Coll. Antropol. **33** (2009) 4: 1387–1395
Professional paper

Dental Status of Victims from Batajnica's Mass Graves

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A B S T R A C T

The aim of this paper is to present the post mortem dental evidence and dental health of the victims interred during 1999 in five grave pits at Batajnica near Belgrade. The investigated sample comprised 32 individuals with only maxillae preserved, 80 with mandible, and 260 individuals with both jaws. We have found high degree of enamel hypoplasia (25.89%), frequent signs of the severe forms of periodontal disease (18.55%), very high percent of antemortem tooth loss (31.48%), and evidence of edentate jaws in an early age of individuals. Amalgam was predominant material for tooth fillings; implants and non-metal ceramic crowns were not found, and three quaters of edentate individuals were found with full prostetic dentures. Despite the detailed postmortem dental analysis, antemortem dental charts were not collected. These individuals were identified by other forensic methods.

Key words: *forensic science, forensic anthropology, mass-graves, dental health, tooth restorations*

Introduction

The role of dental anthropological analysis in the identification process is important not only as an additional method, but as the only possible method of human identification in the cases where teeth and jaws are the only preserved parts of the body[1]. In addition, increasing numbers of tooth restorations present on skeletal remains increases the accuracy. Restorative materials usually survive in the soil and even when exposed to high temperature. Thus they become a potential source of identification[2]. Types of materials, shape, and number of false teeth or type of denture retention can give very important information about dental characteristics that are unique to each individual[1]. Moreover, considering the large number of individuals in mass fatalities and the budget constraints, dental information can provide the data that narrows the investigation process making it simpler and more accessible. However, human remains are often exhumed with missing teeth. The frequency of postmortem tooth loss is influenced by the length of the postmortem interval, decomposition of the soft tissue, alveolar bone loss due to periodontal diseases, and postmortem handling of the bodies[3].

In 2001 and 2002 the Laboratory for Anthropology participated in the exhumation and identification of Kosovar Albanians interred during 1999 in five grave pits at Batajnica, a suburb of Belgrade. Anthropological analysis was performed by medically trained forensic anthropologists, and panoramic radiography by a maxillofacial radiologist. In this study we used anthropological data and radiology reports to analyze the dental status of victims buried in four pits in Batajnica. The aim of this paper is to present the post mortem dental evidence and dental health of the victims. In the previos study[3], we analysed factors affecting antemortem and postmortem tooth loss using the sample from the same mass-graves, so these items are not disscussed in this report.

Material and Methods

For the analysis we selected adult skeletons with at least a complete mandible, and/or maxillae. There were 32 individuals with only maxillae, 80 with only mandible and 260 individuals with both jaws preserved. The entire sample consisted of males (353) and 13 females. For 6 individuals it was not possible to determine sex due to fragmentary skeletal material.

Sex determination was based on dimorphic features of the os coxae[4]. Age assessment of adults was based on the Suchey-Brooks (1990)[5] age scheme, but final estima-

Received for publication March 23, 2007

tion included also Işcan's method (1984)[6], suture closure, dental wear and degenerative changes of skeletons. Individual skeletons were distributed into Suchey-Brooks (SB) age categories, which for males are as follows: I (18.5±2.1 years), II (23.4±3.6 years), III (28.7±6.5 years), IV (35.2±9.4 years), V (45.6±10.4 years), and VI (61.2±12.2 years). Male and female samples were combined because of small number of females.

Data from anthropological records were obtained by macroscopic observation and included information on antemortem and postmortem tooth loss, presence of periodontal and dental diseases, developmental anomalies, tooth fillings and type of prosthodontics.

The presence of dental caries was scored using modified Metress & Convay method (1975)[7] taking into consideration the size of the lesion and its location on the tooth:

a) no evidence of caries
b) caries on tooth crown:
   1st grade – initial caries lesion
   2nd grade – caries which destroyed less than fifty per cent of tooth crown
   3rd grade – caries which destroyed more than fifty per cent of tooth crown
   4th grade – caries which destroyed the whole tooth crown
c) cervical caries or root caries.

The formation of supragingival calculus on lingual surfaces of mandibular incisors and buccal surfaces of molars was initially scored by using a simple three-point system[8]. The cases were distributed into certain category according to the most prominent finding:

0 – teeth with no visible calculus
1st grade – teeth with slight calculus
2nd grade – teeth with medium calculus
3rd grade – teeth with considerable calculus.

