

Caries and Oral Hygiene in Children in Postwar Novi Travnik (Bosnia and Herzegovina) and Zabok (Croatia)

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ABSTRACT

The study was performed in 1997 and involved school children between the age of 6 and 12 in Novi Travnik, Bosnia and Herzegovina (n = 203) and Zabok, Croatia (n = 132). OHI-S (Simplified Oral Hygiene Index by Green-Vermillion) and DMF (Decayed, Missing, Filled) index were used as main outcome measures. Prewar data were taken from the respective literature. The value of the DMF/dmf (PERMANENT/deciduous teeth) for six-year-olds in Novi Travnik of the period before the war was: d = 5.6, m = 0.4, f = 0.6 and D = 0.3, F = 0.1 and the average DMF index of twelve-year-olds for the same period were 6.5. The DMF/dmf index in 1997 in Novi Travnik was: d = 9.4±4.4; m = 0.7±1.1; D = 1.9±1.2 and average DMF index of twelve-year-olds was 9.0±4.16. The DMF index of twelve-year-olds in Zabok in 1990 was 3.4 and 4.1±2.1 in 1997. Total DMF index for all the examined ages in 1997 for Zabok was 6.1±3.7 and for the examinees in Novi Travnik 10.5±4.1 (p<0.001). Similarly, the OHI-S in 1997 for Zabok was 1.0±0.7 whereas 1.7±0.7 (p<0.001) in Novi Travnik. In comparison to prewar data, DMF index in 1997 was considerably higher. Increase of DMF index was higher in Novi Travnik than in Zabok, which can be attributed to the war and wartime conditions.

Key words: war, DMF index, OHI-S index

Introduction

Dental caries is one of the most wide spread diseases in the world. It affects all populations and all age groups¹. Dental plaque is closely linked to the formation

of caries; therefore it is necessary to remove it²⁻⁵. The American Dental Association Council on Dental Therapeutics⁶ recommended a three-minute for teeth brushing. In everyday life it is, however, usual to brush around 60 seconds to achieve a complete removal of plaque, which eventually diminishes the development of caries⁷. Dental caries is a disease rather difficult to eradicate due to a complicated interaction of social, cultural, biological factors as well as different nutritional habits, which all have a strong influence on the development of caries¹. Any change of living conditions can cause the change of living habits. Wartime conditions can change any of the previously mentioned factors, thus increase the risk for developing new cavitations. In war situation, there can be no health, basic human needs cannot be fully met, health care and public health services cannot be optimally provided, and healthy and safe physical and socio-cultural environments cannot exist^{8,9}.

The aim of present study was to investigate the extent to which war can change everyday habits of keeping oral hygiene as well as the effect that the lack of such might have on the prevalence of dental caries. Therefore, the research conducted in 1997 in Novi Travnik as well as in Zabok tried to examine the Simplified Oral Hygiene Index (OHI) according to

Green-Vermillion¹⁰ and Decayed, Missing, Filled (DMF) index according to the standards of WHO for the basic survey methods in dentistry¹¹ and those of the British association for the epidemiological surveys in dentistry¹².

Materials and Methods

This study was conducted in 1997 on the population of school children in two towns: Novi Travnik in Bosnia and Herzegovina and Zabok in Croatia. Novi Travnik was chosen as the war area in which we tried to prove war influence on dental health. However, considering that in Bosnia and Herzegovina there was not any similar area that had not been affected by war, we choose Zabok in Croatia because it was similar by the number of inhabitants with Novi Travnik, and since both towns were parts of the same state before the war. In Novi Travnik, children from two different schools were examined: Elementary school 'Novi Travnik' and Elementary School 'Jozo Gadžić Čupo' (n = 203 or 61%). In Zabok, children from the Elementary School 'Ksaver Šandor Đal-ski' were examined (n = 132 or 39%). The study included children from the first, second, fourth and sixth grade (Table 1).

