



## Oral health-related quality of life among Belgrade adolescents

### Kvalitet života u funkciji oralnog zdravlja beogradskih adolescenata

Milica Gajić, Maja Lalić, Katarina Kalevski, Marjan Marjanović

University Business Academy in Novi Sad, Faculty of Dentistry, Pančevo, Serbia

#### Abstract

**Background/Aim.** Adolescents are vulnerable group in term of acquisition of oral health-related knowledge, habits and attitudes. That is why the aim of this study was to investigate the associations between dental status, dental anxiety and oral health-related behavior and oral health-related quality of life as captured by Oral Impacts on Daily Performances (OIDP) index. **Methods.** This cross-sectional survey included representative sample of 404 adolescents (15 years old), randomly recruited from high schools in Belgrade, Serbia. The adolescents were interviewed using Serbian versions of eight-item OIDP index, Hiroshima University Dental Behavior Inventory (HU-DBI) and modified Corah's Dental Anxiety Scale (MDAS). Three previously trained and calibrated dentists examined the subjects in the classrooms to determine the oral health status of adolescents [the Decayed, missing, filled teeth (DMFT) index and visual signs of gingivitis]. **Results.** At least one oral impact was reported in 49.50% of adolescents. Most frequently, oral health problems affected eating (26.73%), tooth cleaning (27.47%) and sleep and relaxation (16.83%). In comparison with adolescents without oral impacts, the adolescents with at least one oral impact reported, had higher DMFT score, more often reported problems with bleeding gums, usage of hard toothbrush, worries about the color of their teeth and seeing the dentist because of the symptoms. Logistic regression showed that dental anxiety (MDAS score), dental behavior (HU-DBI score) and worrying about the color of the teeth significantly affected OIDP score. **Conclusion.** Oral health-related quality of life among adolescents was affected by their behavior and dental anxiety levels. Implementing public health policies that target adolescents with poor oral health or bad habits might be helpful in improving their oral health-related quality of life.

#### Key words:

adolescent; oral health; quality of life; surveys and questionnaires; serbia.

#### Apstrakt

**Uvod/Cilj.** Adolescenti predstavljaju osetljiviji deo populacije u smislu sticanja znanja, navika i odnosa prema oralnom zdravlju. Stoga, cilj istraživanja je bio da se utvrdi povezanost stanja oralnog zdravlja, straha od stomatologa i ponašanja u vezi sa oralnim zdravljem i njegovog uticaja na kvalitet života. Merenje je izvršeno pomoću upitnika „Uticaj oralnog zdravlja na svakodnevne aktivnosti“ (OIDP). **Metode.** Studijom preseka bila su obuhvaćena 404 adolescenata uzrasta od 15 godina, odabrana metodom slučajnog uzorka iz srednjih škola sa područja Beograda. Adolescenti su anketirani pomoću srpskih verzija upitnika OIDP, upitnika Univerziteta Hirošima za procenu ponašanja u vezi sa oralnim zdravljem (HU-DBI) i modifikovane Korahove skale dentalne anksioznosti (MDAS). Tri prethodno obučena i standardizovana istraživača pregledala su ispitanike u učionicama kako bi utvrdili stanje njihovog oralnog zdravlja [indeks karijes, ekstrakcija, plomba (KEP) i prisustvo gingivitisa]. **Rezultati.** Najmanje jedan negativan uticaj na oralno zdravlje zabeležen je kod 49,50% adolescenata. Problemi u vezi sa oralnim zdravljem najčešće su ometali ishranu (26,73% adolescenata), pranje zuba (27,47%), san i odmor (16,83%). Kod adolescenata sa barem jednim negativnim uticajem oralnog zdravlja na svakodnevne aktivnosti, zabeležen je viši KEP indeks, češće krvarenje desni, upotreba tvrde četkice za zube, zabrinutost zbog boje zuba i odlazak kod stomatologa zbog simptoma, u poređenju sa ispitanicima kod kojih oralno zdravlje nije uticalo na kvalitet života. Logističkom regresijom utvrđeno je da dentalna anksioznost (MDAS skor), ponašanje u vezi sa oralnim zdravljem (HU-DBI skor) i zabrinutost zbog boje zuba značajno utiču na kvalitet života meren pomoću upitnika OIDP. **Zaključak.** Ponašanje adolescenata kada je u pitanju oralno zdravlje i strah od stomatologa utiču na njihov kvalitet života. Uvođenje javnozdravstvenih strategija za zaštitu adolescenata sa lošim oralnim zdravljem i lošim navikama mogao bi da unapredi njihov kvalitet života.