However, detailed analysis and reexamination of some cases showed that distinguishing between categories 0 and 1 was not precise enough due to post-mortem tooth loss and insufficient cleaning of teeth. Therefore, in further analysis we reduced scoring system into two categories: teeth with no visible or slight calculus, and teeth with medium or considerable calculus. In addition, analyses of calculus deposits excluded jaws which became edentate due to different reasons (antemortem tooth loss (AMTL), postmortem tooth loss (PMTL), hypodontia and impaction).

Hypoplastic enamel lesions were observed on incisors, canines and first premolars. The type of scoring was as follows[9]:

1st stage – no signs of linear enamel hypoplasia
2nd stage – one hypoplastic line present
3rd stage – two or more hypoplastic lines present

For the purpose of this study groups of 2nd and 3rd stage of enamel hypoplasia were combined because of the small number of individuals scored as 2nd stage (two individuals). Thus, the whole sample was divided into two groups: individuals with evidence of linear enamel hypoplasia, and individuals without signs of hypoplasia.

Occlusal dental wear was scored after Gustafson (1950)[10] by dividing cases into four categories:

1 – no attrition,
2 – attrition within enamel,
3 – attrition reaching dentin, and
4 – attrition reaching pulp.

Scoring of tooth fillings included their size (number of involved surfaces) and material used for its construction.

Panoramic radiographs were performed on 111 maxillas and 131 mandibles. Criterion for taking radiographs was the presence of any prosthodontic appliances, restorative dentistry, and un-erupted teeth, i.e. assumption that individuals have visited dentist.

In the scoring of periodontal diseases macroscopic examination was used for assessment of root exposure (distance between cemento-enamel junction and alveolar crest), pitting of the alveolar bone, presence of infrabony pockets, and tooth mobility. Analysis of periodontal disease excluded un-aged individuals[5], edentates (32) and the group of individuals where estimation of periodontal disease wasn't possible (114) due to damage of alveolar bone. Radiological assessment of periodontal diseases (in the cases where radiography was done) was based on alveolar bone changes that occur in periodontitis: crestal irregularities, triangulation, reduction of height of interseptal alveolar bone, areas of alveolar bone loss and different types of infrabony pockets[11]. Based on radiological and macroscopic criteria, all cases were divided into three categories[3]:

I – no macroscopic and radiological manifestation of periodontal disease, or presence of early signs of periodontal disease;
II – moderate periodontal disease;
III – severe periodontal disease.

Radiographs were also used to assess endodontic treatments, periapical lesions (abscess, granulomas and cysts), residual roots, and to distinguish between missing and unerupted teeth.

The presence of prosthodontic appliances included recording of different dental restorations:

– Complete denture
– Acrylic partial denture
– Skeleton denture (Frame work)
– Complete crown
– Full veneer crown
– Esthetic crowns (metal with ceramic and metal with acrylic crowns)

Statistical analyses comprised: χ^2-test, Pearson Correlation, Mann-Whitney U and Cramer's V-Test. Furthermore, in analyses of distribution of caries among age

groups we applied Kolmogorov-Smirnov Test which indicated non-parametric ANOVA – Kruskal-Wallis Test.

Results

The frequencies of antemortem (AMTL) and postmortem tooth loss (PMTL) in the investigated sample are shown on Table 1, demonstrating that approximately one third of the teeth were missing prior to death.

Analysis of distribution of signs of periodontal disease (Table 2) demonstrated an increase in frequency with advanced age (χ^2=85.589, p<0.01; Cramer's V=0.622, p<0.01). Furthermore, significant correlation have been demonstrated between age category and grade of periodontal disease (χ^2=97.244, p<0.01; Cramer's V=0.469, p<0.01).

Dental caries mainly affected first (27.93%) and second (21.72%) mandibular molars, followed by first maxillar molar (20.57%). While, caries at least involved lower incisors (about 1%). However, the sum of caries lesions was almost equally distributed in both jaws. Frequencies of caries in different age groups are presented in Table 3, showing significant differences between age categories (Kruskal-Wallis test χ^2=14.290, p<0.05; Mann-Whitney U Z=–1.285, p>0.05), i.e. fourth age group was the most affected by caries. In further analyses caries showed significant correlation to tooth fillings (Pearson Correlation 0.244, p<0.01).

