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DEMOGRAPHY AND PATHOLOGY OF THE MEDIEVAL POPULATION FROM STENJEVEC

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Human skeletal remains from 84 individuals from the medieval (10th-12th century) Stenjevec cemetery in continental Croatia are described. Paleodemographic analysis shows high subadult mortality despite clear underrepresentation in the youngest age category, and peak adult mortality rates between the ages of 21-35 years for females, and 31-45 years for males. Subadult stress, as evidenced by the presence of linear enamel hypoplasia and cribra orbitalia is high in the series. Enamel hypolasia is present in 88.0% of analyzed subadult teeth, and in 51.7% of analyzed adult teeth. Cribra orbitalia is recorded in 70.0% of subadult, and 30.8% of adult crania. Skeletal evidence of infectious disease is also common in the series, as is evidence for trauma. Sex differences in frequencies of carious lesions, osteoarthritis, and Schmorl's lesions suggest differential male/female dietary practices or differences in resource access, and differential activity patterns. Comparison with late antique and early medieval skeletal series from continental Croatia show differences in frequencies of cribra orbitalia, infectious disease and trauma that indicate higher stress in the developed medieval period. Multivariate craniometric analyses (Šlaus, 2000) show that this coincides with a northward expansion of early medieval Croat populations from the eastern coast of the Adriatic into modern Bosnia and Herzegovina and continental Croatia. Data collected from the Stenjevec series suggests that this expansion led to a deterioration of living conditions during the developed medieval period. Continued research of skeletal series from continental Croatia is necessary to see if data from these collections confirm this correlation.

Key words: demography, cribra orbitalia, enamel hypoplasia, infectious disease, trauma, medieval populations, Croatia.

The Stenjevec skeletal series was recovered during systematic excavations carried out from 1983 to 1993. The site, located on the western outskirts of Zagreb, had previously been recognized as an important Antique site. At one point it was considered as the possible location of Andautonia until the site was conclusively located in Ščitarjevo. Excavations carried out in 1982 revealed the presence of a large medieval cemetery located in the orchard of the Parish church of the "Assumption of the Virgin" (Gregl, 1982). Systematic excavations carried out by the Archaeological museum of Zagreb revealed the presence of 161 graves aligned in, more or less, parallel rows. Artifacts recovered from the site date the use of the cemetery to between the 10th to 12th century (Simoni, 1988).

The pathological changes and demographic profiles of skeletal populations from the developed medieval period in continental Croatia have so far received limited attention. Some biological data has been published for the Đakovo phase I skeletal series, but the primary concern in that report was craniometric differentiation between the two burial phases (Šlaus and Filipec, 1998). Boljunčić reported on the demography and pathology of two small skeletal series from Zvonimirovo (Boljunčić, 1993; 1997a) and Josipovo (Boljunčić, 1997b) near Virovitica, and an osteochondroma found in an adult male from the Lobor site has been published as a case report of a bone tumor recovered from an archaeological series (Šlaus et al., 2000). Apart from these reports, little is known about the paleodemography and paleopathology of the Developed medieval period in continental Croatia. This is unfortunate as this is an important period of time, both in terms of political and economic changes about which historical sources are conflicting and confusing. For instance, the political status of continental Croatia in the 10th and 11th centuries is, at present, unclear. In all likelihood this was a period of anarchy during which sovereignty changed between Hungary and Croatia (Klaić, 1971).

After the death of the Croatian king Zvonimir in uncertain circumstances in 1091, the Hungarian king Ladislav I annexed continental Croatia and build a system of "županijas" based on an old Slavic system. Royal županijas were established as organizational units which incorporated royal holdings. Alongside these, smaller tribal župans, counties of free people obliged to serve in the military, functioned (Klaić, 1990). Ladislav's heir Koloman defeated the Croatian king Petar Svačić and crowned himself as king of Hungary, Croatia and Dalmatia in 1102. Under Hungarian rule, in the 12th and 13th centuries, continental Croatia achieved an almost independent position with the Hercegs and Bans as leaders (Klaić, 1990). Economic changes characterize this period, primarily the emergence of secular elites, and the rise in importance of monastic orders, chief among them the Templars and the Hospitallers (Dobronić, 1984). Towns were built and given special privileges until the short, but devastating, Mongol invasion in 1242 highlighted the weaknesses of open settlements.

From the archaeological point of view, the period from the 10th to the 13th century is known as the Bijelo Brdo Culture. This is, in effect, a professional term which has been used for over 70 years to designate different types of material remains with common characteristics found in medieval graves from Slovakia, Hungary, Slovenia, continental Croatia, Vojvodina and western Rumania. The name of the culture derives from the eponymous site near Osijek in Croatia. The question of who the originators, and main bearers of this culture were, aroused much debate in archaeological circles. Only recently have we come to understand that the development of the Bijelo Brdo culture was a complex process influenced by numerous elements including the cultural heritage of previous periods, Byzantine influences, ethnic migrations, and the development of medieval states. The bearers of the Bijelo Brdo Culture have now been identified as Slavs and Hungarians, with the understanding that the Slav component was heterogeneous and consisted of Slovaks, Bulgars, and Croats (Demo, 1996).

Recently published results of multivariate statistical analyses of craniometric measurements from medieval archaeological sites in Central Europe also attest to the complex political and ethnic interactions in continental Croatia during the 10th to 13th centuries. The results of these analyses show that Early medieval Croats migrated to the eastern coast of the Adriatic from an area probably located in modern northern Poland (Šlaus, 1998). During the 10th to 13th centuries this population gradually expanded northward into modern Bosnia and Herzegovina, and what is today the continental part of Croatia (Šlaus, 2000).

With the osteological material from Stenejvac available, a bioarchaeological research project was developed with the aim of deriving osteological information about the health, nutritional status and lifeways of this Late medieval population. Although of marginally significant size for statistical analysis, the data presented in this communication represent the largest amount of osteological evidence currently available from a single skeletal series from this period.

MATERIAL AND METHODS

The Stenjevec skeletal series was recovered during systematic excavations carried out from 1983 to 1993. Excavation and documentation of the burials followed standard archaeological procedures. The series contains the remains of 84 individuals. The majority of the remains were recovered from single primary inhumations. Two graves contained two individuals - grave 12 two subadults, and grave 138 a neonatal subadult and an adult female, while grave 104 contained the remains of three well preserved subadults.

Bone preservation varied from good to excellent. The completeness of the individual skeletons also varied, but the majority are substantially complete (missing only a few bones). Due to fragmentation, considerable restoration of the skeletal material was necessary. Once dry, the bones were relatively stable, and because trace element analysis is planned for the future, no preservative was applied.