#### Ključne reči:

adolescenti; usta, zdravlje; kvalitet života; ankete i upitnici; srbija.

## Introduction

Adolescents are vulnerable group in terms of acquisition of oral health-related knowledge, habits and attitudes. Due to their dynamic physical and psychoemotional development, the pre-established habits are being changed and new patterns of behavior and value systems are being formed under the influence of their immediate environment, peers and informal groups, which might increase the risk of impairing one's health. Smoking, inadequate nutrition, "forgetting" about the oral hygiene, and a lack of understanding of the risks arising from existing forms of inadequate health behavior, may adversely affect the oral health of adolescents<sup>1</sup>. Risk behavior not only affect clinical aspects of oral health, but may also have a negative impact on adolescents' oral health-related quality of life. To measure oral health-related behavior, Kawamura<sup>2</sup> developed Hiroshima University Dental Behavior Inventory (HU-DBI) which contains twenty questions mostly related to oral hygiene behavior. Studies that compared the oral health-related attitudes and behaviors among dental students around the world, using HU-DBI questionnaire translated into several languages, revealed significant differences among students from different countries and cultural groups<sup>3,4</sup>. This indicates that HU-DBI index can be used to assess dental behavior worldwide.

The modern concept of oral health care for adolescents implies that the focus of attention is transferred from clinical parameters onto broader health determinants - psychological, social and physiological. Impact of impaired oral health on everyday life is subtle and pervasive, influencing eating, sleep, work and social roles. Therefore, comprehensive evaluation of oral health should not be based solely on clinical data but connected with clinical findings. In order to assess the impact of oral health conditions on quality of life, different scales have been developed. Most of them are designed and tested on adult population. Among the scales that measure the impact of oral health on daily activities of adolescents for their reliability and validity in different cultural environments the one that stands out is "Oral Impacts on Daily Performances" (OIDP)<sup>5</sup>. Serbian version of OIDP was introduced in 2012 and applied to geriatric population<sup>6</sup>.

The aim of this study was to examine how dental anxiety, oral health-related behavior and clinical parameters of adolescents oral health affect their oral health-related quality of life as captured by OIDP index.

## Methods

This cross-sectional study included 404 first grade secondary school students (aged 15 years). Subjects were randomly recruited from the list provided from ten previously randomly selected schools from different municipalities in the city of Belgrade.

Data regarding oral health behavior were collected using a Serbian version of the English HU-DBI<sup>2</sup>. Questions have two possible forms of answers (agree/disagree). Quantitative assessment of the attitudes and behaviors related to oral health can be determined on the basis of the total

number of adequate responses with a maximum score of 12. Higher score indicates more appropriate oral health-related attitudes and behavior<sup>7</sup>. In calculating the HU-DBI score, 1 point was awarded for each "agree" answer to questions 4, 9, 11, 12, 16 and 19, and for each "disagree" answer to questions 2, 6, 8, 10, 14 and 15. Three additional questions regarding oral hygiene and smoking habits were included in the final Serbian version of HU-DBI questionnaire, with no impact on HU-DBI score.

The estimation of the quality of life in relation to oral health of adolescents was measured using OIDP questionnaire. The OIDP index refers to oral impacts the subjects experienced due to their mouth and teeth problems, during the previous 6 months period, in relation to: 1) eating, 2) speaking and pronouncing clearly, 3) cleaning teeth, 4) sleeping and relaxing, 5) smiling without embarrassment, 6) maintaining emotional state, 7) enjoying contact with other people and 8) carrying out major school work. The scale used was in the range: (0) "never" or "less than once a month", (1) "once or twice a month", (2) "once or twice a week" (3) "3-4 times a week", (4) "every or nearly every day". We used the shortened version of the OIDP questionnaire with unweighted frequency scores.<sup>6</sup> Total score was calculated by adding the 8 OIDP items, with the possible scope ranges from 0 to 32. For analysis, dummy variables were constructed yielding the categories 0 = "never affected" (including the original category 0) and 1 = "affected less than once a month or more often" (including the original categories 1-4).

