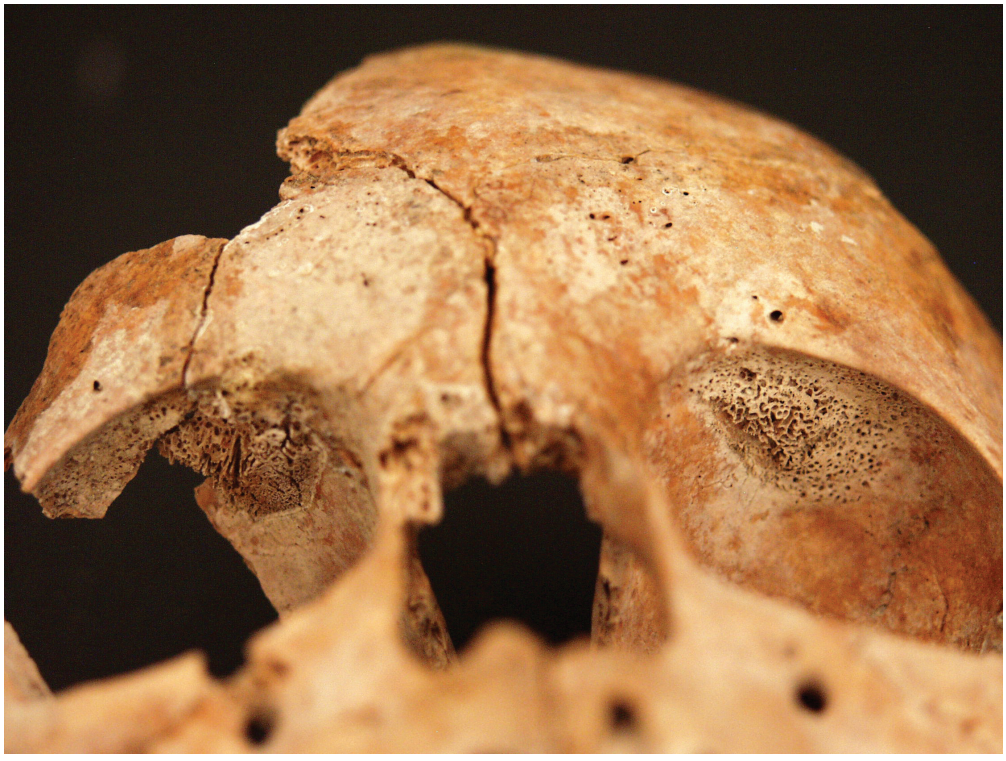

Fig. 2. Severe active form of cribra orbitalia. The kuća Andrić site, grave 2, Southern skeleton – Individual A (1.5.–2.5 years) / *Sl. 2. Jaki aktivni oblik cribrae orbitaliae. Nalazište kuća Andrić, grob 2, južni kostur – individua A (1,5–2,5 godina)*

Oral pathologies

Caries frequency per tooth in the whole sample was 3.4% (9/263); the frequency in adults was 6.8% (8/117) while in subadults only 0.7% (1/146). It is worth to emphasize that caries was observed only in females, however, the female sample was four times larger (8/95 or 8.4% vs. 0/22). The difference was not statistically significant. In total, antemortem tooth loss was observed in 35 out of 425 alveolae (8.2%), and this pathology was recorded only in adults (35/197 or 17.8%). This time, despite a smaller sample, males exhibited higher frequency (21.4% vs. 16.8%), again without statistical significance. Abscesses in the whole sample were found in 8 out of 425 alveolae; in 7 out of 197 adult's alveolae (3.6%) and in 1 out of 228 subadults' alveolae (0.4%). As was the previous case in AMTL, males exhibited higher frequencies of abscesses (7.1% vs. 2.6%), and again without statistical significance.

Osteoarthritis and Schmorl's nodes

Osteoarthritis was observed in 20 out of 100 vertebrae (20%). Females showed higher frequency (23.3%) compared to males (15%), however without statistically significant difference. A similar situation was present in osteoarthritis of major joints. The overall frequency was 29.6% (8/27) with females having a higher frequency (35.7% vs. 23.1%) which again was not statistically significant. Schmorl's nodes were noted in 15 out of 71 vertebrae (21.1%). The frequency was significantly higher in males (46.7% vs. 2.4%) (χ^2=20.336; P<0.001).

Bone fractures

A total of five antemortem fractures were found in three adult skeletons. A poorly healed nasal fracture was recorded in a male buried in the SE room of the kuća Andrić site (individual A; **fig. 3**). A male from grave 9 (individual B) exhibited three well-healed fractures on the 6th, 7th and 8th right rib. The female from the same grave (individual A) had a poorly healed fracture of the middle third of the left ulna diaphysis. The fracture is manifested in a mild callus, mild medial inclination without any inflammatory process. In total, only one fracture was found on six well-preserved skulls (16.7%) and one fracture was found on 78 well-preserved long bones (1.3%).