Accurate determinations of sex, age and precise bone element baseline counts are essential for sample comparisons between different skeletal series. Cross-population interpretations of mortality trends and morbidity patterns are based on sound demographic profiles established through careful consideration of applicable up-to-date morphological, metric, and multivariate criteria.

The criteria selected for determination of sex include pelvic (Phenice, 1969) and cranial morphology (Krogman and Iscan, 1986). These criteria generally provide accurate results. From a sample of skeletons of known sex, Meindl et al. (1985) report a 3% error rate when both the pelvis and skull were evaluated. When these elements were missing, sex was determined by recently developed discriminant functions for sexing adult femora from medieval skeletal series in Croatia (Šlaus, 1997). Based on the variables used, the functions have an accuracy rate of between 87% to 95%. No attempt was made to estimate the sex of subadult individuals.

Adult age at death was estimated using as many methods as possible, including ectocranial suture fusion (Meindl and Lovejoy, 1985), pubic symphysis morphology (Brooks and Suchey, 1990; Gilbert and McKern, 1973; McKern and Stewart, 1957; Todd, 1920, 1921), auricular surface morphology (Lovejoy et al., 1985), and sternal rib end changes (Iscan et al., 1984, 1985). In subadults, age at death was estimated using epiphyseal fusion, diaphyseal lengths, and dental eruption criteria (McKern and Stewart, 1957; Bass, 1987; Fazekas and Kósa, 1978; Moorrees et al., 1963).

Detailed bone inventories were obtained for each skeleton. The coding format used in this procedure is designed for computer analysis and provides a comprehensive inventory of the entire skeleton. This detailed format is essential for paleopathological analysis. In general, it is seldom adequate to base the frequency of pathological observations on the total number of individuals present in a skeletal series. This approach, although perhaps ideal, is impractical because of the vagaries of skeletal preservation and recovery. While some skeletons may be well preserved and nearly complete, as are for instance most of the skeletons from the recently published Štrbinci series (Šlaus, 2002, in press), usually only partial skeletons are recovered. Given this variation in bone preservation and recovery, it is essential to list the elements present in any skeletal collection being investigated. Such a system enables precise bone counts by side including proximal and distal joint surfaces for all major long bones. In this manner when evaluating, for instance, arthritic changes in the distal humerus, it is possible to tabulate the number of complete and partial distal humeral epiphyses by side, sex and age.

All skeletal elements were, therefore, coded for their presence and completeness (i.e., complete or partial). A bone was scored as complete if more than 50% of the bone was preserved. As described, completeness does not reflect total bone preservation but identifies the number of elements that are nearly complete and can be scored for the presence or absence of pathological features.

Detailed dental inventories were also completed for each skeleton. All teeth were coded for their presence as: present, lost antemortem, lost postmortem, partially erupted or unerupted. The presence of carious lesions was noted and scored according to location as: occlusal, buccal, lingual, interproximal, or root (at the cementoenamel junction). The presence of alveolar abscesses was also scored when present.

Bone pathological features were scored using a hierarchical approach that coded lesions descriptively according to the predominant osteoclastic or osteoblastic response as: 1) bone loss, 2) bone increase, or 3) bone loss and bone increase. This general classification refers to the major changes possible in living bone. Following this determination, a second more precise designation was recorded using descriptors that defined the nature of the lesion. For example, pathologies identified as representing bone loss were classified within several subcategories, such as 1) bone loss owing to resorptive (lytic) lesion, 2) bone loss owing to porosity (pinpoint to coalesced), 3) bone loss owing to osteoporosis or osteopenia, or 4) bone loss caused by benign cortical defect. All lesions were further coded for: 1) severity (i.e., mild, moderate, severe), 2) state (i.e., active, healing), 3) extent of involvement (i.e., localized, widespread), and 4) specific location on the bone. Changes caused by degenerative bone disease were scored for presence, location and severity of hypertrophic bone formation (marginal, lipping, osteophytes), porosity, and eburnation (Ortner and Putschar, 1981; Steinbock, 1976).

Traumatic injuries (fractures) were coded separately using a similarly detailed descriptive computer coding format. Skull fractures involving the frontal, occipital, parietals, and temporals were coded for shape, presence of radiating fractures, size and presence of healing. Fractures involving the zygoma, maxillae, and mandible were coded for presence and state.

The inventory and pathology coding procedures used in this investigation are a modified version of those developed by Owsley (Owsley et al., 1987; Owsley et al., 1991).

While all pathological changes noted in the analyzed skeletal material are reported on, not all are summarized. The specific disease categories summarized for the Stenjevec skeletal series are: dental pathology - including caries and alveolar bone disease, subadult stress indicators - including dental enamel hypoplasia and cribra orbitalia, infectious disease - as evidenced by the presence of periostitis and osteomyelitis, trauma, and physical stress - including osteoarthritis on major joints and the spinal column, and the presence of Schmorl's depressions in vertebral bodies. These categories were chosen for two reasons. First, the pathological conditions comprising these categories are relatively common and leave relatively unambiguous traces in the skeleton. Second, when taken together, these categories create a composite profile of general health and quality of life.

Dental pathology data are tabulated for alveolar bone disease and caries. Dental caries is a complex infectious disease of the external surface of the tooth. Various bacteria, primarily Streptococcus spp., produce decalcifying acids, which, if left unchecked, cause dissolution of the enamel and dentin (Bhaskar, 1981). Physiological and possibly external environmental factors may be related to caries incidence (Hildebolt et al., 1988). In a study of lower Great Lakes populations Schneider (1986) reports that zinc, copper and iron when present in enamel have a cariostatic effect whereas nickel has a cariogenic effect. Results such as these suggest that diet may play a multifaceted role in the production of carious lesions. Alveolar bone disease is for the purpose of this report defined as the presence of periodontal or periapical abscesses and antemortem tooth loss.

Dental enamel hypoplasia or chronological aplasia is generally defined as any macroscopic defect in the enamel surface (Pindborg, 1970, Sarnat and Schour, 1941, 1942). Hypoplastic defects can range from minor depressions in the enamel surface, with no dentin exposure, to a complete disruption of the enamel. These defects appear as bandlike depressions (linear enamel hypoplasia) or as pits. They result from a disturbance of the enamel development in the growing deciduous or permanent tooth bud (phase of amelogenesis). The causes of the hypoplastic defects are commonly attributed to a variety of factors including physiological stresses such as malnutrition, infectious disease, psychological or physical trauma, or other metabolic disruptions (Goodman et al., 1980; Goodman and Rose, 1991; Kreshover, 1960). Hypoplasias remain visible until the affected enamel is worn away through dental attrition, providing a nearly permanent record of developmental arrest during infancy and early childhood. While the development of enamel hypoplastic defects cannot be attributed to a specific disease or episode in the life of a deceased individual, studies of living children document the association between higher frequencies of hypoplastic defects and poor nutrition and low socioeconomic status (Goodman et al., 1991, 1992).

