

## PERIODONTAL CONDITIONS AND ORAL HYGIENE IN RURAL POPULATION OF POST-WAR VUKOVAR REGION, CROATIA IN CORRELATION TO STRESS

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### Abstract

**Objective:** The greatest burden of oral diseases is on the socially marginalized population, such as those living in small villages and war areas. The aim of this study was to assess the periodontal conditions of people in post-war area villages in relation to oral hygiene, habits and war stress.

**Methods:** The study was conducted on a sample of 282 subjects (mean age  $41.5 \pm 17.8$ ) in seven Vukovar villages using the questionnaire and clinical periodontal examination.

**Results:** Five years after the war in Croatia the population was still very poor, low educated, and had a low level of periodontal health and oral hygiene habits. The level of periodontal disease and attachment loss tended to increase with age and physical activity and decrease with education level, higher frequency of tooth brushing and toothbrush replacement, dental visits and utilisation of auxiliary devices. Subjects exposed to any kind of war stress had a significantly worse periodontal status and more excluded sextants than those who were not exposed to such stress experience ( $p < 0.05$ ). Better periodontal conditions were found in individuals that were refugees, than those who were in war, wounded or lost a dear person ( $p < 0.05$ ). Individuals who were in war rarely brushed their teeth, visited dentist and changed toothbrushes, but more frequently drank alcohol and smoked, in comparison to other groups, especially those who have not been exposed to war stress.

**Conclusions:** Specific socio-economic and psychological conditions in post-war areas could be significant risk factors for poor periodontal conditions.

**Key words:** periodontal conditions, oral health, oral hygiene, rural, post-war, stress

### INTRODUCTION

The social, economic, political and cultural determinants of oral health are considered to have a significant impact on the quality of life. Despite the achievements in the promotion of oral health many people have been excluded from the benefits of the socio-economic developments and scientific advances that have improved health care and quality of life. The greatest burden of oral diseases is on socially marginalized populations, such as those living in small villages and war areas [1]. In addition to socio-environmental determinants, oral diseases are highly related to lifestyle factors which include diet rich in sugars, tobacco use,

increased consumption of alcohol, and oral hygiene. Noticeable factors are availability and accessibility of oral health services, stress and systemic diseases. A higher risk for oral disease occurrence is related to socio-cultural determinants such as poor living conditions, low education level and lack of traditions, beliefs and culture in support of oral health. Experiences of negative life events may contribute to an increased susceptibility to periodontal diseases. Stress adversely affects various health behaviours and an individual's ability to cope with stressful stimuli plays a role in the progression of periodontal disease as reported in several investigations [2-6].

The population in the Vukovar area exhibited the worst war stress during the war in Croatia (1991-1997) either as active or passive participants; many were soldiers in battles, imprisoned, on forced-labor, wounded, lost a dear person or were refugees. Therefore, we have attempted to compare periodontal conditions and oral hygiene habits of people in post-war Vukovar area with respect to stress conditions and data before the war, as well as with the contemporary data in the Croatian capital Zagreb.

### MATERIAL, METHODS AND STATISTICS

A cross-sectional study of 282 subjects between the ages of 15 and 70 years (average age 41.5) in the formerly military occupied territory of Vukovar region villages Lovas, Opatovac, Miklusevci, Tompojevci, Cakovci, Boksic and Berak was carried out in October 2003. The population was around 2800 inhabitants, and the sample was 10% of the population. Subjects were randomly chosen and classified in groups according to age and stress exposure. Subjects were asked to complete a questionnaire which included nineteen questions: age, gender, marital status, place of birth, number of years living in place of examination, educational level, employment status, type of work (physical activity), mean income per member of household, tooth brushing frequency, dental visit frequency, smoking, alcohol consumption, stress, systemic diseases, toothbrush type used, frequency of replacing of the toothbrush, auxiliary oral hygiene devices and "do you know what periodontitis is?". Clinical examination was performed using the CPI probe, mouth mirror and dental examining light, and assessment was made according to the WHO criteria measuring Community Periodontal Index (CPI) and Loss of Attachment (LA), respectively [7]. Periodontal Screening and Recording (PSR) was used for