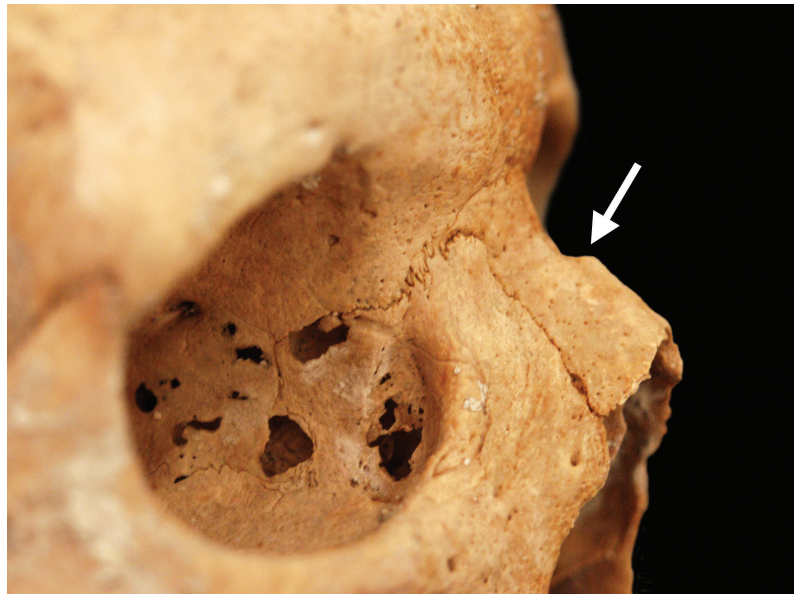

Fig. 3. Nasal fracture. The kuća Andrić site, SE room, Individual A (40–50 years) / *Sl. 3. Fraktura nosa. Nalazište kuća Andrić, JI prostorija, individua A (40–50 godina)*

Discussion

So far only one anthropological analysis of the human remains deriving from late antique Split (*Ad basilicas pictas* site) was conducted and published.[30] Thus, in order to better understand in what circumstances and living conditions the inhabitants of Diocletian's Palace lived, it is important to show the results of the analysis carried out on the osteological material from the kuća Andrić and Hrvojeva ulica sites.

The first thing that stands out is a greater representation of subadults in the sample (63.6%). That differs from some and is similar to other late antique sites from the eastern Adriatic coast. For example, the proportion of subadults in the sample from Solin–Smiljanovac is 20.3%,[31] Zadar–Relja 25.1%,[32] *Ad basilicas pictas* 28.6%,[33] Krk–Baška 41.4%,[34] Narona–*Augusteum* 52.4%,[35] and Gardun 57.9%.[36] It is interesting that higher frequencies of subadults in the samples appear at sites where small numbers of skeletons were excavated in general, so this phenomenon is probably due to a small sample size or archaeological excavations were conducted in the area where mostly children were buried. However, under-representation of subadults in the youngest age category is present, which is similar to other archaeological samples.[37] There are a few factors contributing to the state of preservation in subadults, especially those from the youngest age category. First, subadult bones are more gracile and less dense than adults' bones, and therefore easier to deteriorate.[38] Also, the state of bone preservation is influenced by proximity to water,[39] type of soil,[40] values of pH in the soil,[41] as well as burial depth.[42]

The average age at death for adults (**table 2**) in the kuća Andrić and Hrvojeva ulica sites is 36 years which is similar to Solin–Smiljanovac site (34.5 years)[43]

30 Šlaus 1999.

31 Bugarić 2015.

32 Novak 2008.

33 Šlaus 1999.

34 Novak 2015.

35 Šlaus 2004.

36 Šlaus, Novak 2014.

37 Acsádi, Nemeskéri 1970; Guy *et al*. 1997; Alesan *et al.* 1999.

38 Guy *et al*. 1997.

39 Nielsen-Marsh, Hedges 2000.

40 Janaway 1996.

41 Ferllini 2007.

42 Bello *et al*. 2006.

43 Bugarić 2015.

but low in comparison to other late antique sites from the eastern Adriatic coast, where mean age at death for adults varies between 38 and 45 years. For example, adult's average life span in Zadar–Relja is 38.0 years,[44] in Gardun 38.9 years,[45] in *Ad basilicas pictas* 40.1 years,[46] and in Krk–Baška around 45 years.[47] These differences are probably a consequence of small sample sizes.

Table 2. Comparison with other antique skeletal samples from the eastern Adriatic coast / *Table 2. Usporedba s ostalim uzorcima antičkih kostura s istočne jadranske obale*

	Kuća Andrić i Hrvojeva ulica	Zadar - Relja	Krk - Baška	Narona - Augusteum	Solin - Smiljanovac
Mean age at death	36.0	38.0	45.0	X	34.5
CO	33.3	20.1	16.7	22.2	29.4
DEH	40.0	61.1	54.5	46.7	X
Periostitis	19.0	47.1*	X	X	9.4
Caries[1]	6.8	5.1	7.8	7.5	2.5*
Alveolar bone disease	21.3	7.7*	32.4*	5.3*	10.2*
Vertebral OA	20.0	14.8	31.2	10.9	28.6
Joint OA	29.6	25.3	30.0	X	57.9*
Schmorl's nodes	21.1	12.2*	12.1	5.5*	6.7*
Long bone fractures	1.3	1.9	X	X	X

[1] For easier comparison with other sites caries and alveolar bone disease frequencies were given only for adults. / *Radi lakše usporedbe s ostalim nalazištima učestalost karijesa i alveolarnih oboljenja dana je samo za odrasle.*

*Statistically significant differences / *statistički značajne razlike*

44 Novak 2008.

45 Šlaus, Novak 2014.