Data on enamel hypoplasias were collected on the permanent maxillary central incisors and canines, and on the permanent mandibular canines. The selection of these tooth categories for study was dictated by the following considerations: 1) central incisors and canines are considered to be more susceptible to stress than other teeth (Goodman and Armelagos, 1985; Goodman and Rose, 1990); 2) canines have a long developmental period, from around four months to 6 years (Gustafson and Koch, 1974); and 3) incisors and canines in general display a relatively small amount of dental calculus which obscures enamel in other teeth. Only macroscopic, linear enamel defects - transverse grooves or rows of pits on the crown surface - are counted in these data. Other enamel defects such as circular pits in deciduous dentition, hyperplastic defects, and zones of discoloration were observed in the dental remains, but are not treated in this study. Hypoplasia frequencies are tabulated by individual. Because some of the recovered individuals are poorly preserved and incomplete even in their dental remains, it can be argued that counting all teeth, instead of only one antimere per individual, may create a bias towards well preserved individuals as those with more teeth contribute more to the data set than those with only the right or left preserved. Therefore, to avoid any possibility of artificially altering frequencies, enamel hypoplasia data are presented by considering only one tooth from each tooth category per individual. Enamel defects were counted on teeth from the right side of the mouth, with teeth from the left side being substituted if the one on the right was missing.

Cribra orbitalia is recognized by the presence of sievelike lesions or pitting on the orbital roof. The etiology of this lesion is not fully established, and several diseases have been implicated (El-Najjar, 1976; Mensforth et al. 1978). Of these, iron deficiency anemia is the most often attributed cause (Stuart-Macadam, 1985).

Skeletal evidence for infectious disease was determined by the presence of periostitis and osteomyelitis. Periostitis involves inflammation of the periosteum as evidenced by the deposition of new bone on the outer surface of the affected element (Mann and Murphy, 1990; Ortner and Putschar, 1981, Steinbock, 1976). Osteomyelitis, which results from an acute or chronic infection , affects both the marrow and the bone cortex. Inflammation accompanies the infection and causes bone remodeling and expansion (thickening of the cortex), often with a draining sinus (Mann and Murphy, 1990; Ortner and Putschar, 1981, Steinbock, 1976). The primary causes of these conditions are difficult to determine. Especially in the case of periostitis, many factors (for example trauma, hematogenous infection originating in another part of the body, venous insufficiency, and scurvy) contribute to localized or widespread dissemination throughout the skeleton.

Skeletal evidence for trauma was determined by the presence of fractures, dislocations involving joints out of articulation or alignment as a result of force, and enthesophytes. The latter include bone spurs, heterotopic bone formations, and traumatic myositis ossificans. They form in response to torn ligaments or muscles, and other types of injury and biomechanical stress that result in calcification of inflamed tissue.

Several skeletal features were used to evaluate physical stress. These features are: degenerative osteoarthritis in major joints, vertebral degenerative changes, and the occurrence and frequency of Schmorl's depressions in vertebral bodies.

Degenerative osteoarthritis is characterized by the progressive formation of osteophytes around the edges of an articular joint surface. In advanced cases the normally smooth articular surface develops ossific nodules, porosis or eburnation. These changes are associated with the wear and tear of everyday activities and are distinguished from traumatic arthritis which is caused by disruption of the biomechanical functioning of a joint. Degenerative changes in spinal columns were assessed in the vertebral bodies (osteophytosis and osteoporosis of centra) and the articular surfaces of the posterior elements (osteoarthritis of facets).

Schmorl's depressions are lesions which result from herniation and displacement of intervertebral disc tissue into the adjacent vertebral body. The presence of Schmorl's depressions can be idiopathic, or related to a variety of reasons including among others certain diseases and congenital factors that produce a weakening of the subchondral bone and a disruption of the cartilaginous end-plate, and strong compression caused by traumatic injury. However, the most common cause of Schmorl's depressions according to Schmorl and Junghanns (1971) are degenerative changes associated with ordinary stress on the vertebral column.

Some of the described diseases, for instance dental disease and degenerative osteoarthritis, are age-dependent (i.e., increase with advanced age). Therefore, when tabulating the data, age was controlled by dividing the sample into two broad categories: young adults, defined as individuals aged between 16-35 years, and old adults, defined as individuals older than 36 years.

RESULTS

The age and sex distribution of the series is presented in Table 1. The total sample for analysis consists of 84 well preserved skeletons. Subadults comprise 32.1% of the total sample but are clearly underrepresented in the youngest (birth-1 year) age category (only 2 individuals or 2.4% of the total series). Subadult mortality in the series is highest from 6-10 years (37.1% of the subadult sample).

Males and females are evenly represented in the adult sample (29 and 28 individuals respectively). The average age at death of adults over 15 years is 33.6 years for females, and 36.0 years for males. This 2.4 years difference in average life-spans is reflected

TABLE 1: Age and sex distribution in the Stenjevec series

Age category	Subadult		Female		Male		Total	
	N[1]	%[2]	N	%	N	%	N	%
Birth -1	2	7.4					2	2.4
2-5	8	29.6					8	9.5
6-10	10	37.1					10	11.9
11-15	7	25.9					7	8.3
16-20			2	7.1	2	6.9	4	4.8
21-25			5	17.9	4	13.8	9	10.7
26-30			5	17.9	2	6.9	7	8.3
31-35			8	28.6	6	20.8	14	16.7
36-40			2	7.1	5	17.3	7	8.3
41-45			2	7.1	7	24.1	9	10.7
46-50			0		1	3.4	1	1.2
51-55			3	10.7	0		3	3.6
56-60			0		1	3.4	1	1.2
60+			1	3.6	1	3.4	2	2.4
Total	27	100.0	28	100.0	29	100.0	84	100.0
Mean age at death[3]			x =	33.61	x =	36.00		
			sd =	11.45	sd =	10.92		

[1] N = number of individuals dying.

[2] % = % of individuals dying.