recording of furcation involvement, tooth mobility and gingival recession over 3.5mm in jaw sextants. No radiographs were taken. All clinical data was collected by a single investigator (S.S.), who had been calibrated prior to the commencement of the study. The intra-examiner agreement was evaluated with a 7-day interval from the first examination, and reproducibility assessed by Cohen Kappa test was 0.81. For variable with discrete values nonparametric statistics was used (Chi-square, Fisher, Kruskal-Wallis and Mann-Whitney) and for variable with continuous values parametric statistics was used (ANOVA and post hoc tests Tukey and Games-How-

ell). All statistical analyses mentioned above were performed by using a commercial statistical software program, SPSS Version 10.0, SPSS Inc. Chicago, IL, USA, statistical significance being defined at  $p < 0.05$ .

## RESULTS

Rural population in the Vukovar war area five years after the war in Croatia and peaceful reintegration of that military occupied territory was very poor and lowly educated. According to their statements 19% of the population did not exhibit direct war stress, 25% were ac-

Table 1. Demographic and socioeconomic variables of the groups.

Variable	No war stress (N = 53)	Was in war (N = 71)	Refugee (N = 123)	Wounded/ lost dear person (N = 35)	Total (N = 282)	<i>p</i>
Age*						
mean $\pm$ SD	31.9 $\pm$ 17.6	44.1 $\pm$ 12.5	41.1 $\pm$ 19.4	52.4 $\pm$ 13.9	41.5 $\pm$ 17.8	0.000
Gender (%)†						
Female	33 (62.3)	11 (15.5)	78 (63.4)	22 (62.9)	144 (51.1)	0.000
Male	20 (37.7)	60 (84.5)	45 (36.6)	13 (37.1)	138 (48.9)	
Marital status (%)†						
Married	18 (34.0)	50 (70.4)	66 (53.7)	15 (42.9)	149 (52.8)	0.000
Single	27 (50.9)	11 (15.5)	32 (26.0)	3 (8.6)	73 (25.9)	
Widow	8 (15.1)	8 (11.3)	22 (17.9)	17 (48.6)	55 (19.5)	
Divorced	-	2 (2.8)	3 (2.4)	-	5 (1.8)	
Place of birth (%)†						
Town	33 (62.3)	23 (32.4)	57 (46.3)	5 (14.3)	118 (41.8)	0.000
Village	20 (37.7)	48 (67.6)	66 (53.7)	30 (85.7)	164 (58.2)	
No. of years living in place of examination (%)†						
Since birth	19 (35.8)	37 (52.1)	58 (47.2)	21 (60.0)	135 (47.9)	0.000
5-10 years	13 (24.5)	10 (14.1)	39 (31.7)	2 (5.7)	64 (22.7)	
10-20 years	8 (15.1)	4 (5.6)	3 (2.4)	-	15 (5.3)	
20+ years	13 (24.5)	20 (28.2)	23 (18.7)	12 (34.3)	68 (24.1)	
Educational level (%)†						
Elementary	20 (37.7)	30 (42.3)	67 (54.5)	29 (82.9)	146 (51.8)	0.000
High school	28 (52.8)	39 (54.9)	52 (42.3)	6 (17.1)	125 (44.3)	
College	2 (3.8)	2 (2.8)	4 (3.3)	-	8 (2.8)	
University	3 (5.7)	-	-	-	3 (1.1)	
Employment status (%)†						
Employed	13 (24.5)	37 (52.1)	24 (19.5)	6 (17.1)	80 (28.4)	0.000
Unemployed	40 (75.5)	34 (47.9)	99 (80.5)	29 (82.9)	202 (71.6)	
Type of work (%)†						
Hard	14 (26.4)	39 (54.9)	48 (39.0)	18 (51.4)	119 (42.2)	0.011
Moderate	26 (49.1)	27 (38.0)	56 (45.5)	15 (42.9)	124 (44.0)	
Easy	13 (24.5)	5 (7.0)	19 (15.4)	2 (5.7)	39 (13.8)	
Mean income (%)†						
<68 euro	8 (15.1)	6 (8.5)	8 (6.5)	1 (2.9)	23 (8.2)	0.002
69-135	18 (34.0)	31 (43.7)	74 (60.2)	13 (37.1)	136 (48.2)	
136-270	18 (34.0)	21 (29.6)	35 (28.5)	18 (51.4)	92 (32.6)	
271-675	7 (13.2)	13 (18.3)	4 (3.3)	3 (8.6)	27 (9.6)	
676+ euro	2 (3.8)	-	2 (1.6)	-	4 (1.4)	
Tobacco use (%)†						
None	35 (66.0)	36 (50.7)	99 (80.5)	26 (74.3)	196 (69.5)	0.000
<10 cigarettes/day	7 (13.2)	2 (2.8)	3 (2.4)	1 (2.9)	13 (4.6)	
< 20	9 (17.0)	14 (19.7)	16 (13.0)	5 (14.3)	44 (15.6)	
20+	2 (3.8)	19 (26.8)	5 (4.1)	3 (8.6)	29 (10.3)	
Alcohol consumption (%)†						
None	36 (67.9)	21 (29.6)	95 (77.2)	27 (77.1)	179 (63.5)	0.000
Sometimes	17 (32.1)	42 (59.2)	25 (20.3)	7 (20.0)	91 (32.3)	
Every day	-	8 (11.3)	3 (2.4)	1 (2.9)	12 (4.3)	