Through the analyses of all present teeth amalgam tooth fillings (particularly those involving one or two tooth surfaces) were the most frequent when compared to composite resin, and temporary fillings (Table 4). Distribution of tooth fillings in different teeth groups demonstrated highest involvement of the first and second maxillar (22.34% and 16.37%) and mandibular (26.13% and 18.77%) molars. In addition, tooth fillings were not observed at lower incisors.

Table 5 demonstrated that about 8% of jaws were affected by medium or considerable calculus deposits. In addition, our results showed that calculus was more often in the mandible (χ^2=34.424, p<0.01; Cramer's V=0.388, p<0.01) than in the maxilla.

Frequency of tooth wear in different age groups of investigated sample is presented on Table 6. Starting from the 4th age category, nearly one-fifth of the jaws (18.8%) demonstrated advanced forms (3rd and 4th grade) of tooth wear. Statistical analysis showed significant association between estimated age and frequency of tooth wear in both, the maxilla (χ^2=38.419, p<0.01; Cramer's V=0.388, p<0.01) and mandible (χ^2=36.948, p<0.01; Cramer's

TABLE 1
FREQUENCIES OF AMTL AND PMTL IN INVESTIGATED SAMPLE

Jaw	AMTL[1]		PMTL[2]		Hypodontia		Impacted		Present		Total
	n[3]	%	n	%	n	%	n	%	n	%	
Maxilla	1449	31.36	560	17.66	46	0.98	6	0.13	2611	55.89	4672
Mandible	1699	31.58	614	16.68	59	1.08	1	0.02	3067	56.38	5440
Total	3148	31.48	1174	17.13	105	1.04	7	0.07	5678	56.15	10112

[1] AMTL – antemortem tooth loss
[2] PMTL – postmortem tooth loss
[3] number of teeth

TABLE 2
DISTRIBUTION OF PERIODONTAL DISEASE IN DIFFERENT AGE GROUPS

Age category[1]	n[2]	I Category		II Category		III Category	
		N	%	n	%	n	%
1	40	40	100.00	0	0	0	0
2	20	14	70.00	5	25.00	1	5.00
3	30	10	33.33	16	53.33	4	13.33
4	75	24	32.00	36	48.00	15	20.00
5	49	7	14.29	26	53.06	16	32.65
6	7	0	0	2	28.57	5	71.43
Total	221	95	42.99	85	38.46	41	18.55

[1] Mean age at death: 1(18.5±2.1 years), 2 (23.4±3.6 years), 3 (28.7±6.5 years), 4 (35.2±9.4 years), 5 (45.6±10.4 years), and 6 (61.2±12.2 years)
[2] n – number of observed individuals (selection of cases with assessed age and grade of periodontal disease, excluding edentate persons)

TABLE 3
DISTRIBUTION OF CARIES IN DIFFERENT AGE GROUPS

Age category[1]	n[2]	No caries		1st grade		2nd grade		3rd grade		4th grade		Cervical	
		n	%	n	%	n	%	n	%	n	%	n	%
1	960	890	92.71	18	1.88	27	2.81	18	1.88	4	0.42	3	0.31
2	578	534	92.39	8	1.38	18	3.11	13	2.25	5	0.87	0	0
3	802	713	88.90	18	2.24	28	3.49	29	3.62	14	1.75	0	0
4	2082	1837	88.23	38	1.83	65	3.12	68	3.27	53	2.55	21	1.01
5	1093	976	89.30	21	1.92	47	4.30	12	1.10	27	2.47	10	0.91
6	119	106	89.08	3	2.52	6	5.04	1	0.84	3	2.52	0	0
Total	5634	5056	89.74	106	1.88	191	3.39	141	2.50	106	1.88	34	0.60

[1] Mean age at death: 1 (18.5±2.1 years), 2 (23.4±3.6 years), 3 (28.7±6.5 years), 4 (35.2±9.4 years), 5 (45.6±10.4 years), and 6 (61.2±12.2 years)
[2] n – number of observed teeth (selection of cases with assessed age)

V=0.353, $p<0.01$). There was no difference in the presence of tooth wear between maxilla and mandible (χ^2=1.620E2, $p<0.01$; Cramer's V=0.845, $p<0.01$).