[3] Mean age at death is calculated using median values of each age category (for example, 23 for the age category 21-25), and 65 for the age category 60+.

in differential mortality profiles for the sexes. While high mortality rates are recorded for both sexes in the 31 to 35 years age category (28.6% of the total female sample, and 20.8% of the male) highest female mortality is clearly between 21-35 years (64.4% of the total female subsample), while highest male mortality is between 31-45 years (62.2% of the total male subsample). Few individuals - 4 females or 14.3% of all females, and 2 males or 6.8% of all males in the series, lived to be older than 50 years. (17.4% compared to 9.3%). This difference is statistically significant (χ^2 =5.1, P< .03). The difference appears to be related to differences in the young adult age category where males exhibit a significantly higher frequency of carious lesions than females (15.1% compared to 6.0%, χ^2 =5.0, P< .03). Caries frequencies are, once again, very low in subadults (3.8%).

A four scale grading system was used to evaluate the severity of carious lesions: grade 1 - indicates a pit or slight fissure, grade 2 - more than a pit but less than half of the surface destroyed, grade 3 - more than half of the surface destroyed but not the complete crown, and grade 4 - complete destruction of the tooth crown. Applying this grading system to the Stenjevec skeletal series the modal category for severity of lesion in females is grade 2, in males grade 1. Carious lesions in females are most frequently located interproximally (in 10/25 or 40.0% of all carious lesions), followed by occlusal (9/25 or 36.0%), root (5/25 or 20.0%), and buccal (1/25 or

TABLE 2: Frequency of alveolar bone disease in the Stenjevec series

Age category	Subadult		Female		Male	
	A[1]/O[2]	%[3]	A/O	%	A/O	%
Young adult[4]			34/270	12.6	11/152	7.2
Old adult			28/111	25.2	56/239	23.4
Total	1/358	0.3	62/381	16.3	67/391	17.1

1 A = number of tooth sockets with periodontal or periapical abscess, or antemortem tooth loss.
2 O = number of tooth sockets observed.
3 % = % of tooth sockets with periodontal or periapical abscess, or antemortem tooth loss.
4 Young adult = individuals aged between 16 to 35 years; Old adult = individuals older than 36 years.

Frequencies of alveolar bone disease are summarized in Table 2. Alveolar bone disease is present in only one subadult tooth socket (0.3%). In adults the overall frequency is 16.7% (129/772) with an even total distribution between males and females (17.1% in males, compared to 16.3% in females). Similarities in the frequencies of alveolar bone disease are present in both the young adult and old adult age categories.

This is not true, however, for the distribution of carious lesions in the series (Table 3). Males exhibit a considerably higher total frequency than females

TABLE 3: Frequency of carious lesions in the Stenjevec

Age category	Subadult		Female		Male	
	A[1]/O[2]	%[3]	A/O	%	A/O	%
Young adult[4]			12/199	6.0	19/126	15.1
Old adult			13/70	18.6	24/121	19.8
Total	10/261	3.8	25/269	9.3	43/247	17.4

1 A = number of teeth with carious lesions.
2 O = number of teeth observed.
3 % = % of teeth with carious lesions.
4 Young adult = individuals aged between 16 to 35 years; Old adult = individuals older than 36 years.

4.0%) lesions. In males carious lesions are most frequently recorded on the root of the tooth (18/43 or 41.9%), followed by occlusal (13/43 or 30.2%), interproximal (10/43 or 23.2%), and buccal (2/43 or 4.6%) lesions. Most of the carious lesions recorded in subadults (7/10) are located interproximally, 2/10 are located on the root of the tooth, and one is located on the buccal surface.

TABLE 4: Hypoplasia frequencies by individual in the Stenjevec series

Tooth	N[1]	NwLEH	%wLEH
Maxillary I1[2]	24	16	66.7
Maxillary C	21	11	52.4
Mandibular C	32	19	59.4

[1] N = number of teeth observed; NwLEH = number of teeth with one or more LEH; %wLEH = % of N with one or more LEH.

[2] I = incisor; C = canine.

Enamel hypoplasia frequencies are high in the series, 46/77 (59.7%) of the analyzed teeth exhibit hypoplastic defects. Hypoplasias are most frequent in the maxillary central incisors - 66.7%, followed by mandibular canines - 59.4% and maxillary canines - 52.4% (Table 4).

Subadults are poorly represented in the series. The frequencies of hypoplastic defects are, however, very high in the assemblage (Table 5). Of the 17 subadult teeth available for analysis, 15 (88%) exhibit hypoplastic defects. The highest frequency is recorded in maxillary canines where all three recovered teeth exhibit deep hypoplastic defects. Hypoplasia frequencies are also high in adults. Slightly more than half (31/60 or 51.7%) of the analyzed teeth exhibit hypoplastic lines. The highest frequency in adults is recorded in maxillary central incisors (58.8%).

A breakdown of the adult sample by sex shows that adult males exhibit higher frequencies than females in all three tooth categories analyzed. The total frequency of hypoplastic defects in male teeth (20/32 or 62.5%) is almost twice as high as that recorded in females (11/28 or 39.3%). The difference is not, however, statistically significant.

Males also exhibit a higher mean number of hypoplasias per tooth (Table 6) than females. Two teeth categories in males (maxillary central incisors,

TABLE 5: Hypoplasia frequencies in the Stenjevec series for subadults and adults

Tooth	Subadults		All adults		Females		Males	
	Nw/N[1]	%wLEH[2]	Nw/N	%wLEH	Nw/N	%wLEH	Nw/N	%wLEH
Maxillary I1[3]	6/7	85.7	10/7	58.8	4/8	50.0	6/9	66.7
Maxillary C	3/3	100.0	8/18	44.4	2/8	25.0	6/10	60.0
Mandibular C	6/7	85.7	13/25	52.0	5/12	41.7	8/13	61.5

[1] Nw = number of individuals with one or more LEH; N = number of individuals observed.

[2] %wLEH = % of N with one or more LEH.

[3] I = incisors; C = canines.

TABLE 6: Mean number of hypoplasias in incisors and canines in the Stenjevec series

Tooth	Subadults			All adults			Females			Males		
	Mean	N	S.D.	Mean	N	S.D.	Mean	N	S.D.	Mean	N	S.D.
MaxillaryI1[1]	1.29	7	0.75	1	17	0.93	0.87	8	0.99	1.11	9	0.93
Maxillary C	1.33	3	0.57	0.61	18	0.78	0.37	8	0.74	0.8	10	0.79
Mandibular C	1.29	7	0.76	0.84	25	0.94	0.5	12	0.67	1.15	13	0.95

[1] I = incisors; C = canines.

and mandibular canines) exhibit a mean number of defects per tooth higher than 1.00. Such high values are not recorded in any of the female teeth categories. Even higher values are, however, recorded in subadult teeth. The mean number of defects per tooth in all three tooth categories analyzed in subadults is greater than 1.00. Subadults, also, consistently exhibit a higher mean number of defects per tooth than all adults in the three tooth categories.