The examination was carried with a sharp dental probe and a mirror. We also use one artificial light source from dental

TABLE 1
DEMOGRAPHIC DATA ON CHILDREN IN NOVI TRAVNIK (N=203) AND ZABOK (N=132) INCLUDED IN THE STUDY (1997)

Age	Novi Travnik			Zabok		
	Boys	Girls	Total	Boys	Girls	Total
12 yr.	12	22	34	8	20	28
11 yr.	11	8	19	8	6	14
10 yr.	22	18	40	10	10	20
8 yr.	8	9	17	7	7	14
7 yr.	43	36	79	14	24	38
6 yr.	5	9	14	6	12	18
Total	101	102	203	53	79	132

chair. Probing was conducted by one examiner (author B.J.). Intraexaminer reproducibility was assessed and 79% range was found. Two questionnaires were prepared: one for the children and it included questions about how and when they brush their teeth and the other for the parents containing questions about oral hygiene, as well as those regarding the frequency of their visits to the dentist. The following step was to calculate DMF and OHI-S indexes. The indexes were calculated according to the age groups; 1985, 1986, 1987, 1989, 1990, 1991. Data regarding the children born in 1988 were not calculated since there were not enough examinees to obtain a valuable statistical analysis. The data obtained for DMF index in Novi Travnik in 1997 were compared to prewar data for Bosnia and Herzegovina and the data obtained for the DMF index in Zabok in 1997 were compared to prewar data for Croatia. Further on, the upper and lower jaw was divided in sections each comprising 3 sextants, and the OHI-S index according to Green and Vermilion was obtained.

Data was analyzed using one- or two-way analysis of variance with LSD *post hoc* test. To ensure that data was eligible for ANOVA, key prerequisites (regularity of distribution and homogeneity of variances) were tested. Relevant value for statistical analysis was $p = 0.05$.

Results

Prevalence of caries in both environments

Total DMF (DMF+dmf) index for the examinees in Zabok ($n = 132$) in 1997 was 6.1 ± 3.7 , while for those in Novi Travnik ($n = 203$) it was 10.5 ± 4.1 ($p < 0.001$). The examinees in Novi Travnik had significantly worse results in all segments of the DMF especially according to decayed (D) and filled (F) teeth. Children in Novi Travnik not only had a lot of caries, but

they also had a small number of teeth which have been treated with a filling (Figure 1). Children from Novi Travnik had more decayed teeth ($p < 0.001$). Also, there were statistically important differences in the number of decayed teeth with caries among the examinees of a different age. Younger examinees had more teeth with caries than the elder ones ($p < 0.001$). Two ways analysis of variance revealed statistically significant differences between the examinees in Zabok and those in Novi Travnik with regard to the number of extracted teeth. The examinees in Novi Travnik had a significantly greater number of extracted teeth ($p < 0.001$). Younger examinees, especially in Zabok, had more extracted teeth than the elder ones ($p > 0.050$). This can be explained by the fact that children in Zabok more frequently visited the dentists than do the children in Novi Travnik. »Only when it hurts» was the answer of 68.5% of the children in Novi Travnik to the question »how often do you go to the dentist», whereas in Zabok 38% gave this answer. »I never go to the dentist» was the answer of 7.9% in Novi Travnik and of only 0.7% in Zabok. 10.3% of the examinees in Novi Travnik visited the dentist twice a year and in Zabok the percentage was 47%. There was a uniform growth of the value

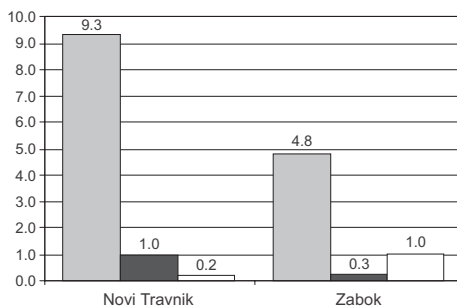


Fig. 1. Relation between the components of DMF index in two towns in 1997. (Grey bars – decayed teeth; closed bars – missing teeth; open bars – filled teeth.)

of the DMF index from younger to the older age with the exception of the children born in 1989, when we can see a sudden growth of the value especially for the decayed (D) and missing (M) component. It is primary dentition that causes the increase of the value of the total DMF index (Table 2). However, the caries of the permanent teeth of the children of this age was also significant, which can be attributed to the transmission of caries from deciduous teeth to the neighboring permanent teeth.