Dental anxiety levels in adolescents were measured using a modified version of Corah's Dental Anxiety Scale (MDAS)<sup>8</sup>. This scale estimates respondents' feelings the day before going to the dentist, during his/her stay in the waiting room, in the chair before the intervention starts, at the beginning of the intervention and while receiving anesthesia. Answers were ranked on a scale from 0 to 4, with 0 - denoting not frightened at all; 1 - a little frightened; 2 - moderately frightened; 3 - quite frightened; 4 - extremely frightened.

Clinical dental examination was undertaken by three previously trained and calibrated dentists in school classrooms, under natural light. The number of healthy, decayed, filled and missing teeth (DMFT) index was recorded, as well as the presence of the visual signs of gum inflammation (redness and gingival enlargement).

The SPSS 17.0 (SPSS, Inc., Chicago, IL, USA) program was used to analyze the data. Simple frequency tables and descriptive statistics (means and standard deviations) were processed and analyzed by  $\chi^2$  and Fisher's exact tests. Differences in DMFT score and its components in relation to agree/disagree responses of HU-DBI questionnaire were assessed using independent samples *t*-test.

Pearsons' correlation coefficient was calculated for OIDP items. The influence of clinical parameters for assessing oral health, oral health-related behavior and dental anxiety on the quality of oral health was evaluated using logistic regression.

The significance level established for all analyses was  $p < 0.05$ .

## Results

### Clinical examination

All healthy teeth (DMFT = 0) were found in only 35 (8.66%) patients. Less than a third of respondents (119 adolescents, 29.46%) had no untreated teeth at the time of examination [decayed or carious teeth (DT) = 0]. Average number of [decayed teeth was DT = 2.65 ± 0.14 (Table 1). Average number of filled teeth (FT), which represents treated dental pathology, was mean ± SD = 2.71 ± 0.14, denoting a rather low dental treatment rate. The presence of gingival inflammation (redness, swelling and/or bleeding from marginal gingiva) was observed in 74.9 % of adolescents.

and 22 (Table 3). Agreement with the statement “I go to see the dentist at least ones a year” was related with significantly lower DMFT ( $p < 0.01$ ) and FT ( $p < 0.05$ ). Agreement with the statement “My gums bleed when I brush my teeth” was related to higher DMFT score, DT and MT components ( $p < 0.05$ ). A significant correlation was observed between negative attitude “I think that I cannot help having false teeth when I am old” and high MT component ( $p < 0.05$ ). Subjects who agreed with the statement “I think my teeth are getting worse despite my daily brushing” had higher DMFT score and higher DT component ( $p < 0.01$ ). Subjects who received feedback from their dentist regarding their brushing efficacy had lower DMFT score, DT and MT components ( $p < 0.01$ ).

**Table 1**  
**Hiroshima University-Dental Behavioural Inventory (HU-DBI) score and oral health status of adolescents [composition of decayed, missing, filled teeth (DMFT) index] according to the gender**

Parameter	Males	Females	$p^*$
	$\bar{x} \pm SD$	$\bar{x} \pm SD$	
HU-DBI score	6.22 ± 1.44	6.28 ± 1.450	0.674
Healthy teeth, n	23.24 ± 3.396	21.88 ± 4.325	0.003
Decayed teeth, n	2.77 ± 3.005	2.61 ± 2.685	0.594
Missing teeth, n	0.28 ± 0.679	0.58 ± 1.033	0.005
Filled teeth, n	1.93 ± 2.067	2.99 ± 3.077	0.001
DMFT	4.95 ± 6.16	3.357 ± 4.214	0.003

$\bar{x}$  – mean value; SD – standard deviation; \*  $p$  value for Fisher's  $\chi^2$  – test.  
 $p < 0.05$  was considered statistically significant.

### Oral health-related behavior

Adolescents expressed moderately acceptable oral health-related behavior measured by HU-DBI questionnaire. HU-DBI score ranged from 2 to 11 with average value of 6.27 ± 0.27. The female subjects had a higher score (6.28 ± 1.45) compared with male subjects (6.22 ± 1.45;  $p < 0.05$ ). HU-DBI questionnaire items and percentage of agree/disagree responses are presented in Table 2. Dental visits at least once a year were reported by 67.3% adolescents, more often by girls ( $p < 0.05$ ). Bleeding gums were reported by 18.4% of participants; 65.1% answered that it was impossible to prevent gum disease with only toothbrushing. Majority of subjects (70.7%) reported that they had been professionally taught how to brush their teeth, girls more often than boys ( $p < 0.05$ ). Toothpaste was considered necessary for brushing in 91.8% of subjects, more often among girls ( $p < 0.05$ ). Almost half of the subjects used toothbrush with hard bristles and brushed with hard strokes, girls more often than boys ( $p < 0.05$ ). Postponing of dental visits until toothache was reported by 47.1% of adolescents. Majority of subjects reported brushing twice a day or more often (86.2%), girls more often than boys ( $p < 0.001$ ), but only 13.4% reported regular flossing and 30.3% daily use of mouth rinses. Nearly one quarter of adolescents (23.3%) reported smoking cigarettes every day.