\*ANOVA; †Chi-square; SD, standard deviation

Table 2. Prevalence (% of persons) and severity (mean number of sextants) of periodontal disease and loss of attachment according to stress.

Variable	No war stress (N = 53)	Was in war (N = 71)	Refugee (N = 123)	Wounded/lost dear person (N = 35)	Total (N = 282)	<i>p</i>
PD prevalence*						
HP	5.9%	1.5% <b>a</b>	9.7% <b>a</b>	3.7%	6.3%	0.146
BP	11.8% <b>bc</b>	1.5% <b>bd</b>	9.7% <b>de</b>	0.0% <b>ce</b>	7.0%	0.031
CP	41.2% <b>f</b>	26.2%	31.9%	18.5% <b>f</b>	30.9%	0.058
P1P	31.4%	46.2%	36.3%	33.3%	37.5%	0.312
P2P	9.8% <b>g</b>	24.6% <b>h</b>	12.4% <b>hi</b>	44.4% <b>gi</b>	18.4%	0.003
LA prevalence*						
LA0P	52.9% <b>jk</b>	23.1% <b>jl</b>	40.7% <b>lm</b>	14.8% <b>km</b>	35.9%	0.000
LA1P	29.4%	38.5%	32.7%	22.2%	32.4%	0.292
LA2P	11.8%	26.2%	17.7%	33.3%	20.3%	0.186
LA3P	3.9%	9.2%	6.2%	18.5%	7.8%	0.243
LA4P	0.2%	3.1%	2.7%	11.1%	3.5%	0.282
PD severity†						
HK	1.57 ± 1.96 <b>ab</b>	0.46 ± 1.16 <b>a</b>	1.04 ± 1.89	0.43 ± 1.22 <b>b</b>	0.92 ± 1.72	0.001
BK	3.42 ± 2.04	3.63 ± 2.01	3.16 ± 2.22	2.8 ± 2.21	3.28 ± 2.14	0.232
CK	1.92 ± 1.72 <b>c</b>	2.92 ± 1.93 <b>cd</b>	2.11 ± 1.86 <b>d</b>	2.57 ± 2.15	2.34 ± 1.92	0.010
P1K	1.04 ± 1.66 <b>eh</b>	1.89 ± 1.97 <b>fh</b>	1.12 ± 1.69 <b>fg</b>	2.17 ± 2.26 <b>eg</b>	1.43 ± 1.88	0.001
P2K	0.19 ± 0.86 <b>i</b>	0.48 ± 1.14	0.3 ± 1.02 <b>j</b>	0.86 ± 1.42 <b>ij</b>	0.39 ± 1.1	0.023
X	1.02 ± 1.9 <b>k</b>	1.9 ± 2.11	1.8 ± 2.2	2.77 ± 2.31 <b>k</b>	1.8 ± 2.18	0.003
LA severity†						
LA0K	3.7 ± 2.67 <b>lm</b>	1.73 ± 2.35 <b>ln</b>	2.73 ± 2.66 <b>no</b>	0.83 ± 1.77 <b>mo</b>	2.43 ± 2.63	0.000
LA1K	1.28 ± 1.77 <b>p</b>	2.37 ± 2.1 <b>pr</b>	1.52 ± 1.86 <b>r</b>	2.37 ± 2.26	1.79 ± 2	0.002
LA2K	0.45 ± 1.22 <b>s</b>	0.8 ± 1.27	0.52 ± 1.16 <b>t</b>	1.34 ± 1.64 <b>st</b>	0.68 ± 1.29	0.004
LA3K	0.17 ± 0.87	0.25 ± 0.82	0.22 ± 0.86	0.4 ± 0.88	0.24 ± 0.86	0.646
LA4K	0.08 ± 0.55	0.03 ± 0.17	0.07 ± 0.46	0.14 ± 0.49	0.07 ± 0.43	0.639