46 Šlaus 1999.

47 Novak 2015.

The frequency of *CO* in the studied sample (33.3%) is the closest to Solin–Smiljanovac frequency (29.4%),[48] but generally higher than in other samples from the Eastern Adriatic coast (16.7%–22.2%).[49] However, the differences are not statistically significant. This result is possibly correlated with the fact that in the kuća Andrić and Hrvojeva ulica sites almost all cases of *CO* were registered in subadults who made up the majority of the overall sample. The frequency of dental enamel hypoplasia (DEH) in the kuća Andrić and Hrvojeva ulica samples is somewhat lower than in other samples (40.0% compared to 46.7–61.1%).[50] However, the difference is not statistically significant probably due to a small sample. The frequency of non-specific periostitis could be compared to Zadar–Relja sample where it shows much lower values (19% compared to 47.1%),[51] which is statistically significant (χ^2=5.84; P=0.01) and to Solin–Smiljanovac (9.38%),[52] where it shows higher value which is not statistically significant.

A comparison with other sites from the eastern Adriatic coast showed that biological stress indicators, especially DEH and non-specific periostitis were lower in the kuća Andrić and Hrvojeva ulica samples. During childhood, these pathologies are caused by different factors such as metabolic disorders, contagious diseases, anaemia (caused by inadequate nourishment and iron deficiency), starvation, etc.[53] It could be concluded that the population (or at least one part of it) buried at the kuća Andrić and Hrvojeva ulica sites was exposed to a low physiological stress – in other words, they must have lived in better living conditions with higher hygienic standards and probably consumed high-quality food. That was also an interpretation of results for late antique series obtained by Šlaus (2008), where he compared continental and eastern Adriatic late antique sites to early medieval ones.

However, in these instances, osteological paradox should also be considered as a possible explanation. The presence of childhood stress indicators in the skeleton is taken as evidence that an individual was unhealthy at the time of death. On the contrary, if a skeleton does not exhibit any indicators of subadult stress, it is designated as healthy. In osteological paradox this would mean that unhealthy individuals who lived long enough to express skeletal lesions were healthier than those who died of a disease before it could manifest itself in the skeleton (Wood *et*

48 Bugarić 2015.

49 Novak 2008; 2015; Šlaus 2004.

50 Novak 2008; 2015; Šlaus 2004.

51 Novak 2008.

52 Bugarić 2015.

53 Stuart-Macadam 1991; Guatelli-Steinberg, Lukacs 1999; Ortner 2003; Brickley, Ives 2008; Walker *et al*. 2009.

al. 1992). It should be noted that higher frequencies of *cribra orbitalia* and non-specific periostitis in the studied sample are correlated with younger age categories. This was reported in several other studies[54] and indicates that subadult stress results not in increased resilience, but in biological damage that decreases the adult lifespan.

Dental caries frequency in adults in the analysed sample (6.8%) is similar to other late antique samples from the eastern Adriatic coast where frequency varies between 5.1% to 7.8%.[55] Only the comparison with Solin–Smiljanovac[56] showed a statistically significant higher frequency (6.6% vs. 2.5%; χ^2=6.375; P=0.01). In a more comprehensive study conducted by Šlaus *et al.* in 2011, a composite late antique sample from the eastern Adriatic coast exhibited 9.7% of caries frequency. This higher frequency is probably correlated to a larger sample in general as well as a higher percentage of individuals older than 36 years. Nonetheless, all sites from the eastern Adriatic coast have in common an urban character, ecological features, a Mediterranean climate, similar subsistence strategies, a marked cultural uniformity in dietary habits, nutrition and health practices that characterised the entire Roman Empire.[57]Available historical sources report about the typical meal of the lower and middle classes in Roman Italy, containing wheat, olives, figs, bread (rich in bran and impurities), porridge of cereals (puls), wine, vegetables, and some fruit and olives.[58] The diet was complemented with fish and meat (transhumance goat and sheep herding), which would be in accordance with the study of Powell (1985) where low rates of caries are correlated with low carbohydrate diets, while high levels of proteins and fat inhibit caries.[59] The study of the stable isotope analyses from the period between the Iron Age and Early Middle Ages conducted by Lightfoot *et al.* in 2012 confirms these results. Unlike the Iron Age diet that consisted of C3 plants without evidence of consuming C4 plants (millet), in Roman times when C3 plants continued to be important, seafood was introduced in the diet.[60] It must be emphasized that caries in males in the analysed sample were not recorded at all. A possible explanation for this could be a small sample size of only 22 teeth. However, in some previous studies a higher prevalence of caries in females was explained by the fact that females mainly stayed at home preparing food and consequently ate several small meals and snacks, unlike ma-

54 Mittler, Van Gerven 1994; Duray 1996; Sullivan 2005; Šlaus 2008.

55 Novak 2008; 2015; Šlaus 2004.

56 Bugarić 2015.

57 Šlaus *et al.* 2011.