Oral hygiene

The association of oral hygiene and the dental health level has been established by the two ways analysis of variance. The DMF index for post war period in Novi Travnik was higher than in Zabok ($p < 0.001$). Statistically important differences were displayed between the examinees who do not brush their teeth compared to those who do once a day (morning or evening) and those who brush twice a day (both morning and evening) in both towns. Low oral hygiene increases

TABLE 2
DENTAL STATUS FINDINGS (MEAN ± SD) FOR PERMANENT TEETH (D), DECIDUOUS TEETH (d) AND TOTAL OF PERMANENT TEETH AND DECIDUOUS TEETH (D+d) IN CHILDREN IN NOVI TRAVNIK AND ZABOK IN 1997*

Age	6 Teeth	Dental status, findings in town								
		D			d			D+d		
		Novi Travnik	p	Zabok	Novi Travnik	p	Zabok	Novi Travnik	p	Zabok
12x	Decayed	7.6±4.5	<0.001	2.5±1.8	0.1±0.7	<0.867	0	7.7±4.4	<0.001	2.5±1.4
	Missing	0.7±1.1	<0.001	0.1±0.4	0	<1.0	0	0.7±1.1	<0.054	0.1±0.4
	Filled	0.6±1.2	<0.001	1.5±2.0	0	<1.0	0	0.6±1.2	<0.003	1.5±2.0
11	Decayed	7.2±4.4	<0.001	4.2±2.8	0.9±2.4	<0.275	0	8.1±4.9	<0.001	4.2±2.8
	Missing	1.3±1.6	<0.001	0	0.1±0.3	<0.715	0	1.4±1.5	<0.001	0
	Filled	0.2±0.5	<0.001	1.8±1.1	0	<1.0	0	0.2±0.5	<0.001	1.8±1.1
10	Decayed	4.0±3.1	<0.017	1.4±1.4	4.0±3.2	<0.001	2.2±2.6	8.1±3.6	<0.001	3.6±3.4
	Missing	0.8±1.1	<0.001	0	0.3±0.5	<0.295	0.1±0.2	1.0±1.2	<0.002	0.1±0.2
	Filled	0.1±0.5	<0.001	1.0±1.8	0.4±1.8	<0.030	0.4±0.6	0.3±1.8	<0.001	1.4±1.7
8	Decayed	3.5±1.7	<0.194	1.6±1.5	7.2±3.3	0	5.8±1.8	10.8±3.3	<0.001	7.4±2.7
	Missing	0.5±0.8	<0.109	0	1.0±1.3	<0.001	0.1±0.4	1.5±1.2	<0.001	0.1±0.4
	Filled	0	<0.001	0.1±0.5	0	<1.0	0.1±0.4	0	<0.001	0.3±0.6
7	Decayed	2.7±2.0	<0.797	1.3±1.6	7.7±3.1	<0.001	4.7±3.7	10.3±3.6	<0.001	6.1±4.3
	Missing	0.5±0.2	<0.473	0	0.9±1.4	<0.001	0.3±0.7	0.9±1.4	<0.003	0.3±0.7
	Filled	0.1±0.5	<0.001	0.2±0.7	0.1±0.3	<0.717	0.5±1.1	0.1±0.5	<0.001	0.7±1.1
6	Decayed	1.9±1.6	<0.498	0.8±0.9	9.4±4.0	<0.001	4.7±2.7	11.4±4.3	<0.001	5.5±2.7
	Missing	0	<0.511	0	0.7±1.0	<0.025	0.9±2.3	0.7±1.0	<0.126	0.9±2.3
	Filled	0	<0.001	0	0	<1.0	0.4±1.0	0	<0.001	0.4±1.0

* Number of examinees in Novi Travnik according to age is: 12=34, 11=19, 10=40, 8=17, 7=79, 6=14, and for Zabok 12=28, 11=14, 10=20, 8=14, 7=38, 6=18.

x Before the 1991-1995 war data: Novi Travnik (11): DMF=6.47; Zabok DMF=3.4 (14)

the DMF in Novi Travnik as well as in Zabok ($p = 0.796$).