\* paired letters – Kruskal-Wallis test for several independent samples and Mann-Whitney tests for two independent samples  $p < 0.05$ ;

† paired letters - ANOVA and post hoc tests Tukey and Games - Howell  $p < 0.05$

PD, periodontal disease; LA, loss of attachment; H, healthy; B, bleeding on probing; C, calculus; P1, shallow pockets 4-5mm; P2, deep pockets 6mm+; LA0, loss of attachment 0-3mm; LA1, 4-5mm; LA2, 6-8mm; LA3, 9-11mm; LA4, 12mm+; X, excluded sextants; P, prevalence; K, cumulative severity.

tive participants in the war as soldiers in battles, imprisoned or on forced-labor, 44% were refugees and 12% were wounded or lost a dear person. Demographic and socioeconomic data are shown in Table 1. Almost half of the population after the war had a mean income per member of household between 68-135 euro and only 11% above 270 euro. 52% of the subjects finished only elementary school, and only 4% college or university. Almost half of the population lived in villages all their life. The prevalence and severity of both periodontal disease and loss of attachment according to stress and age are presented in Tables 2 and 3. Population born in the city had a higher prevalence of healthy, bleeding and sextants without attachment loss. They also had a lower prevalence of deep and shallow pockets and excluded sextants as well as attachment loss higher than 4 mm ( $p < 0.05$ ). The prevalence of minimal attachment loss tended to decrease and attachment loss 4-8mm tended to increase with a longer period of living in a village. Singles had more healthy sextants and married more deep pockets, and greater attachment loss ( $p < 0.05$ ). Level of periodontal disease and attachment loss tended to increase with age and physical activity and decrease with the level of education. With a higher age both the prevalence and severity of advanced forms of periodontal diseases and attachment loss increases ( $p < 0.05$ , Table 3). Mean number of healthy and

bleeding sextants and minimal attachment loss was lower in persons who have practiced heavy physical activity, and prevalence of shallow pockets, excluded sextants and attachment loss 4-8mm was higher ( $p < 0.05$ ). With a higher education level healthy and bleeding sextants, and those without attachment loss increase and severity of deep pockets, excluded sextant and those with attachment loss 6-11mm decreases ( $p < 0.05$ ).

Subjects exposed to any kind of war stress had a lower mean number of healthy sextants and a higher number of sextants with calculus, shallow or deep pockets, as well as excluded sextants compared to those that were not exposed to such stress experience (Table 2;  $p < 0.05$ ). There was also lower prevalence of subjects with bleeding and calculus, and a higher prevalence of subjects with deep pockets in a stress-exposed population (Table 2;  $p < 0.05$ ). In a stress-exposed population there was a lower severity of sextants and prevalence of persons without attachment loss and higher severity of sextants with attachment loss above 4 mm (Table 2;  $p < 0.05$ ). Better periodontal conditions were found in individuals that did not exhibit war stress or were refugees compared to those who were in war, wounded or lost a dear person ( $p < 0.05$ ).

Oral hygiene habits data are shown in Table 4. Almost 70% of the subjects brushed their teeth once a day or less and women brushed more frequent than

Table 3. Prevalence (% of persons) and severity (mean number of sextants) of periodontal disease and loss of attachment in age groups.