58 Dosi, Schnell 1990.

59 Powell 1985.

60 Lightfoot *et al.* 2012.

les who spent most of the day in the field or with the cattle eating one or two bigger meals.[61] This is in accordance with clinical studies that correlate frequent snacks with higher caries values.[62]

Despite the small sample, males showed a higher frequency in the alveolar bone disease. The aetiology of an alveolar abscess is penetrating and destructive caries with pulp cavity exposure, heavy wear and trauma,[63] while the aetiology of antemortem tooth loss (AMTL) is caries, abscesses, heavy wear, calculus, alveolar resorption and trauma.[64] Since caries was not recorded in males, it can be ruled out as the main causing factor, however, at this time, it is uncertain what was the main cause of these pathologies. It has to be mentioned that in study conducted by Šlaus *et al.* (2011) the late antique series exhibited significantly higher rates of heavy wear on the anterior dentition, which raises the possibility that non-dietary factors, possibly activities related to fishing (making fishing nets) may have contributed to the wearing down of their front teeth. Since heavy wear can be an aetiological factor for both abscess and AMTL, it could have also affected the high frequency of this pathology in the studied sample.

When compared to other sites, frequency of alveolar bone disease in the kuća Andrić and Hrvojeva ulica sites (21.3%) was lower than in Krk–Baška (32.4%)[65] and much higher than in Zadar–Relja (7.7%),[66] Narona–*Augusteum* (5.3%),[67] and Solin–Smiljanovac (10.25%).[68] All of the recorded differences are statistically significant (χ^2=4.544; P<0.05; χ^2=44.701; P<0.001; χ^2=12.03; P<0.001; χ^2=17.691; P<0.001 respectively). A high frequency of this pathology in Krk–Baška may be explained by the higher average life span because of the known correlation between higher frequencies of oral pathologies and older age. This, however, cannot be the case with the kuća Andrić and Hrvojeva ulica sample, because the mean age at death was only 36 years. Also, a similar frequency of caries in all Late antique sites eliminates this pathology as a main aetiological factor. Therefore, at this point it is not clear why the alveolar bone disease is so high in the studied sample.

Frequency of vertebral osteoarthritis in the kuća Andrić and Hrvojeva ulica sample (20%) is lower than the values recorded in Krk–Baška (31.2%)[69] and Solin–

61 Walker, Hewlett 1990.

62 Nizel 1973; Rowe 1982.

63 Littleton, Frohlich 1993; Dias, Tayles 1997.

64 Hillson 2000.

65 Novak 2015.

66 Novak 2008.

67 Šlaus 2004.

68 Bugarić 2015.

69 Novak 2015.

Smiljanovac (28.6%),[70] and higher than in Zadar–Relja (14.8%)[71] and Narona–*Augusteum* (10.9%).[72] None of these differences are statistically significant. High frequency of vertebral osteoarthritis in Krk–Baška could probably be explained by a higher average life span. The same principle cannot be applied for Solin–Smiljanovac sample, because the mean age at death is lower than in the kuća Andrić and Hrvojeva ulica sample. What is interesting, in both the kuća Andrić and Hrvojeva ulica and Solin–Smiljanovac samples, frequency of vertebral osteoarthritis is higher in females, which is atypical for archaeological populations. Usually, only males show a higher frequency, indicating they were performing tasks that required hard labour, suggesting the division of labour by sex. Bugarić (2015) hypothesizes that females from the Solin–Smiljanovac sample performed specific works carrying the burden on their heads, which would explain the higher frequency of osteoarthritis on the cervical spine. The other explanation would be the fact that only a small portion of the total sample from the Solin–Smiljanovac site was used for the analysis, and that a larger proportion of women with osteoarthritis of the vertebrae were accidentally represented.[73] In the case of kuća Andrić and Hrvojeva ulica, it is also possible that women performed some specific labour that affected their spine.

Frequency of joint osteoarthritis in the analysed sample (29.6%) is similar to Krk–Baška (30%)[74] and Zadar–Relja (25.3%),[75] and differs greatly from Solin–Smiljanovac (57.9%),[76] which makes a statistically significant difference (χ^2=7.69; P<0.01). As osteoarthritis mostly occurs due to mechanical stress and physical activity,[77] it can be concluded that the population from the kuća Andrić and Hrvojeva ulica sites performed jobs that required hard labour. A higher frequency of this pathology was again recorded in females and it can be speculated, as in the case of the vertebral osteoarthritis, that women performed some specific labour that affected their joints.

Frequency of Schmorl's nodes in the kuća Andrić and Hrvojeva ulica sample (21.1%) is almost twice as higher in comparison to other sites, where values vary between 5.5% and 12.2%.[78] Almost all of the differences are statistically significant

70 Bugarić 2015.

71 Novak 2008.

72 Šlaus 2004.

73 Bugarić 2015.

74 Novak 2015.

75 Novak 2008.

76 Bugarić 2015.

77 Hough, Sokoloff 1989.

78 Šlaus 2004; Bugarić 2015; Novak 2008; Novak 2015.