More than a quarter of the sample (excluding edentate jaws and those with absence or prosthodontic appliances on incisors, canines or first premolars) showed hypoplastic lines of crown enamel (Table 7). This feature was significantly more frequent in the mandible (χ^2=1.08E2, $p<0.01$; Cramer's V=0.714, $p<0.01$), than in the maxilla, and showed negative correlation to estimated age (Pearson Correlation –0.137, $p<0.05$).

Radiographs (Table 8) demonstrated the frequency of endodontic treatments, the presence of periapical lesions and residual roots (radix relicta). Among 90 teeth with endodontic treatment 29 (32.22%) were associated with periapical lesions. Statistical analyses confirmed significant correlation of radiologicaly detected lesions with caries (Pearson Correlation 0.236, $p<0.01$) and tooth fillings (Pearson Correlation 0.334, $p<0.01$).

Additionally, we have found two abutments, which suggest that those individuals had crowns probably lost before death or that stomatological intervention was interrupted.

Analysis of distribution of prosthodontic appliances in different teeth groups showed that esthetic crowns were the most frequent, with frequency of about 3% of all teeth. In addition, analyses showed that other restorations were very rare, with frequency lower than 0.5% by each prosthodontic group. Furthermore, statistics showed that age (Table 9) significantly influenced the frequency of prosthodontics (Pearson Correlation 0.309, $p<0.01$) considering their presence in all analyzed jaws. Absence of all dental prosthetic appliances was observed in first two age categories, while this feature was the most frequent in the eldest group, where complete dentures were present in nearly one third of jaws.

Finally, to evaluate a correlation between prosthodontics and AMTL in each individual, a Pearson Correlation test was used. The results showed that there was significant association between the number of AMTL and teeth with prosthodontic appliances of each individual (Pearson Correlation 0.645, $p<0.01$). We haven't found implants or non metal crowns in this sample.

TABLE 4
FREQUENCY OF DIFFERENT TOOTH FILLINGS AND CROWN SURFACES INVOLVED

Jaw	n[1]	No filling		Amalgam filling						Composit filling								Temporary filling			
				I[2]		II[3]		III[4]		I		II		III		IV[5]		I		II	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Maxilla	2611	2370	90.77	88	3.37	78	2.99	5	0.19	36	1.38	18	0.69	0	0	0	0	12	0.46	4	0.15
Mandible	3067	2853	93.02	125	4.08	49	1.60	4	0.13	14	0.46	8	0.26	1	0.03	1	0.03	9	0.29	3	0.10
Total	5678	5223	91.99	213	3.75	127	2.24	9	0.16	50	0.88	26	0.46	1	0.02	1	0.02	21	0.37	7	0.12

[1] n – number of observed teeth
[2] I – one crown surface involved
[3] II – two crown surfaces involved
[4] III – three crown surfaces involved
[5] IV – four crown surfaces involved

Discussion

Previous study of this sample also showed that the age significantly influenced the frequency of AMTL, demonstrating that in the sixth S&B age category over 80% of teeth were missing[3]. Comparison of this data with surveys of dental health in urban population of Belgrade, and studies in United States indicates the poorer dental health of Kosovar Albanian population.

Frequency and estimated grade of periodontal disease increased with age of investigated individuals. Signs of the severe forms of periodontal disease (considerable alveolar bone loss and deep infrabony pockets with definite widening of the periodontal space) were recorded in over 18% of individuals, and were mostly observed in elder S&B age group. Periodontal epidemiology literature lacks consistency in methodology of research, making comparison between populations difficult. In addition, there are very limited data on periodontal disease in the Balkans. In the survey of prevalence and severity of periodontal disease in the Ljubljana population (in the north-west of former Yugoslavia), gingivitis was present in 19.9% of the population, calculus and shallow pockets (4–5 mm) in 57.4%, and deep pockets (greater than or equal to 6 mm) in 20.3% of the examined participants, mainly in 45-, 55- and 65-year old adults[12]. In a study recently conducted of a population over 60 years old from Belgrade, the distance between the cementoenamel junction and the alveolar crest (for six index teeth) has shown mean value of 4.25–4.60 millimeters, greatly exceeding the distance of 2 mm frequently cited as representative of teeth supported by healthy bone[13].