Variable	Age groups							p	
	15-19 (N = 37)	20-29 (N = 28)	30-34 (N = 27)	35-44 (N = 46)	45-54 (N = 43)	55-64 (N = 32)	≥65 (N = 69)		(N = 282)
PD prevalence*									
HP	21.6	17.9	3.7	2.2	0.0	0.0	2.0	6.3	0.000
BP	37.8	7.1	0.0	0.0	2.4	0.0	2.0	7.0	0.000
CP	35.1	46.4	51.9	31.1	28.6	18.5	16.0	30.9	0.000
P1P	5.4	28.6	44.4	44.4	38.1	40.7	54.0	37.5	0.006
P2P	0.0	0.0	0.0	22.2	31.0	40.7	26.0	18.4	0.000
LA prevalence*									
LA0P	100	67.9	59.3	28.9	7.1	3.7	6	35.9	0.000
LA1P	0	32.1	33.3	40	42.9	40.7	36	32.4	0.001
LA2P	0	0	7.4	20	35.7	29.6	36	20.3	0.000
LA3P	0	0	0	6.7	11.9	14.8	16	7.8	0.063
LA4P	0	0	0	4.4	2.4	11.1	6	3.5	0.272
PD severity†									
HK	2.9	2.3	1.4	0.5	0.4	0.1	0.1	0.9	0.000
BK	3.1	3.6	4.5	4.4	3.9	2.6	2.0	3.3	0.000
CK	0.8	2.0	2.9	3.6	3.1	2.2	1.9	2.3	0.000
P1K	0.2	0.6	1.2	2.2	2.0	1.6	1.6	1.4	0.000
P2K	0.0	0.0	0.0	0.5	0.9	0.6	0.5	0.4	0.001
X	0.0	0.1	0.1	1.1	1.7	3.3	3.9	1.8	0.000
LA severity†									
LA0K	6	5.1	4.4	2.3	1.4	0.5	0.3	2.4	0.000
LA1K	0	0.9	1.4	2.6	2.9	2.2	1.8	1.8	0.000
LA2K	0	0	0.1	0.9	1.3	1	0.9	0.7	0.000
LA3K	0	0	0	0.4	0.4	0.4	0.3	0.2	0.068
LA4K	0	0	0	0.1	0.1	0.2	0.1	0.1	0.649

\*ANOVA.

†Kruskal – Wallis test for several independent samples.

PD, periodontal disease; LA, loss of attachment; H, healthy; B, bleeding on probing; C, calculus; P1, shallow pockets 4-5mm; P2, deep pockets 6mm+; X, excluded sextants; P, prevalence; K, cumulative severity; LA0, loss of attachment 0-3mm; LA1, 4-5mm; LA2, 6-8mm; LA3, 9-11mm; LA4, 12mm+.

men, 22% females and 9% of males did it more or equal to two times a day ( $p = 0.001$ ). Almost half of the subjects replaced their toothbrush once a year or less, 24% every three months, with females being more frequent ( $p = 0.018$ ). Other differences between gender, employment status as well as between mean income per member of household in distribution of oral health and habits were proven to be negligible. More than half of the subjects visited dentist less than once a year, and only 21% two times or more. Younger subjects visited dentist more frequently. Less than 5% of the population used auxiliary oral hygiene devices (floss or toothpick). Examinees that used auxiliary devices had a higher number of sextants without attachment loss and less excluded sextants ( $p < 0.05$ ). The majority of the population (72%) did not know what periodontitis is. Fisher test proved gender differences – 65% females and 80% males ( $p = 0.008$ ). Subjects who knew what periodontitis is, had a higher severity of all forms of periodontal disease and attachment loss above 9mm, as well as a higher prevalence of deep pockets, but they did not have more excluded sextants from those who were not familiar with the term “periodontitis” ( $p < 0.05$ ).

Individuals who were in war most rarely brushed their teeth, visited dentists and changed toothbrushes, but more frequently drank alcohol and smoked, in comparison to other groups, especially those who have

not been exposed to war stress. Systemic diseases were more frequent in persons who were wounded, lost a dear person or have been a refugee (Table 4).