(vs. Narona–*Augusteum* χ^2=4.334; P<0.05; vs. Solin–Smiljanovac χ^2=11.229; P<0.001; vs. Zadar–Relja χ^2=4.907; P<0.05). Schmorl's nodes indicate a high mechanical load exerted on the spine,[79] so the high frequency in the analysed sample suggests that they performed more difficult physical tasks than other populations from the eastern Adriatic coast. This is especially evident in males, who showed a significantly higher frequency in comparison to females, which is characteristic for most of the archaeological populations indicating a sex-based division of labour.

All traumas recorded in the kuća Andrić and Hrvojeva ulica samples are antemortem, which means they had occurred long before death and healed well. Traumas were recorded in the skull and a long bone – ulna. A nasal trauma in the male's skull could be attributed to intentional violence. These injuries along with zygomatic bones and mandible are considered to have high specificity for a clinical diagnosis of assault, which can result from the direct trauma of punches or kicks.[80] The second trauma noted on the female skeleton is a diaphyseal fracture of the left ulna. This kind of trauma can result from either a direct or indirect trauma and is usually caused by a fall onto an outstretched hand with forced pronation, but it may also be caused by a blow to the back of the upper forearm (i.e., a "parry" fracture).[81]

Traumas could only be compared to the Zadar–Relja sample, where the long bone trauma frequency showed a similar value (1.3% vs. 1.9%), as well as the cranial trauma frequency (16.7% vs. 23.3%). However, there is one big difference. In Zadar–Relja a high cranial trauma frequency, along with two perimortem fractures, testify of intentional violence consistent with street fights and tavern brawls with only occasional use of sharp weapons, rather than the more overtly violent confrontations encountered in battles or other military operations.[82] On the contrary, such case cannot be claimed for the kuća Andrić and Hrvojeva ulica samples just on the basis of only two fractures.

Conclusion

Although the sample studied in this analysis was small, new results considering life conditions during the Late antique period in the Diocletian's Palace were obtained. The kuća Andrić and Hrvojeva ulica samples are characterised by a high prevalence of subadults in the sample, relatively low frequencies of markers of subadult stress, caries and traumas, but higher frequencies of alveolar bone disease and Schmorl's nodes in comparison to other late antique sites from East-

79 Schmorl, Junghanns 1971.

80 Lovell 1997.

81 Lovell 1997.

82 Novak 2007.

ern Adriatic coast. By most of the features, it seems that the population buried in the kuća Andrić and Hrvojeva ulica sites lived similar to other communities from that period and geographical region. The reason for the high frequency of alveolar bone disease in the sample (especially in males) at this moment cannot be explained fully, while the high frequency of Schmorl's nodes is probably a consequence of hard labour performed by males. However, it must be emphasized that bioarchaeological analysis was conducted on the small sample as was the most of the comparative material from the eastern Adriatic coast, and that results and conclusions must be taken with reserve.

LITERATURE / *LITERATURA*

Acsádi, Nemeskéri 1970 — G. Acsádi, J. Nemeskéri, *History of human life span and mortality*, Akadémiai Kiadó, Budapest.

Alesan *et al.* 1999 — A. Alesan, A. Malgosa, C. Simó, Looking into the demography of an Iron Age population in the Western Mediterranean, I. Mortality, *AJA* 110, 285–301.

Antoljak 1996 — S. Antoljak, A *Survey of Croatian History*, Laus/Orbis, Split.

Bello *et al.* 2006 — S. Bello, A. Thomann, M. Signoli, O. Dutour, P. Andrews, Age and sex bias in the reconstruction of past population structures, *AJPhA* 129, 24–38.

Bhaskar 1981 — S. N. Bhaskar, *Synopsis of Oral pathology*, Maryland Heights, Mosby.

Brickley, Ives 2008 — M. Brickley, R. Ives, *The Bioarchaeology of Metabolic Bone Disease*, Academic Press, Amsterdam.

Bugarić 2015 — A. A. Bugarić, *Forenzičnoantropološka analiza uzorka sa salonitanske nekropole*, diplomski rad, Sveučilišni odjel za forenzične znanosti, Split.

Dias, Tayles 1997 — G. Dias, N. Tayles, ''Abscess cavity'' – a misnomer, *IJO* 7, 545–554.

Duray 1996 — S. M. Duray, Dental indicators of stress and reduced age at death in prehistoric Native Americans, *AJPhA* 99, 275–286.

Eshed *et al*. 2006 — V. Eshed, A. Gopher, I. Hershkovitz, Tooth Wear and Dental Pathology at the Advent of Agriculture: New Evidence from the Levant, *AJPhA* 130, 145–159.

Facchini *et al.* 2006 — F. Facchini, E. Rastelli, M. G. Belcastro, Peri mortem cranial injuries from a medieval grave in Saint Peter's Cathedral, Bologna, Italy, *International Journal of Osteoarchaeology* 18, 421–430.

Ferllini 2007 — R. Ferllini, Bone Scatter on Chalk: The Importance of Osteological Knowledge and Environmental Assessment, in: M. B. Brickley, R. Ferllini (eds), *Forensic Anthropology: Case Studies from Europe*, Charles C. Thomas Publisher, Springfield, 216–231.

Gilbert, McKern 1973 — B. M. Gilbert, T. W. McKern, A method for aging the female os pubis, *AJPhA* 38, 31–38.