TABLE 5
DISTRIBUTION OF DENTAL CALCULUS DEPOSITS

Jaw	n[1]	No visible or slight calculus		Medium or considerable calculus	
		n	%	n	%
Maxilla	260	250	96.20	10	3.80
Mandible	302	267	88.40	35	11.60
Total	562	517	91.99	45	8.01

[1] n – number of observed jaws excluding edentate maxillas (31) and mandibles (36)

TABLE 6
DISTRIBUTION OF TOOTH WEAR IN DIFFERENT AGE GROUPS

Age category[1]	Jaw	n[2]	1st grade		2nd grade		3rd grade		4th grade	
			n	%	n	%	n	%	n	%
1	Maxilla	38	35	92.11	3	7.89	0	0	0	0
	Mandible	35	33	94.29	2	5.71	0	0	0	0
	Total	73	68	93.15	5	6.85	0	0	0	0
2	Maxilla	21	20	95.24	1	4.76	0	0	0	0
	Mandible	22	21	95.45	1	4.55	0	0	0	0
	Total	43	41	95.35	2	4.65	0	0	0	0
3	Maxilla	36	32	88.89	1	2.78	3	8.33	0	0
	Mandible	34	27	79.41	4	11.76	3	8.82	0	0
	Total	70	59	84.29	5	7.14	6	8.57	0	0
4	Maxilla	90	49	54.44	29	32.22	11	12.22	1	1.11
	Mandible	111	60	54.05	38	34.23	13	11.71	0	0
	Total	201	109	54.23	67	33.33	24	11.94	1	0.50
5	Maxilla	60	33	55.00	9	15.00	18	30.00	0	0
	Mandible	81	44	55.32	18	22.22	18	22.22	1	1.23
	Total	141	77	54.61	27	19.15	36	25.53	1	0.71
6	Maxilla	10	5	50.00	2	20.00	3	30.00	0	0
	Mandible	13	6	46.15	3	23.08	4	30.77	0	0
	Total	23	11	47.83	5	21.74	7	30.43	0	0
Total	Maxilla	255	174	68.24	45	17.65	35	13.73	1	0.39
	Mandible	296	191	64.53	66	22.30	38	12.84	1	0.34
	Total	551	365	66.24	111	20.15	73	13.25	2	0.36

[1] Mean age at death: 1(18.5±2.1 years), 2 (23.4±3.6 years), 3 (28.7±6.5 years), 4 (35.2±9.4 years), 5 (45.6±10.4 years), and 6 (61.2±12.2 years)
[2] n – number of observed jaws (selection of cases with assessed age) excluded edentate and those with only present prosthodontics

TABLE 7
DISTRIBUTION OF HYPOPLASTIC LINES IN DIFFERENT AGE GROUPS

Age category[1]	Jaw	n[2]	No hypoplasia		Hypoplastic lines present	
			n	%	n	%
1	Maxilla	37	28	75.68	9	24.32
	Mandible	35	21	60.00	14	40.00
	Total	72	49	68.06	23	31.94
2	Maxilla	21	15	71.43	6	28.57
	Mandible	22	12	54.55	10	45.45
	Total	43	27	62.79	16	37.21
3	Maxilla	36	31	86.11	5	13.89
	Mandible	33	25	75.76	8	24.24
	Total	69	56	81.16	13	18.84
4	Maxilla	88	64	72.73	24	27.27
	Mandible	109	68	62.39	41	37.61
	Total	197	132	67.01	65	32.99
5	Maxilla	54	49	90.74	5	9.26
	Mandible	77	64	83.12	13	16.88
	Total	131	113	86.26	18	13.74
6	Maxilla	9	8	88.89	1	11.11
	Mandible	12	10	83.33	2	16.67
	Total	21	18	85.71	3	14.29
Total	Maxilla	245	195	79.59	50	20.41
	Mandible	288	200	69.44	88	30.56
	Total	533	395	74.11	138	25.89

[1] Mean age at death: 1(18.5±2.1 years), 2 (23.4±3.6 years), 3 (28.7±6.5 years), 4 (35.2±9.4 years), 5 (45.6±10.4 years), and 6 (61.2±12.2 years)
[2] n – number of observed jaws (selection of cases with assessed age) excluded edentate and those with absence/prosthodontics of incisors, canines and first premolars

Generally, periodontal disease is more prevalent in older people than in younger groups[14–18]. Some authors point out that this may be the result of cumulative tissue destruction throughout a lifetime, and higher frequency of the comorbid conditions associated with periodontal disease in people of advanced age, rather than an age-related risk of periodontal susceptibility[19].