Cribra orbitalia frequencies are summarized in Table 7. In the Stenjevec series the expression of this condition ranges from slight pitting to severe sieve-like lesions with considerable diplotic expansion.

Cribra orbitalia is observed in 22 of the 46 crania (47.8%) with intact orbits. The overall subadult frequency is 70.0% with the majority of lesions (10/14 or 71.4%) active at time of death. In adults the lesion has a frequency of 30.8% with all of the lesions exhibiting some degree of healing. No significant sex differences in healing lesion frequencies are noted.

Skeletal evidence for infectious disease is present in subadults and adults. Periostitis frequencies are high in subadults. More than half (15/27 or 55.5%) of the subadults in the sample exhibit at least one case of periostitis. Periostitis is recorded on the endocranial surfaces of the parietals and frontal bone in 2 individuals (2/23 subadults with preserved craniums), on the clavicle in one individual (1/11 subadults with preserved clavicles), humerus in one individual (1/19), radius in one individual (1/12), femur in one individual (1/19), tibia in 14 individuals (14/17), and fibula in 3 individuals (3/11).

In adults, skeletal evidence for infectious disease is seen in 4/28 (14.3%) females, and in 11/29 (37.9%) males. In females periostitis is recorded on the tibia in 4 individuals (4/22 females with recovered tibias), and on the fibula in one individual (1/16). In males, periostitis is recorded on the endocranial surface of the frontal and right parietal bone (healed and mild in expression) in a 16-20 year old male, on the femur in one individual (1/26), on the tibia in 11 individuals (11/25), and on the fibula in 4 individuals (4/18).

Skeletal evidence for healed fractures is present only in adults. Fractures are recorded in the cranium and postcranium. Cranial fractures are recorded in 2 males (2/14 males with preserved crania), and one female (1/13). All three fractures are well healed depression fractures located on the frontal bone. All have rounded margins and smooth floors. None penetrated the inner table of the skull and none show evidence of infection. Postcranial fractures are noted on the clavicle, in 1/21 (4.8%) males with preserved clavicles, humerus, in 1/25 (4.0%) males with preserved humerii, radius, in 1/21 (4.8%) females with preserved radii and 4/23 (17.4%) males, and ulna, in 1/23 (4.3%) females, and 4/23 (17.4%) males.

There is one possible case of postparalytic deformity in the series. The case is recorded in a 25-30 years old female recovered from grave number 138. Apart from the female, the grave contained the remains of a neonatal subadult, buried by the right side of the female. The deformity is located in the left leg. The left femur, tibia and fibula are lighter, and considerably more gracile than the ones on the

TABLE 7: Frequency of occurrence of cribra orbitalia in the Stenjevec series

Age/sex	Cribra orbitalia			Active lesions	
	O[1]	A1[2]	%	A2[3]	% of A1
0 - 0.9	2	1	50.0	1	100.0
1 - 3.9	6	3	50.0	2	66.7
4 - 9.9	11	9	81.8	7	77.8
10 - 14.9	1	1	100.0	0	0.0
All subadults	20	14	70.0	10	71.4
Adult females	12	4	33.3	0	0.0
Adult males	14	4	28.6	0	0.0
All adults	26	8	30.8	0	0.0

[1] O = number of frontal bones observed.

[2] A1 = number of frontal bones in which at least one orbit shows evidence of cribra orbitalia.

[3] A2 = number of frontal bones in which cribra orbitalia is active at time of death.

right side. The bones from the left side are slightly damaged preventing accurate length measurements, but there appear to be no significant differences in the lengths of the bones. The primary differences are present in the sagittal diameters. The sagittal diameters in the subtrochanteric regions of the femurs are 24 mm on the right, and 18 mm on the left. The sagittal diameter at midshaft is 28.5 mm on the right, and 17.5 mm on the left femur. This is slightly compensated by a somewhat larger transverse midshaft diameter on the left side (27.5 mm compared to 25 mm on the right). The circumference at the midshaft of the right femur is 83 mm, compared to 74 mm on the left. The same pattern is observed on the tibia (maximum diameter at nutritium foramen on right side is 33.5 mm, on left 20 mm, circumference at nutritium foramen is 89 mm on right compared to 57.5 mm on left side), and on the fibula (maximum diameter on right side is 17 mm, compared to 15 mm on left side). The left innominate is not preserved. The observed changes are consistent with some type of post-adolescent neuromuscular paralysis.

A possible case of slipped femoral capital epiphysis is present in the right femur of a young adult female. This individual, aged between 17-20 years, exhibits a flattened femoral head, much greater in diameter than the left, with a poorly defined fovea capitis. The maximum length of the right femur is 12 mm shorter than that of the left (420 mm compared to 432 mm), but this is misleading due to the inferior displacement of the right femoral head. The right diaphysis shows a slight degree of anteroposterior flattening (sagittal diameter on right side is 23 mm, on left 25 mm, circumference at midshaft is 75 mm on right side, 80 mm on left), which may have been caused by the abnormal gait induced by the defective femoral head. The right femoral head is displaced inferiorly. It's maximum diameter is 47 mm, compared to 42 mm on the left side. The right femoral neck is considerably shorter and thicker than the left. There is no porosity on either the right femoral head or acetabulum. The right acetabulum does, however, appear to be slightly shallower, and more elongated, than the left.

Enthesophytes are recorded mostly in males and are present in one individual on the left humerus, in one individual on the right femurs, in 5 individuals on the right fibulae, and in 3 individuals on the calcaneus. In females enthesophytes are recorded in 8 individuals, in 2 cases on the distal fibula, and in 6 on the calcaneus.

Spondylolysis is present in the fifth lumbar vertebra of one male (in 1/21 or 4.8% of males with complete lumbar spines). No cases are noted in the female sample.

Osteoarthritis frequencies in the series are summarized in Table 8. Of the four major joints in the skeleton, osteoarthritis is in both sexes most frequently recorded in the knee. In females this is followed by the shoulder, elbow and hip, and in males by the elbow, shoulder and hip. Osteoarthritis frequencies are similar between males and females and more common in the old adult than the young adult age group.

The overall frequency of vertebral osteoarthritis in the series is 16.5% (125/756). The different re-

TABLE 8: Frequency of occurrence of osteoarthritis at major joints in the Stenjevec series

		Shoulder		Elbow		Hip		Knee	
		A[1]/O[2]	%	A/O	%	A/O	%	A/O	%
Female	Young adult[3]	6/15	40.0	3/16	18.7	0/18	0.0	6/16	37.5
	Old adult	3/6	50.0	6/7	85.7	3/7	42.8	5/7	71.4
	Total	9/21	42.9	9/23	39.1	3/25	12.0	11/13	47.8
Male	Young adult	2/11	18.2	4/12	33.3	0/14	0.0	5/13	38.5
	Old adult	9/12	75.0	9/14	64.3	4/12	33.3	11/13	84.6
	Total	11/23	47.8	13/26	50.0	4/26	15.4	16/26	61.5

1 A = number of joints affected with osteoarthritis. Osteoarthritis was scored as present if at least one joint element showed evidence of osteoarthritic change.