Goodman, Armelagos 1985 — A. H. Goodman, G. J. Armelagos, Factors affecting the distribution of enamel hypoplasias within the human permanent dentition, *AJPhA* 68, 479–493.

Goodman, Rose 1990 — A. H. Goodman, J. C. Rose, Assessment of systemic physiological perturbations from dental enamel hypoplasias and associated histological structures, *Yearbook of Physical Anthropology* 33, 59–110.

Goodman, Rose 1991 — A. H. Goodman, J. C. Rose, Dental enamel hypoplasias as indicators of nutritional status, in: M. Kelley, C. Larsen (eds), *Advances in dental anthropology*, Wiley-Liss, New York, 279–294.

Goodman *et al.* 1980 — A. H. Goodman, G. J. Armelagos, J. C. Rose, Enamel Hypoplasias as Indicators of Stress in Three Prehistoric Populations from Illinois, *Human Biology* 52, 515–528.

Griffeth *et al.* 1980 — M. T. Griffeth, R. A. Dailey, S. Ofner, Bilateral spontaneous subperiosteal hematoma of the orbits: a case report, *The Archives of Arch Ophthalmology* 115, 679–680.

Guatelli-Steinberg, Lukacs 1999 — D. Guatelli-Steinberg, J. R. Lukacs, Interpreting sex differences in enamel hypoplasia in human and non-human primates: Developmental, environmental and cultural considerations, *Yearbook of Physical Anthropology* 42, 73–126.

Guy *et al.* 1997 — H. Guy, C. Masset, C. A. Baud, Infant taphonomy, *IJO* 7, 221–229.

Hengen 1971 — O. P. Hengen, Cribra Orbitalia: Pathogenesis and Probable Aetiology, *Homo* 22, 57–75.

Hillson 1996 — S. Hillson, *Dental Anthropology*, Cambridge University Press, Cambridge.

Hillson 2000 — S. Hillson, Dental Pathology, in: M. A. Katzenberg, S. R. Saunders (eds), *Biological Anthropology of the Human Skeleton*, Wiley-Liss, New York, 249–286.

Hough, Sokoloff 1989 — A. J. Hough, L. Sokoloff, Pathology of osteoarthritis, in: D. J. McCarty (ed.), *Arthritis and Allied Conditions*, Lea and Febiger, Philadelphia, 1571–1594.

Janaway 1996 — R. C. Janaway, The decay of human buried remains and their associated materials, in: J. Hunter, C. Roberts, A. Martin (eds), *Studies in crime: An introduction to forensic archaeology*, Routledge, London, 58–85.

Jović Gazić 2001 — V. Jović Gazić, Urban development from late Antiquity to the middle ages: Dubrovnik, Split, Trogir, Zadar – the state of research, *AAdr* 5, 151–196.

Karaman 1940 — Lj. Karaman, O počecima srednjovjekovnog Splita do godine 800, *Serta Hoffilleriana*, Zagreb, 419–436.

Kreshover 1960 — S. J. Kreshover, Metabolic Disturbances in Tooth Formation, *Annals of the New York Academy of Sciences*, 85, 161–167.

Krogman, Iscan 1986 — W. M. Krogman, M. Y. Iscan, *The Human Skeleton in Forensic Medicine*, *2nd ed.*, C. C. Thomas, Springfield.

Kurilić, Serventi 2014 — A. Kurilić, Z. Serventi, Late Roman Tombs and Burial Places in the Province of Dalmatia, *International scientific conference The Basilica of St Sophia During The Transition From Paganism To Christianity*, Sofia, March 11–13, 450–468.

Larsen 1997 — C. S. Larsen. *Bioarchaeology*, Cambridge University Press, Cambridge.

Larsen *et al.* 1991 — C. S. Larsen, R. Shavit, M. C. Griffin, Dental Caries Evidence for Dietary Change: An Archaeological Context, in: M. A. Kelley, C. S. Larsen (eds), *Advances in Dental Anthropology*, Wiley-Liss, New York, 179–202.

Lightfoot *et al.* 2012 — E. Lightfoot, M. Šlaus, T. O'Connell, Changing cultures, changing cuisines: Cultural transitions and dietary change in Iron Age, Roman, and Early Medieval Croatia, *AJPhA* 148, 543–556.

Littleton, Frohlich 1993 — J. Littleton, B. Frohlich, Fish-eaters and farmers: dental pathology in the Arabian Gulf, *AJPhA* 92, 427–447.

Lovejoy *et al*. 1985 — C. O. Lovejoy, R. S. Meindl, T. R. Pryzbeck, R. P. Mensforth, Chronological metamorphosis of the auricular surface of the ilium: A new method for the determination of age at death, *AJPhA* 68, 15–28.

Lovell 1997 — N. C. Lovell, Trauma analysis in paleopathology, *AJPhA* 104, 139–170.

Lovell 2008 — N.C. Lovell, Analysis and interpretation of skeletal trauma, in: M. A. Katzenberg, S. R. Saunders (eds), *Biological anthropology of the human skeleton*, Wiley, Hoboken, 341–386.

Luckin 1980 — W. Luckin, Death and survival in the city: approaches to the history of disease, *Urban History Yearbook* 24, 53–62.