Oral hygiene and socioeconomic status has been considered as the most important predictor for periodontitis[20,21], although some authors found that oral hygiene practices were not associated with periodontitis[22]. Our investigated population lived in economically disadvantaged environment, with low access to routine dental professional care, low education level, and was probably exposed to other potential risk factors, such as tobacco use.

In this study, we did not calculate the mean number of decayed, missing and filled teeth (DMFT), mainly because of fragmentary material and postmortem tooth loss, and the difficulties in comparing our data with epidemiological studies of living populations. However, we could calculate that in our sample 41.9% of teeth were affected by AMTL, caries and tooth filling, which means that the approximate mean DMFT was 13.5. Results are consistent with findings from postwar Bosnia where almost every adult (98%) was affected with dental caries, and where mean DMFT of adults was 15.1[23]. The authors considered that effect of 1991–95 war on social conditions and the health care system could explain such poor dental health. However, results from Slovenia – the most developed part of former Yugoslavia demonstrated that mean DMFT during 6 observed years (1987–1993) changed from 20.5 to 19.0 at individuals of 35–44 years, and from 27.0 to 28.0 in persons aged 65 years or older[24]. In the previous study of caries prevalence in Slovenia[25] authors concluded that in a majority of age groups immigrant inhabitants (from less developed parts of former Yugoslavia) had more decayed and more missing teeth, less filled teeth and a lower mean DMFT values in comparison with native inhabitants. The majority of these immigrants were from Bosnia and Kosovo, and our findings in this population from Kosovo correspond to the remark of Slovenian authors, i.e. we found only 8% of teeth with tooth filling, while 31.48% of teeth were lost antemortem.

In our sample there was no significant difference in the number of teeth affected by caries between different

TABLE 8
DISTRIBUTION OF RADIOLOGICALY DETECTED LESIONS IN DIFFERENT TEETH GROUPS

Teeth groups	Present teeth on radiograms	No finding		Endodontic treatment		Periapical lesion		Radix relicta	
		n	%	n	%	n	%	n	%
11+21	150	146	97.33	2	1.33	2	1.33	0	0
31+41	189	188	99.47	1	0.53	0	0	0	0
12+22	155	149	96.13	4	2.58	2	1.29	0	0
32+42	206	205	99.51	0	0	0	0	0	0
13+23	184	174	94.57	9	4.89	4	2.17	0	0
33+43	225	225	100.00	0	0	0	0	0	0
14+24	165	142	86.06	18	10.91	9	5.45	0	0
34+44	212	207	97.64	5	2.36	2	0.94	0	0
15+25	157	137	87.26	10	6.37	12	7.64	2	1.27
35+45	177	168	94.92	6	3.39	4	2.26	0	0
16+26	132	115	87.12	9	6.82	10	7.58	2	1.52
36+46	113	94	83.19	9	7.96	10	8.85	2	1.77
17+27	158	143	90.51	9	5.70	9	5.70	1	0.63
37+47	175	162	92.57	8	4.57	5	2.86	2	1.14
18+28	123	119	96.75	0	0	0	0	3	2.44
38+48	160	153	95.63	0	0	6	3.75	0	0
Maxilla	1224	1125	91.91	61	4.98	48	3.92	8	0.65
Mandible	1457	1402	96.23	29	1.99	27	1.85	4	0.27
Total	2681	25277	94.26	90	3.36	75	2.80	12	0.45

age groups. This may be explained by the increasing of AMTL with increasing age of individuals, i.e. carious teeth were already extracted in an advanced age. However, dental caries significantly correlated with tooth fillings, endodontic treatments, residual roots and periapical lesions, suggesting that there was no continuity in dental treatments. The material most frequently used for dental fillings was amalgam (6.15%). The similar findings were presented in Croatia, in the analysis of post mortem dental evidence of war victims[26], where frequency of amalgam fillings was from 1.5% to 8%, depending on county.