2 O = number of joints observed. A joint was scored as present if at least one joint element was completely present, or if two or three elements were partially present.

3 Young adult = individuals aged between 16 to 35 years; Old adult = individuals older than 36 years.

gions of the spine show similar frequencies of osteoarthritis (Table 9). Greatest involvement occurs in the lumbar region (39/208 or 18.7%), followed by the cervical (18/150 or 18.0%) and thoracic (59/398 or 14.8%) regions. No sex differences are present in the total, and young adult age categories, but females older than 36 years exhibit significantly higher total frequencies of vertebral osteoarthritis than males (50.6% compared to 26.0%, χ^2 = 6.44; P < .02). This, statistically significant, difference appears to be primarily related to higher female frequencies of vertebral osteoarthritis in the thoracic spine (20.7% compared to 9.5%), a difference which is also statistically significant (χ^2 =6.58; P < .02).

The frequencies of Schmorl's depressions in the series are summarized in Table 10. The overall frequency of Schmorl's depressions in the sample is 20.0% (121/606). Frequencies of Schmorl's depressions in the thoracic and lumbar spine are similar (19.8% in the thoracic, and 20.2% in the lumbar spine). The total male frequency (23.6%) is higher than that recorded in females (15.7%). This difference is marginally not significant (χ^2 =3.56; P < .06).

TABLE 9: Frequency of occurrence of vertebral osteoarthritis in the Stenjevec series

		Cervical		**Thoracic**		**Lumbar**		**Total**	
		A[1]/O[2]	**%**	**A/O**	**%**	**A/O**	**%**	**A/O**	**%**
Female	Young adult[3]	4/57	7.0	16/147	10.9	6/75	8.0	26/279	9.3
	Old adult	8/19	42.1	23/41	56.1	8/17	47.1	39/77	50.6
	Total	12/76	15.8	39/188	20.7	14/92	15.2	65/356	18.2
Male	Young adult	0/31	0.0	1/115	0.9	8/58	13.8	9/204	4.4
	Old adult	15/43	34.9	19/95	20.0	17/58	29.3	51/196	26.0
	Total	15/74	20.3	20/210	9.5	25/116	21.5	60/400	15.0

1 A = number of vertebrae affected with osteoarthritis or osteophytosis.
2 O = number of vertebrae observed.
3 Young adult = individuals aged between 16 to 35 years; Old adult = individuals older than 36 years.

TABLE 10: Frequency of occurrence of Schmorl's depressions in the Stenjevec series

		Thoracic		**Lumbar**		**Total**	
		A[1]/O[2]	**%**	**A/O**	**%**	**A/O**	**%**
Female	Young adult[3]	24/147	16.3	12/75	16.0	36/222	16.2
	Old adult	5/41	12.2	3/17	17.6	8/58	13.8
	Total	29/188	15.4	15/92	16.3	44/280	15.7
Male	Young adult	25/115	21.7	16/58	27.6	41/173	23.7
	Old adult	25/95	26.3	11/58	19.0	36/153	23.5
	Total	50/210	23.8	27/116	23.3	77/326	23.6

1 A = number of vertebrae with Schmorl's depressions.
2 O = number of vertebrae observed.
3 Young adult = individuals aged between 16 to 35 years; Old adult = individuals older than 36 years.

DISCUSSION

Analysis of the skeletal series from Stenjevec and comparisons with published data and other ongoing studies help expand our understanding of the biological history of the inhabitants of continental Croatia. The accumulation of osteological data from skeletal collections is an important step, not only for evaluating conclusions from historical, archaeological and economic sources, but also for expanding empirical evidence not available through these sources. Although of marginally significant size for statistical analysis, the data represented above represent the most skeletal evidence currently available from a single series from this time period. Conclusions and interpretations derived from this sample are open to revision when larger and better documented series become available.

Longevity and mortality are important measures of the life context of any group. The Stenjevec series is comprised of 27 subadults and 57 adults. The youngest individuals are aged from birth to 0.5 years, while the oldest age category represented in the series is 60+ years. The sample of adults (15 years and older) includes 28 females and 29 males.

As already stated, despite the relatively high percentage of subadult burials in the series (32.1% of the total sample), subadults are clearly underrepresented in the youngest (birth-1 year) age category where subadult mortality is typically highest. In the Stenjevec series only 2 individuals or 2.4% of the total sample died in this age category. To put this into perspective, when skeletal preservation allows recovery of complete series, as is for instance the case in the Retz-Gajary culture urn cemetery from Krog in Slovenia, analyses have shown that 32/113 individuals (or 28.5% of the total sample) died during the first two years of life (Šlaus, technical report 45-10/00, available at the Croatian Academy of Sciences and Arts).

Subadult underrepresentation is, however, by no means specific only to continental Croatia. The underrepresentation of infants in cemetery samples is a ubiquitous problem. Contributing factors include possible differential burial customs for infants and stillborns, and differential burial depths for subadults and adults. Graves dug for adults were, as a rule, deeper than those of children and thus more likely to remain undisturbed. There is some evidence that that this practice is present in continental Croatia (Jakovljević, personal communication;), and it has been documented in neighboring Hungary in medieval cemeteries from Alattyan-Tulat and Kerpuszta (Acsádi and Nemeskéri, 1970). Whatever the reasons, the biased exclusion of subadult individuals in both medieval composite series compromises analyses of subadult mortality trends and precludes meaningful consideration of longevity, survivorship, and life expectancy from birth.

The average age at death of adults over 15 years (males - 36.0; females - 33.6) is lower than the mean ages recorded in Late antique populations from Croatia and Central Europe. For instance, in the Late antique population from Štrbinci (4th century) males lived on average 39.3 years, females 35.5 years (Šlaus, 2002, in press). In the Linz cemetery in Austria, dated from the 4th to the 5th century, average age at death for adult males and females is 47.8 and 47.4 years respectively (Wiltschke-Schrotta and Teschler-Nicola, 1991), in the Hungarian Tokod series also dated from the 4th to the 5th century, adult males lived on average 46.7 and adult females 44.7 years (Ery, 1981), and in the small Late Antique “Ad Basilicas Pictas” skeletal series from Split males lived on average 41.0 years and females 37.5 years (Šlaus, 1999). Higher mean ages at death are also recorded in the Early medieval Avaroslav population from Stari Jankovci - 37.4 for males, and 40.3 for females (Šlaus, 1996a).