Lysell *et al*. 1962 — L. Lysell, B. Magnusson, B. Thilander, Time and order of eruption of the primary teeth: A longitudinal study, *Odontologisk Revy* 13, 217–234.

Mann, Murphy 1990 — R. W. Mann, S. P. Murphy, *Regional Atlas of Bone Disease. A Guide to Pathologic and Normal Variation in the Human Skeleton*, Charles C. Thomas, Springfield.

Maples 1986 — W. R. Maples, Trauma analysis by theforensic anthropologist, in: K. J. Reichs (ed.), *Forensicosteology: advances in the identification of human remains*, Charles C. Thomas, Springfield, 218–228.

Marinković 2010 — V. Marinković, *Pregled arheoloških istraživanja i restauratorsko-konzervatorskih zahvata u Dioklecijanovoj palači u Splitu*, Zaštita spomenika, Split.

McKeag 1992 — D. B. McKeag, The Relationship of Osteoarthritis and Exercise, *Clinics in Sports Medicine* 11, 471–478.

Meindl, Lovejoy1985 — R. S. Meindl, C. O. Lovejoy, Ectocranial suture closure: A revised method of the determination of skeletal age at death based on the lateral-anterior sutures, *AJPhA* 68, 57–66.

Mensforth *et al.* 1978 — R. P. Mensforth, C. O. Lovejoy, J. W. Lallo, G. J. Armelagos, The role of constitutional factors, diet and infectious disease in the etiology of porotic hyperostosis and periosteal reactions in prehistoric infants and children, *Medical Anthropology* 2, 1–59.

Mittler, Van Gerven 1994 — D. M. Mittler, D. P. Van Gerven, Developmental, diachronic and demographic analysis of cribra orbitalia in the medieval Christian populations of Kulubnarti, *AJPhA* 93, 287–297.

Nielsen-Marsh, Hedges 2000 — C. M. Nielsen-Marsh, R. E. M. Hedges, Patterns of diagenesis in bone I: The effects of site environments, *Journal of Archaeolical Science* 27, 1139–1151.

Nizel 1973 — A. E. Nizel, Nutrition and oral problems, *World Review of Nutrition and Diet* 16, 226–252.

Novak 2007 — M. Novak, Trauma analysis in Roman era sample from Zadar – Relja, in: A. Uglešić (ed.), *Abstracts book of the 13th annual meeting of the European Association of Archaeologists*, Sveučilište u Zadru, Zadar, 338–339.

Novak 2008 — M. Novak, *Antropološka analiza antičke nekropole Zadar – Relja u kontekstu antičkih nekropola Hrvatske*, disertacija, Filozofski fakultet, Zagreb.

Novak 2015 — M. Novak, Zdravlje i bolest tijekom antike u Baškoj na Krku rezultati bioarheološke analize ljudskih koštanih ostataka s lokaliteta Sveti Marko, in: Z. Ettinger Starčić, D. Tončinić (eds), *Istraživanja na otocima*, *IzdHAD* 30, Hrvatsko arheološko društvo, Lošinjski muzej, Zagreb, 129–139.

Ortner 2003 — D. J. Ortner, *Identification of Pathological Conditions in Human Skeletal Remains*, Academic Press, San Diego.

Perojević *et al.* 2009 — S. Perojević, K. Marasović, J. Marasović, Istraživanja Dioklecijanove palace od 1985. do 2005. godine, in: N. Cambi (ed.), *Dioklecijan, Tetrahija i Dioklecijanova palača o 1700. obljetnici postojanja*, Književni krug Split, Split, 51–94.

Phenice 1969 — T. W. Phenice, A newly developed visual method of sexing the os pubis, *AJPhA* 30, 297–301.

Pindborg 1970 — J. J. Pindborg, *Pathology of the dental hard tissues*, W. B. Saunders, Philadelphia.

Powell 1985 — M. L. Powell, The Analysis of Dental Wear and Caries for Dietary Reconstruction, in: R. I. Gilbert, J. H. Mielke (eds), *The Analysis of Prehistoric Diets*, Academic Press Inc., New York.

Rathbun 1987 — A. T. Rathbun, Health and Disease at a South Carolina Plantation 1840–1870, *AJPhA* 74, 239–253.

Rismondo, Šarić 2006 — T. Rismondo, E. Šarić, *Arheološka istraživanja u Hrvojevoj ulici i kući Andrić*, katalog izložbe, Split.

Robb 1994 — J. Robb, Ritual, Context and Gender in Neolithic South-eastern Italy, *Journal of European Archaeology* 2, 199–214.

Rowe 1982 — N. Rowe, Dental caries, in: P. F. Steele (ed.), *Dimensions of Dental Hygiene*, Lea and Febiger, Philadelphia, 209–237.

Saluja *et al.* 1986 — G. Saluja, K. Fitzpatrick, M. Bruce, J. Cross, Schmorl's Nodes (Intervertebral Herniations of Intervertebral Disc Tissue) in Two Historic British Populations, *Journal of Anatomy* 145, 87–96.