Medium and considerable dental calculus was found on 8.01% of jaws, and calculus deposits were mostly accumulated on the lingual and labial surfaces of the lower six anterior teeth. In the survey of recent population from Croatia, Spalj and Plancak (2003)[27] also found calculus the most frequently accumulated in lower anterior sextant, and emphasized its correlation with deep periodontal pockets. Mechanical stress caused by post mortem

TABLE 9
DISTRIBUTION OF PROSTHODONTIC APPLIANCES IN DIFFERENT AGE GROUPS

Age category[1]	n[2]	Only natural teeth		Complete denture		Acrylic partial denture		Frame work		Complete crown		Full veneer crown		Esthetic crown	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%
1	73	73	100.00	0	0	0	0	0	0	0	0	0	0	0	0
2	43	43	100.00	0	0	0	0	0	0	0	0	0	0	0	0
3	70	66	94.29	0	0	0	0	1	1.43	0	0	0	0	3	4.29
4	205	195	95.12	2	0.98	0	0	0	0	2	0.98	0	0	7	3.41
5	177	149	84.18	9	5.08	1	0.56	2	1.13	6	3.39	1	0.56	12	6.78
6	58	35	60.34	17	29.31	0	0	1	1.72	0	0	0	0	6	10.34
Total	626	561	89.62	28	4.47	1	0.16	4	0.64	8	1.28	1	0.16	28	4.47

[1] Mean age at death: 1(18.5±2.1 years), 2 (23.4±3.6 years), 3 (28.7±6.5 years), 4 (35.2±9.4 years), 5 (45.6±10.4 years), and 6 (61.2±12.2 years)

[2] n – number of observed jaws (selection of cases with assessed age)

handling, cleaning and even taphonomic conditions could interfere to result of calculus incidence in our sample making it less pronounced.

Advanced forms of tooth wear were found in older age groups. However, there is no study about incidence of tooth wear in populations of Kosovo or former Yugoslavia limiting further correlation of our findings.

Enamel hypoplasia can result from different causes: nutritional deficiency, systemic diseases, congenital syphilis, hypocalcemia, birth injury, Rh hemolytic disease, local infection or trauma, ingestion of chemicals and idiopathic causes[11]. Some of these causes could be related to the high frequency of enamel hypoplasia found in population of Kosovo, considering that it is a poor and economically undeveloped rural region of Serbia.

The most frequent prosthodontic appliances in older age categories were complete dentures. Their frequency in entire population was nearly 6%, which is consistent with findings in exhumed human remains from Croatia, where frequency was ranged from 1.3% to 11.6%[26].

Conclusion

We believe that our results will help to future investigators of mass graves in former Yugoslavia by listing the types of findings that could be expected in population from Kosovo. We have found high degrees of enamel hypoplasia, frequent signs of the severe forms of periodontal disease, a very high percent of AMTL, and evidence of edentate jaws in young individuals. Amalgam was the predominant material for tooth fillings; implants and non-metal ceramic crowns were not found, and three quoters of edentate individuals were found with full prostetic dentures.

Unfortunately, there were no individuals from this mass grave identified by dental charts. The reasons for the small number of dental identifications of the victims were incomplete or unavailable antemortem data provided by relatives and friends of the deceased, poorly collected data by UNMIC police, the absence of official dental documentation from regional medical centers or private clinics and surgeries, and the predominant orientation toward other forensic identification methods. The economic aspect of the region also led to poor dental identification, i.e. there was a small percentage of prosthodontic appliances and dental restorations, and dental charts were often unavailable because of great number of non official private clinics. The personnel engaged in data collecting should be aware of regional medical insurance characteristics; this would assure better antemortem dental data and would help in the identification process.

Acknowledgements

This work was supported by Ministry of Science of Republic of Serbia (grant number: 145012).

The preliminary study of this work has been presented orally during Annual International Forensic Inforce Conference, Bournemouth, 2005. Abstract book, page 11.

The authors thank professor Djukanovic and professor Rakocevic for assistance and critical input.