More similar values are recorded in the Late medieval Danilo series - 37.2 years for males and 31.5 years for females (Šlaus, 1996a), and in the Late medieval Đakovo phase I series, males - 35.4 years, females - 34.9 years (Šlaus and Filipec, 1998).

Of interest are the sex differences in mean ages at death in the Stenjevec series and the differential mortality patterns recorded for males and females. As previously stated, greatest female mortality in the series is from 21-35 years, greatest male mortality from 31-45 years. In theory, this difference in sex-related mortality could be attributed to complications in pregnancy and childbirth, an assumption which is supported by analysis of burial configuration. In cases of multiple interments within graves, the only consistent pattern noted in continental Croatia involves the pairing of infants with adult females. Unfortunately, antepartum complications such as toxemia and premature rupture of membranes, and postpartum complications such as hemorrhage, hypertensive disorders, and puerperal sepsis, do not affect the skeleton, precluding this hypothesis from being tested on skeletal collections. The only evidence for childbirth-related deaths that can be seen in skeletal material is the presence of fetal remains in the abdomino-pelvic cavity of an adult female. Such events are, however, rarely documented in an archaeological context on a worldwide basis (Acsádi and Nemeskéri, 1970; Owsley and Bradtmiller, 1983) and are absent in the Stenjevec series. These incidents, furthermore do not reflect female deaths during the puerperal period, as well as the long-term effects of suboptimal health caused by maternal depletion, where female health is comprised due to repeated episodes of pregnancy and lactation. The role of these factors in developing differential male/female mortality profiles needs further investigation through comparative analyses of mortality distributions through time and across different geographical regions.

Differential stress levels are also noted in the frequencies of carious lesions. Males in the sample exhibit significantly higher frequencies than females. There is also a noticeable difference in the distribution of lesions. Female lesions are most frequently located interproximally while male lesions are most often recorded on the root of the tooth.

Significant sex differences in frequencies of carious lesions are sometimes recorded in archaeological populations. When higher frequencies are recorded in females this is generally explained by one of three factors: 1) earlier eruption of teeth in girls and consequently, longer exposure of girl's teeth to the cariogenic oral environment, 2) easier access to food supplies by women during food preparation, and 3) the effects of hormonal fluctuations and pregnancy. In the Stenjevec series, however, higher frequencies are recorded in males. As males in the series live on average 2.4 years longer than females, the higher frequency of carious lesions could in theory simple reflect a longer average male life span. However, analysis controlling for age indicate that old adult carious frequencies are similar in males and females while significant differences are present in the young adult age category. Together with the differential distribution of carious lesion in male and female teeth this is tentatively indicative of differences in dietary practices or food preparation, or the result of some, as yet unidentified, cultural factors. Further systematic analyses of dental disease in other Late medieval populations from continental Croatia are necessary to evaluate if the observed differences in male/female frequencies of carious lesions are the result of random variation in a small sample, or the result of specific, as yet unidentified, factors.

The frequencies of subadult stress indicators: enamel hypoplasia and cribra orbitalia are high in the series. Enamel hypoplasia frequencies - 88.2% in subadults, and 51.6% in adults, are similar to those recorded in the Late antique Štrbinci series - 77.7% for subadults, and 59.2% for adults (Šlaus, 2002, in press). Cribra orbitalia frequencies are, however, considerably higher. In Stenjevec cribra orbitalia is recorded in 70.0% of subadult, 33.3% of female and 28.6% of male crania. In Štrbinci cribra orbitalia is recorded in 50.0% of subadult, and 22.2% of male crania. No cases (0/5) are recorded in females. Lower frequencies of cribra orbitalia are also recorded in the Early medieval series from Privlaka - 46.6% in subadults, 19.3% in females and 25.4% in males (Šlaus, 1996b), as well as in the Late medieval series from Danilo - 41.6% in subadults, 18.2% in females, and 18.2% in males (Šlaus, 1996a).

Subadults in the Stenjevec skeletal series consistently exhibit higher frequencies of enamel hypoplasia than adults. Furthermore, not only do adults have a lower incidence of hypoplasia, they also have a smaller number of defects in the teeth affected than individuals who died as children. Adults older than 36 years also tend to have lower frequencies of hypoplasia than adults who died before 35 years. These data are consistent with the pattern recorded in other skeletal series (Cook and Buikstra, 1979; Duray, 1996; Goodman and Armelagos, 1988, 1989; Rose et al, 1978; Simpson et al. 1990; Stodder, 1997; White, 1978), and strongly suggest that hypoplasias are related to age at death in the archaeological series from Stenjevec.

The same pattern of subadult and adult involvement is noted in cribra orbitalia frequencies. Adult frequencies: 33.3% in females, and 28.6% in males, are considerably lower than the 70.0% frequency recorded in subadults. This is consistent with the pattern recorded in other skeletal series (Cybulski, 1977; El-Najjar et al., 1976; Hengen, 1971; Mittler and Van Gerven, 1994, Stuart-Macadam, 1985; Walker, 1985). The implication of the age association is further supported by differentiating active from healed lesions. In the Stenjevec skeletal series the frequency of active lesions is highest in the three youngest (0-0.9, 1-3.9, and 4-9.9 years) age categories. Together, these data support Stuart-Macadam's (1985) assertion that cribra orbitalia represents a childhood condition.

Subadults in Stenjevec also experienced higher frequencies of infectious disease than adults as evidenced by higher frequencies of periostitis. The higher susceptibility to infectious disease noted in subadults may be related to greater iron deficiency as indicated by the higher frequencies of cribra orbitalia in subadults. There is evidence that iron deficiency can contribute to decreased immunocompetence and a corresponding increased susceptibility to infectious disease (Basta et al., 1979; Bhaskaram, 1988; Sherman, 1984). Individuals who died as subadults also experienced greater level of subadult stress as seen in the higher frequencies of enamel hypoplasia recorded in subadults. It is therefore probable that the synergism of physiological stressors and impaired immune function increased susceptibility to infectious disease in subadults.

Adult periostitis frequencies are also high. For instance, in the Štrbinci skeletal series 3/31 (9.7%) adult tibiae exhibit periostitis. In Stenjevec the frequency is much higher - 30/94 (31.9%) preserved adult tibiae exhibit skeletal evidence of infectious disease.