Analysis of the DMF and the OHI-S index in their relation to the frequency of teeth brushing has shown that the values of both indexes were lowest in examinees who brushed their teeth twice a day (morning and evening) ($p < 0.005$ and $p < 0.050$ for DMF and OHI-S, respectively).

Those examinees that brushed their teeth once a day, whether it is morning or evening, had similar values of OHI-S and DMF index. The examinees who do not brush their teeth had the worst results of both indexes (Tables 3 and 4).

Discussion

This study detected some differences of the DMF index of the six-year olds in two towns, which moved from 6.83 in Zabok to 12.07 in Novi Travnik. When compared the DMF index in Novi Travnik (Table 2) to the results of Maglajlić et al.¹³, from 1990 ($d = 5.57$, $m = 0.44$, $f = 0.55$, $D = 0.28$ and $F = 0.11$), a significant

increase in DMF index was noted. That can be attributed to the living conditions in the wartime, poor health care organization in that period of time¹⁴. Those values of the DMF are rather high when compared to those of some European countries. Thus, for example, the DMF of a six-year-olds in France is 0.3, in Finland 1.2, and in Norway 0.6¹⁵. The DMF index of a twelve-year-olds in 1997 was 4.1 in Zabok and 9.0 in Novi Travnik. According to the criteria of the World Health Organization¹⁵, the DMF ranging from 2.7 to 4.4 is considered to be of a medium value (Zabok), whereas the DMF which is higher than 6.6 is very high (Novi Travnik). Still, when compared to the values in some European countries, the values of the DMF in Zabok, where the situation was a lot better than in Novi Travnik are rather high. For example, the DMF of a twelve-year-olds in France is 3.4, in Finland 4.0 and in Norway 5.2¹⁵. When compared the DMF index twelve-year-olds in Novi Travnik (Table 2) to the results obtained by Maglajlić et al.¹³ in 1990 (DMF = 6.47), a significant increase

TABLE 3
FINDINGS (MEAN ± SD) OF DMF IN RELATION TO FREQUENCY OF BRUSHING TEETH FOR NOVI TRAVNIK AND ZABOK

Time of teeth brushing	Novi Travnik	p	Zabok
Does not brush	11.1 ± 3.9	<0.001	7.4 ± 4.7
Morning	10.2 ± 4.6	<0.005	5.8 ± 2.0
Evening	10.1 ± 4.1	<0.013	5.8 ± 3.6
Morning and evening	8.7 ± 3.8	<0.226	5.7 ± 3.3

TABLE 4
AVERAGE VALUES (±SD) OF OHI IN RELATION TO FREQUENCY OF BRUSHING TEETH FOR NOVI TRAVNIK AND ZABOK

Time of teeth brushing	Novi Travnik	p	Zabok
Does not brush	1.9 ± 0.7	<0.001	1.2 ± 0.7
Morning	1.7 ± 0.7	<0.004	1.1 ± 0.8
Evening	1.6 ± 0.7	<0.021	1.2 ± 0.7
Morning and evening	1.2 ± 0.3	<0.994	1.0 ± 0.7