With an increasing tooth brushing frequency the mean number of healthy sextants increased, and number of excluded sextants decreased. There was also higher prevalence of persons without loss of attachment and a smaller mean number and prevalence of persons with attachment loss 4-5 and 6-8 mm. By increasing the frequency of dental visits there was an increase in the mean number, severity of sextants and prevalence of persons without loss of attachment, and those with healthy, bleeding and calculus sextants. At the same time there was a decrease in the severity of attachment loss above 4, 6, 9 and 12 mm and shallow and deep pockets as well as excluded sextants ( $p < 0.05$ ). As people more frequently replaced their toothbrush the mean number, severity and prevalence of persons without attachment loss as well as healthy sextants became less frequent. At the same time there was an increased number and severity of attachment loss above 4 and 6 mm and prevalence of shallow pockets and number and severity of excluded sextants.

Tobacco smokers more frequently have had sextants with attachment loss above 4 mm and a higher severity of bleeding, calculus and shallow pockets. They also have had a lower number of excluded sextants than non-smokers. Persons who have not drunk

Table 4. Oral hygiene and health variables of the groups.

Variable	No war stress (N = 53)	Was in war (N = 71)	Refugee (N = 123)	Wounded/lost dear person (N = 35)	Total (N = 282)	<i>p</i> *
Tooth brushing (%)						
Never	10 (18.9)	19 (26.8)	23 (18.7)	8 (22.9)	60 (21.3)	0.031
Once a day	17 (32.1)	38 (53.5)	64 (52.0)	15 (42.9)	134 (47.5)	
Twice a day	20 (37.7)	12 (16.9)	33 (26.8)	11 (31.4)	76 (27.0)	
More then twice	6 (11.3)	2 (2.8)	3 (2.4)	1 (2.9)	12 (4.3)	
Dental visits (%)						
Less then once a year	16 (30.2)	44 (62.0)	66 (53.7)	24 (68.6)	150 (53.2)	0.000
Once a year	8 (15.1)	21 (29.6)	35 (28.5)	10 (28.6)	74 (26.2)	
Twice a year	9 (17.0)	2 (2.8)	17 (13.8)	-	28 (9.9)	
More then twice	20 (37.7)	4 (5.6)	5 (4.1)	1 (2.9)	30 (10.6)	
Toothbrush type (%)						
Manual	53 (100.0)	71(100.0)	123 (100.0)	35 (100.0)	282 (100.0)	-
Electric	-	-	-	-	-	
Toothbrush replacement frequency (%)						
3 months	24 (45.3)	11 (15.5)	26 (21.1)	6 (17.1)	67 (23.8)	0.002
6 months	15 (28.3)	20 (28.2)	35 (28.5)	13 (37.1)	83 (29.4)	
1 year	14 (26.4)	40 (56.3)	62 (50.4)	16 (45.7)	132 (46.8)	
Auxiliary oral hygiene devices use (%)						
Dental floss	2 (3.8)	1 (1.4)	3 (2.4)	-	6 (2.1)	0.092
Toothpick	2 (3.8)	1 (1.4)	-	1 (2.9)	4 (1.4)	
Both	2 (3.8)	-	-	-	2 (0.7)	
None	47 (88.7)	69 (97.2)	120 (97.6)	34 (97.1)	270 (95.7)	
Do you know what periodontitis is? (%)						
Yes	14 (26.4)	20 (28.2)	35 (28.5)	11 (31.4)	80 (28.4)	0.967
No	39 (73.6)	51 (71.8)	88 (71.5)	24 (68.6)	202 (71.6)	
Systemic diseases (%)†						
None	41 (77.4)	51 (71.8)	73 (59.4)	11 (31.4)	176 (62.4)	0.000
DM type 1	1 (1.9)	-	-	-	1 (0.4)	
DM type 2	-	1 (1.4)	6 (4.9)	-	7 (2.5)	
Cardiac diseases	4 (7.6)	7 (9.9)	15 (12.2)	12 (34.3)	38 (13.4)	
Hypertension	7 (13.2)	11 (15.5)	33 (26.8)	22 (62.9)	73 (25.9)	
Respiratory diseases	2 (3.8)	2 (2.8)	5 (4.1)	1 (2.9)	10 (3.6)	
Cerebral insult	1 (1.9)	-	-	2 (5.7)	3 (1.1)	
Other diseases	3 (5.7)	3 (4.2)	6 (4.9)	1 (2.9)	13 (4.6)	

\*Chi-square test.