Trauma frequencies are also high in the Stenejvac series. No cases are noted in subadults, but adults exhibit both cranial and postcranial fractures. Of particular interest are the high frequencies of defensive "parry" fractures to the midshaft of the ulna. These fractures occur when an individual covers his face or head with his arm in an attempt to protect them from an assailant. In the Stenjevec skeletal series this type of trauma is noted in 4.3% (1/23) of females, and 17.4% (4/23) of males. No such fractures are recorded in the Štrbinci series (Šlaus, 2002, in press) and only 1/63 (1.6%) females and 2/67 (2.9%) males from the Early medieval Privlaka series exhibit this type of trauma (Šlaus, 1996b).

The frequencies of joint and vertebral osteoarthritis are considerably higher than frequencies recorded in Štrbinci, and similar to those recorded in Privlaka. A general observation for the Stenjevec series is that males appear to be under greater physical stress than females, and that old adults uniformly exhibit higher frequencies of joint and vertebral osteoarthritis than young adults. The high frequencies of Schmorl's depressions is consistent with heavy physical strain on the vertebral column. Due to the nonspecific nature of this stress indicator etiological determinations of specific activities are inappropriate. What is, however, clear from the skeletal data is that males in the analyzed sample have considerably higher frequencies of Schmorl's depressions than females, indicating differential male/female activity patterns.

CONCLUSION

Skeletal collections are, like historical documents, and artifacts recovered from archaeological sites, a record of the past and must be studied if that past is to be understood. The accomplishments of past researchers are numerous but there is still much that we do not know and, more important, data that can be inferred only by bioarchaeological research. Future investigations of newly recovered and existing museum collections are therefore necessary. These investigations must take full advantage of recent technological advances, including DNA analyses, and more sophisticated research designs. Archaeological institutions must insure that bioarchaeological research is an integral part of any project dealing with recovered human skeletal remains, including cremated remains, and that the completed analysis is of high quality. Once this is recognized, and adequate funding for this type of research is made available, bioarchaeological data will become a primary source for elucidating the lives of the past inhabitants of Croatia.

Examination of the Stenjevec skeletal series provides a rare opportunity to address questions concerning health, disease, and lifeways in medieval continental Croatia. There is little comparable bioarchaeological information from this region and time period. Hence, the biological and pathological information collected from Stenjevec provides an important data base for future osteological research. Analysis of the Stenjevec skeletal series and comparisons with late antique and early medieval series show that there are significant temporal differences in the frequencies of cribra orbitalia, infectious disease and trauma that indicate higher stress in the developed medieval period. This stress may have affected mortality as evidenced by greater subadult mortality and shorter adult average life-spans in the late medieval series. Multivariate craniometric analyses (Šlaus, 2000) show that this coincides with a northward expansion of Early medieval Croat populations from the eastern coast of the Adriatic into modern Bosnia and Herzegovina and continental Croatia. Data collected from the Stenjevec series suggests that this expansion led to a deterioration of living conditions during the Developed medieval period. Continued research of skeletal series from continental Croatia is necessary to see if data from these collections confirm this correlation.

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ABBREVIATIONS FOR JOURNALS CITED

Am. Anthropol.	- American Anthropologist
Am. J. Clin. Nutr.	- American Journal of Clinical Nutrition
Am. J. Phys. Anthropol.	- Americam Journal of Physical-Anthropology
Ann. N.Y. Acad. Sci.	- Annales of the New York Academy of Science
ARR	- Arheološki radovi i rasprave
CMJ	- Croatian Medical Journal
Hum. Biol.	- Human Biology
Hum. Evol.	- Human Evolution
J. Amer. Dent. Assoc.	- Jornal of the American Dental Association
J. Dent. Res.	- Journal of Dental Research
J. Forensic Sci.	- Journal of Forensic Sciences
Med. Anthropol.	- Medical Anthropology
Odont. Rev.	- Odontological Review
Opusc. Archaeol.	- Opuscula Archaeologica
Pril. Inst. arheol.	- Prilozi Instituta za arheologiju u Zagrebu
SHP	- Starohrvatska prosvjeta
VAMZ	- Vjesnik Arheološkog muzeja u Zagrebu
World Archaeol.	- World Archaeology
Yearbook Phys. Anthropol.	- Yearbook of Physical Anthropology

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SAŽETAK

PALEODEMOGRAFSKA I PALEOPATOLOŠKA ANALIZA SREDNJOVJEKOVNE POPULACIJE IZ STENJEVCA

Ključne riječi: demografija, cribra orbitalia, hipoplazija zubne cakline, zarazne bolesti, trauma, srednji vijek, Hrvatska.

U radu su prikazani rezultati paleodemografskih i paleopatoloških analiza provedenih na 84 kostura sa srednjovjekovnog nalazišta Stenjevec (10.-12. stoljeće). Rezultati analiza pokazuju visoki mortalitet djece usprkos očite podzastupljenosti najmlađe dobne kategorije. Kod odraslih osoba (osoba starijih od 15 godina) najveća stopa smrtnosti kod žena je između 21-35 godina života, kod muškaraca između 31-45 godina. Učestalosti koštanih pokazatelja dječjeg stresa: hipoplazije zubne cakline i cribra orbitaliae visoke su u analiziranom uzorku. Hipoplazija zubne cakline prisutna je u 88.0% dječjih i 51.7% odraslih zubiju. Cribra orbitalia evidentirana je u 70.0% dječjih i 30.8% odraslih lubanja. Koštani pokazatelji zaraznih bolesti i trauma također su visoki. Spolne razlike u učestalostima zubnih karijesa, osteoartritisa i Schmorlovih lezija ukazuju na moguće razlike u načinu prehrane ili dostupnosti hrane i različitim muško/ženskim stupnjevima fizičkog opterećenja.

Usporedbe s drugim kasnoantičkim i ranosrednjovjekovnim nalazištima iz kontinentalne Hrvatske pokazuju razlike u učestalostima cribra orbitaliae, zaraznih bolesti i trauma, koje sugeriraju veći stres tijekom razvijenog srednjeg vijeka. Multivarijatne kraniometrijske analize arheoloških populacija središnje Europe (Šlaus, 2000) pokazale su da u tom razdoblju dolazi do ekspanzije ranosrednjovjekovnih hrvatskih populacija, iz njihovih uporišta na istočnoj obali Jadrana i u njegovu neposrednom zaleđu, prema sjeveru, na teritorij moderne Bosne i Hercegovine i u kontinentalnu Hrvatsku. Rezultati paleodemografskih i paleopatoloških analiza uzorka iz Stenjevca sugeriraju da je ova ekspanzija negativno utjecala na kvalitetu života u kontinentalnoj Hrvatskoj. Buduća istraživanja srednjovjekovnih populacija iz kontinentalne Hrvatske nužna su da bi se ova korelacija potvrdila.