REFERENCES

1. CHOMDEJ T, PANKAOW W, CHOYCHUMROON S, Forensic Sci Int, 158 (2006) 27. — 2. BOSE RS, MOHAN B, LAKSHMINARAYANAN L, Indian J Dent Res, 16 (2005) 56. — 3. DJURIC M, RAKOCEVIC Z, TULLER H, J Forensic Sci, 49 (2004) 1313. — 4. BUIKSTRA J, UBELAKER D, Standards for data collection from human skeletal remains (Arkansas archaeological Survey Press, Fayetteville, 1994). — 5. SUCHEY JM, BROOKS S, Hum Evol, 5 (1990) 227. — 6. ISCAN MY, LOTH SR, WRIGHT RK, J Forensic Sci, 29 (1984) 1094. — 7. METRESS J, CONVAY T, J Dent Res, 54 (1975) 908. — 8. BROTHWELL D, Digging up Bones (Oxford University Press, Oxford, 1981). — 9. SCHULTZ M, Paläopathologische Diagnostik. In: KNUßMANN R (Ed) Anthropologie Handbuch der vergleichenden Biologie des Menschen (Gustav Fischer Verlag, Stuttgart, 1988). — 10. GUSTAFSON G, J Am Dent Assoc, 41 (1950) 45. — 11. LANGLAIS RP, LANGLAND OE, NORTJE CJ, Diagnostic imaging of the jaws (Williams and Wilkins, Baltimore, 1995). — 12. SKALERIC U, KOVAC-KAVCIC M, Community Dent Oral Epidemiol, 17 (1989) 304. — 13. DJURIC M, RAKOCEVIC Z, RANKOVIC N, Vojnosanit Pregl, 62 (2005) 557. — 14. SCHEI O, WAERHAUG J, LÖVDAL A, ARNO A, J Periodontol, 30 (1959) 7. — 15. ABDELLATIF HM, BURT BA, J Dent Res, 66 (1987) 13. — 16. PAPAPANOU PN, WENNSTROM JL, GRONDAHL K, J Clin Periodontol, 15 (1988) 469. — 17. STRECKFUS CF, PARSELL DE, STRECKFUS JE, PENNINGTON W, JOHNSON RB, Gerontology, 45 (1999) 110. —18. BAHRAMI G, ISIDOR F, KIRKEVANG LL, VAETH M, WENZEL A, Oral Health Prev Dent, 4 (2006) 119. — 19. DOUGLASS CW, J Am Dent Assoc, 137 (2006) 27. — 20. U.S. Public Health Service, National Center for Health Statistics. Basic data on dental health examination findings of persons 1–75 years, United States, 1971–74. Hyattsville, Md.: National Center for Health Statistics, 1979. U.S. Department of Health, Education and Welfare publication (PHS) 79–1662. Vital Health Stat; series 11, no. 214. — 21. BORRELL LN, BECK JD, HEISS G, Am J Public Health, 96 (2006) 332. — 22. MERCHANT A, PITIPHAT W, DOUGLASS CW, CROHIN C, JOSHIPURA K, J Periodontol, 73 (2002) 531. — 23. IVANKOVIĆ A, LUKIĆ IK, IVANKOVIĆ Z, RADIĆ A, VUKIĆ I, ŠIMIĆ A, Community Dent Oral Epidemiol, 31 (2003) 100. — 24. VRBIĆ VL, Community Dent Health, 12 (1995) 39. — 25. KOVAČ-KAVČIĆ M, SKALERIĆ U, Zobozdrav Vestn, 44 (1989) 91. — 26. BRKIĆ H, ŠLAUS M, KEROS J, JEROLIMOV V, PETROVEČKI M, Coll Antropol, 28 (2004) 259. — 27. SPALJ S, PLANCAK D, Coll Antropol, 27 (2003) 183.

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DENTALNI STATUS ŽRTAVA IZ MASOVNE GROBNICE U BATAJNICI

S A Ž E T A K

Cilj ovog rada je prezentirati postmortalne podatke o zubima, odnosno o dentalnom zdravlju žrtava pokopanih tijekom 1999. godine u pet masovnih grobnica u Batajnici, kraj Beograda. Analizirani uzorak je obuhvatio 32 pojedinca sa sačuvanom samo gornjom čeljusti (maksilom), 80 sa samo donjom čeljusti (mandibulom) i 260 pojedinaca sa sačuvane obje čeljusti. Ustanovljen je visok stupanj hipoplazije zubne cakline (25,89%), česti znakovi teških oblika periodontalnih oboljenja (18,55%), vrlo visok postotak zaživotno izvađenih zubiju (31,48%) te postojanje bezubih čeljusti u vrlo mladih pojedinaca. Najčešći materijal od kojeg su rađene zubne ispune je bio amalgam; nisu nađeni implanti i nemetalne keramičke krunice, a tri četvrtine bezubih pojedinaca je nađeno s ugrađenim totalnim protezama. Unatoč detaljnoj postmortalnoj dentalnoj analizi, antemortalni podaci iz dentalnih zdravstvenih kartona nisu prikupljeni. Pojedinici su identificirani drugim forenzičkim metodama.