Sarnat, Schour 1941 — B. G. Sarnatand, I. S. Schour, Enamel Hypoplasia (Chronologic Enamel Aplasia) in Relation to Systemic Disease: A Chronologic Morphologic, and Etiologic Classification, *Journal of American Dental Association* 29, 67–75.

Schmorl, Junghanns 1971 — G. Schmorl, H. Junghanns, *The Human Spine in Health and Disease*, Grune and Stratton, New York.

Sullivan 2005 — A. Sullivan, Prevalence and etiology of acquired anemia in Medieval York, England, *AJPhA* 128, 252–272.

Šlaus 1999 — M. Šlaus, Antropološka analiza kasnoantičke populacije s nalazišta *Ad basilicas pictas*, in: F. Oreb, T. Rismondo, M. Topić (eds), *Ad basilicas pictas*, Ministarstvo kulture RH, Uprava za zaštitu kulturne baštine, Split, 60–65.

Šlaus 2004 — M. Šlaus, Bioarheološka analiza ljudskog osteološkog materijala s nalazišta Narona–*Augusteum*, *VAHD* 96, 539–561.

Šlaus 2008 — M. Šlaus, Osteological and Dental Markers of Health in the Transition From the Late Antique to the Early Medieval Period in Croatia, *AJPhA* 136, 455–469.

Šlaus, Novak 2014 — M. Šlaus, M. Novak, Antropološka analiza ljudskog osteološkog materijala, in: M. Sanader (ed.), *Tilurium III. Istraživanja 2002.–2006. godine*, Zavod za arheologiju Filozofskog fakulteta Sveučilišta u Zagrebu, Zagreb, 117–131.

Šlaus *et al.* 2011 — M. Šlaus, Ž. Bedić, P. Rajić Šikanjić, A. Domić Kunić, Dental Health at the Transition from the Late Antique to the Early Medieval Period on Croatia's Eastern Adriatic Coast, *IJO* 21, 577–590.

Stuart-Macadam 1991 — P. Stuart-Macadam, Nutrionional deficiency diseases: a survey of scurvy, rickets, and iron-deficiency anemia, in: M. Y. Işcan, K. A. R. Kennedy (eds), *Reconstruction of Life from the Skeleton*, Liss, New York, 201–222.

Tayles 1997 — N. Tayles, Tooth Ablation in Prehistoric Southeast Asia, *IJO* 6, 333–345.

Üstündag 2009 — H. Üstündag, Schmorl's Nodes in a Post-medieval Skeletal Sample from Klostermarienberg, Austria, *IJO* 19(6), 695–710.

Wakely 1997 — J. Wakely, Identification and analysis of violent and non-violent head injuries in osteoarchaeological material, in: J. Carman (ed.), *Material harm: archaeological studies of war and violence*, Cruithne Press, Glasgow, 24–46.

Waldron 1994 — T. Waldron, *Counting the Dead: The Epidemiology of Skeletal Populations*, John Wiley and Sons, Chichester.

Walker, Hewlett 1990 — P. L. Walker, B. S. Hewlett, Dental health diet and social status among Central African foragers and farmers, *American Anthropologist*, 92, 382–398.

Walker *et al.* 2009 — P. L. Walker, R. R. Bathurst, R. Richman, T. Gjerdrum, V. A. Andrushko, The Causes of Porotic Hyperostosis and *cribra orbitalia*: A Reappraisal of the Iron-Deficiency-Anemia Hypothesis, *AJPhA* 139, 109–125.

Wheatley 2008 — B. Wheatley, Perimortem or postmortem bone fractures? An experimental study of fracture patterns in deer femurs, *The Journal of Forensic Sciences* 53, 69–72.

Wolter 1979 — J. R. Wolter, Subperiosteal hematomas of the orbit in young males: a serious complication of trauma or surgery in the eye region, *The Journal of Pediatric Ophthalmology and Strabismus* 16, 291–296.

SAŽETAK

Bioarheološka analiza ljudskih skeletnih ostataka s kasnoantičkih nalazišta kuća Andrić i Hrvojeva ulica u Splitu

Bioarheološka analiza indikatora subadultnog stresa, oralnog zdravlja, fizičkog stresa i trauma napravljena je na koštanom materijalu koji potječe s nalazišta kuća Andrić i Hrvojeva ulica, kasnoantičkih grobalja smještenih u Dioklecijanovoj palači u Splitu. Promatrani indikatori uključuju sljedeće patološke promjene: *cribra orbitalia*, hipoplaziju zubne cakline, nespecifični periostitis, karijes, alveolarni apsces, zaživotni gubitak zuba, osteoartritis na kralježnici i velikim zglobovima, Schmorlove defekte i traume. Uzorak se sastoji od 33 kostura iz 17 grobova, od kojih je 12 odraslih i 21 dijete. Rezultati upućuju na veći omjer djece u uzorku, relativno niske učestalosti subadultnog stresa, karijesa i trauma te po više neučestalosti alveolarnih oboljenja i Schmorlovih defekata, što je posebno vidljivo kod muškaraca. U usporedbi s drugim kasnoantičkim nalazištima s istočne obale Jadrana, uzorak iz kuće Andrić i Hrvojeve ulice pokazuje da je analizirana populacija živjela u sličnim, a po nekim pokazateljima i boljim uvjetima života.