of the DMF index for this population as for that of the six-year olds was found. On the other hand, the values of the DMF index of the twelve-year olds in Zabok (DMF = 4.14) compared to the results of Rajić et al., for the Republic of Croatia in 1990 (DMF = 3.4)¹⁶, displays the increase of the value of the DMF index, but it is not so distinguished as in Novi Travnik. The worsening of the DMF index that has been noted at six and twelve-year-old children in Novi Travnik matches the results of Ivanković et al.¹⁷, who also proved the DMF index worsening at both populations in Bosnia and Herzegovina. The OHI-S index was everywhere between 1 and 2, with higher values of a greater statistical importance in Novi Travnik in relation to the values in Zabok. When it comes to the OHI-S there is a strong tendency of its decrease in Zabok, whereas in Novi Travnik it is increasing with age. This difference could be explained by the harsh living conditions in the wartime period, including difficult water and food supply and the poor health protection organization in that period. The same causes were responsible for the increase of the DMF index in relation to prewar period. It is also interesting that in both surroundings the

DMF index was the highest in children born in 1989. That increase of the DMF index value can be explained with the fact that the first permanent molars and the first permanent incisors were grown and were contaminated with caries from deciduous teeth. These children had the highest OHI-S index as well. It seems that the influence of the wartime conditions was greatest with this generation. The connection of the oral hygiene and the DMF index is not in accordance with the results of Tubert-Jeanin et al.¹⁸, who have not found a statistically significant correlation between the frequency of brushing and the DMF index. Dummer et al.¹⁹ and Beck et al.²⁰ have shown some important differences between the appearance of caries and the frequency of teeth brushing. Mascharenhas²¹ has shown that with the persons with bad oral hygiene caries more easily penetrates from the enamel into the dentin. The drawback of this study might be the fact that the results have been compared to the data of other authors and other countries for the same age group. Only a repeated examination would give the real answers and therefore such an examination is being prepared.

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KARIJES I ORALNA HIGIJENA U POSLIJERATNE DJECE U NOVOM TRAVNIKU (BOSNA I HERCEGOVINA) I ZABOKU (HRVATSKA)

S A Ž E T A K

Cilj ovog rada bio je posredno procijeniti utjecaj ratnih prilika života na stanje oralne higijene i pojavnost karijesa u populaciji školske djece u Hrvatskoj i Bosni i Hercegovini. Ispitivanje je provedeno 1997. godine i uključilo je djecu školske dobi između 6 i 12 godina života u Novom Travniku, Bosna i Hercegovina ($n = 203$) i Zaboku, Hrvatska ($n = 132$). U istraživanju su rabljeni OHI-S (Simplified Oral Hygiene Index prema Green-Vermillionu) i DMF (Decayed, Missing, Filled) indeksi. Predratni podaci su uzeti iz priznate literature. Vrijednosti za DMF/dmf (TRAJNI/mliječni zubi) indeks za šestogodišnjake u Novom Travniku za predratni period je bio: $d = 5.6$, $m = 0.4$, $f = 0.6$ i $D = 0.3$, $F = 0.1$, a prosječni DMF indeks dvanaestogodišnjaka za isti period bio je 6,5. DMF/dmf 1997. godine u Novom Travniku bio je: $d = 9.4 \pm 4.4$; $m = 0.7 \pm 1.1$; $D = 1.9 \pm 1.2$ a prosječni DMF indeks za dvanaestogodišnjake je bio $9,0 \pm 4,16$. DMF indeks za dvanaestogodišnjake u Zaboku je bio 3,4 1990. godine a 1997. godine bio je $4,1 \pm 2,1$. Ukupni DMF indeks za sva ispitivana godišta bio je 1997. godine $6,1 \pm 3,7$ u Zaboku a u Novom Travniku $10,5 \pm 4,1$ ($p < 0.001$). Slično tome, vrijednost OHI-S za 1997. godinu za Zabok bila je $1,0 \pm 0,7$ a za Novi Travnik $1,7 \pm 0,7$ ($p < 0.001$). U usporedbi sa predratnim podacima, vrijednost DMF indeksa 1997. godine bila je značajno viša. Porast vrijednosti DMF indeksa bio je veći u Novom Travniku u odnosu na Zabok, što se može pripisati ratu i ratnim uvjetima života.