†The sum does not correspond to the number of the subjects as the diagnoses do not exclude one another (except for DM). DM, diabetes mellitus.

any alcohol significantly have had more healthy sextants than those who have drunk every day, and by increasing the frequency of alcohol consumption there was a decrease in the prevalence of healthy, and an increase of bleeding and calculus sextants, as well as prevalence of persons with shallow pockets. Persons with systemic diseases had lower prevalence and severity of sextants without attachment loss, and higher severity of attachment loss above 6, 9 and 12 mm. In the same time they have had lower prevalence and severity of healthy, bleeding and calculus sextants, and higher severity of excluded sextants then those without systemic diseases.

Tooth mobility measured by PSR increased with age from 0.6% in thirties to 30.6% in age 65+ ( $p < 0.05$ ). Mean percentage was 11% and it was most frequent in lower central sextant ( $p < 0.001$ ; Table 5). Furcation involvement also enhanced with age from 5% in age 35 to 27.5% in 65+. Mean percentage was 7.2%, more

frequent in upper then lower jaw, and right then left jaw side (Table 5). Excluded sextants were more frequent lateral then central and most rarely lower central sextant ( $p < 0.001$ ; Table 5). In both jaws most frequently excluded sextant was the right one. Upper right sextant had the highest frequency of shallow and deep pockets, lower right highest frequency of gingivitis, and upper left sextant had highest frequency of healthy periodontal tissue. Although lower central sextant had highest frequency of calculus it was most rarely excluded.

Two- and three-way ANOVA indicated significant correlation of oral health and age, as well as oral health, gender and age, while connection of oral health and stress appeared in correlation of stress, gender and age ( $p < 0.05$ ). Two-way ANOVA showed connection of stress, poor oral hygiene habits and lower oral health ( $p < 0.05$ ). After all it must be consider that 50% of the population that did not exhibit war

Table 5. Prevalence of periodontal disease, loss of attachment, furcation involvement, recession >3.5mm, tooth mobility, and excluded sextants in jaw sextants in population.

Parameter	Sextant 1	Sextant 2	Sextant 3	Sextant 4	Sextant 5	Sextant 6	<i>p</i> *
CPI 0	16.1%	30.7%	26.1%	26.9%	10.9%	22.9%	0.000
CPI 1	19.4%	31.1%	15.9%	30.2%	7.7%	34.0%	0.000
CPI 2	25.6%	7.1%	22.2%	8.8%	49.0%	10.1%	0.000
CPI 3	28.3%	20.8%	25.0%	24.2%	22.7%	28.2%	0.000
CPI 4	10.6%	10.4%	10.8%	9.9%	9.7%	4.8%	0.000
Sum CPI	100%	100%	100%	100%	100%	100%	
LA 0	57.2%	61.8%	57.9%	61.0%	47.4%	59.0%	0.000
LA 1	26.7%	22.2%	26.7%	23.6%	32.4%	29.3%	0.000
LA 2	11.7%	8.0%	8.5%	8.8%	15.0%	7.5%	0.000
LA 3	2.8%	5.7%	5.1%	4.9%	4.5%	2.7%	0.000
LA 4	1.7%	2.4%	1.7%	1.7%	0.8%	1.6%	0.000
Sum LA	100%	100%	100%	100%	100%	100%	
Excluded	36.2%	24.8%	37.6%	35.5%	12.4%	33.3%	0.000
Furcation	6,0%	-	5,3%	3,9%	-	3,2%	0.000
Recession	12,4%	13,1%	11,7%	13,5%	12,4%	10,6%	0.000
Mobility	5,7%	8,2%	5,7%	6,4%	13,1%	7,4%	0.000

\*Chi-square test.

CPI 0, healthy; CPI 1, bleeding on probing; CPI 2, calculus; CPI 3, shallow periodontal pockets 4-5mm; CPI 4, deep pockets 6mm+; LA0, loss of periodontal attachment 0-3mm; LA1, 4-5mm; LA2, 6-8mm; LA3, 9-11mm; LA4, 12mm+.

stress was in age 15-29, more than 50% of the population that was in war was in the age 35-54, 30% of refugees are above 65 years and 40% of the population who had been wounded or lost a dear person have also been above 65 years. According to the multivariate discriminate analysis three canonical discriminate functions were created with stress as a grouping variable. First function illustrated 67.1% of total variability – frequency of dental visits, age, number of sextants with LA 0-3mm, bleeding, tooth replacing frequency, number of healthy sextants, excluded sextants, tooth brushing frequency, usage of auxiliary devices and LA 9-11mm, second function – number of sextants with LA 6-8mm, calculus, deep pockets and LA above 12mm (23.2%) and the third function – number of sextants with shallow pockets and LA 4-5mm (9.6% of variability).

## DISCUSSION

Almost 60% of the population in Zagreb in 2002 had a mean income per member of household above 270 euro and in the Vukovar villages this was only the case in 11% [8]. Education situation was inverse - in Zagreb 43% of the adult population finished college or university and only 8% elementary school, much higher than in the Vukovar villages 4% and 52%, respectively. In the villages of the Vukovar area there were more excluded sextants, less healthy and bleeding while the prevalence of periodontal disease was very similar to the research of Bozic in Zagreb 2002 [8]. The Zagreb population has a higher prevalence of tooth brushing - 84% of females and 68% of males brushed their teeth

more or equal to twice a day, and only 23% of population once a day or less. Frequency of dental visits was also inverse in Zagreb - 20% visited dentist less than once a year, and more than half of the population two times of more. Toothbrush replacement was also more frequent in Zagreb – only 9% replaced it once a year or less and 66% every three months. Utilization of auxiliary oral hygiene devices is also more frequent in Zagreb (21%), and more people knew what periodontitis is (55% - 64% females and 42% males). Better periodontal conditions were in Zagreb in year 2000 [9]. There was similar prevalence and severity of both periodontal disease and attachment loss in Croatian littoral and mountain villages in year 2000, but there were less excluded sextants in Vukovar villages [10]. In comparison with a previous investigation from 1986 severity of periodontal disease in the Vukovar area has decreased in age group 15 – 54 and number of excluded sextants has increased in age 35-64 [11]. Furthermore, the prevalence of advanced forms of periodontal disease has decreased and healthy periodontal tissue as well as mild forms of disease has increased in comparison to the 1986 data. Similar data on periodontal conditions are found in Zimbabwe, Slovakia and Saudi Arabia, lower periodontal health in South Africa, Namibia, Nepal, Sudan, Thailand and Vietnam, and higher in Greece, Finland, Australia, Italy and Ireland [12]. Although WHO in its global goals for oral health in the year 2000 recommended that 90% of the population aged 15-19 should have a CPI 0 code in at least 3 sextants this goal was accomplished in only 54% of population in the Vukovar village area [13, 14]. Only 11% of population aged 35-44 had CPI 0 in three sextants and

WHO suggested 75%. Even 25% of people aged 65+ had CPI 4 code in at least one sextant and WHO recommendation was not more than 10%.

According to Friedlander et al. [15] dental implications of post-war stress disorder may be extensive oral diseases because of the neglect of oral hygiene compounded by depressed mood, social withdrawal and excessive use of alcohol and tobacco. Other authors concluded that a higher prevalence of periodontal disease, temporomandibular disorders and decay can be attributed to the war and wartime conditions [16-19].

Specific socio-economic conditions in post-war areas could be significant factors for poor oral health. The psychosocial stress may induce a neglect of oral hygiene, an increase of plaque accumulation and periodontal diseases. Persons exposed to any kind of war stress had a significantly worse periodontal status and more excluded sextants than those who were not exposed to such stress experience. Better periodontal conditions had were found in individuals that were refugees, than those who were in war, wounded or lost a dear person. Individuals who were in the war rarely brushed their teeth, visited dentist and changed their toothbrushes, but more frequently drank alcohol and smoked, in comparison to other groups, especially those who have not been exposed to war stress.

The rural population in the Vukovar area five years after the war was very poor, lowly educated, and had a low level of periodontal health and unsatisfactory oral hygiene habits. Level of periodontal disease and attachment loss tended to increase with age and physical activity and decrease with education level, higher frequency of tooth brushing and toothbrush replacement, dental visits and usage of auxiliary devices. Differences between employment statuses as well as between mean income per member of household in the distribution of oral health and habits were proven to be negligible. Periodontal conditions also correlated with systemic diseases, alcohol consumption and smoking. Additional efforts must be made to improve the oral health of socially marginalized population, such as those living in small villages and post-war areas.

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