Significant differences between DMFT, DT, missed teeth (MT) or FT values in relation to agree/disagree HU-DBI responses were found in Items 1, 2, 5, 6, 13, 14, 16, 18, 19

Those who were satisfied with the appearance of their teeth had significantly lower DMFT score, DT, MT and FT components ( $p < 0.01$ ).

### Dental anxiety

Adolescents expressed moderate dental anxiety levels. Dental anxiety score ranged from 5 to 25, with the mean of 12.16 ± 5.47. Girls were significantly more anxious compared with boys (12.86 ± 5.54 vs. 10.36 ± 4.8, respectively;  $p = 0.001$ ).

### Oral health-related quality of life

At least one oral impact was reported in 49.50% of adolescents. The frequency of oral impacts was greater in females (53.08%) than males (40.54%),  $\chi^2 = 5.06$ ;  $p = 0.024$ . Oral health most frequently affected eating and enjoying food (26.73%), tooth cleaning (27.47%), and sleep and relaxation (16.83%), while least severe impacts affected speaking and pronouncing words (6.19%) and social life of adolescents (6.93%).

Table 4 shows correlation matrix for OIDP frequency scores (1–8). The inter-item correlation coefficients among the eight OIDP items ranged from 0.05 (between eating and emotional status) to 0.57 (between showing teeth and carrying out work). There were no negative correlation coefficients, indicating the homogeneity among the items.

Table 2

**Percentage of agree and disagree Hiroshima University-Dental Behavioural Inventory (HU-DBI) items according to the gender**

HU-DBI Item	Gender, n (%)		Total	p
	M	F		
1. I go to see the dentist at least ones a year				
agree	84 (21.0)	185 (46.3)	269 (67.3%)	0.032
disagree	27 (6.8)	104 (26.0)	131 (32.8%)	
2. My gums bleed when I brush my teeth				
agree	24 (6.0)	50 (12.4)	74 (18.4)	0.316
disagree	87 (21.6)	241 (60.0)	328 (81.6)	
3. I am worried about the color of my teeth				
agree	50 (12.5)	106 (26.6)	156 (39.1)	0.135
disagree	60 (15.0)	183 (45.9)	243 (60.9)	
4. I've noticed some white sticky deposits on my teeth				
agree	20 (5.0)	42 (10.5)	62 (15.5)	0.440
disagree	91 (22.7)	248 (61.8)	339 (84.5)	
5. I think that I cannot help having false teeth when I am old				
agree	30 (7.5)	81 (20.3)	111 (27.8)	0.901
disagree	81 (20.3)	208 (52.0)	289 (72.3)	
6. I think my teeth are getting worse despite my daily brushing				
agree	21 (5.2)	35 (8.7)	56 (14.0)	0.106
disagree	90 (22.4)	255 (63.6)	345 (86.0)	
7. I brush each of my teeth carefully				
agree	56 (13.9)	146 (36.2)	202 (50.1)	1.000
disagree	55 (13.6)	146 (36.2)	201 (49.9)	
8. I have never been professionally taught how to brush				
agree	42 (10.4)	76 (18.9)	118 (29.3)	0.027
disagree	69 (17.1)	216 (53.6)	285 (70.7)	
9. I think I can clean my teeth without using toothpaste				
agree	15 (3.7)	18 (4.5)	33 (8.2)	0.024
disagree	96 (23.8)	274 (68.0)	370 (91.8)	
10. I often check my teeth in a mirror after brushing				
agree	101 (25.1)	279 (69.2)	380 (94.3)	0.093
disagree	10 (2.5)	13 (3.2)	23 (5.7)	
11. I worry about having bad breath.				
agree	91 (22.9)	236 (59.4)	327 (82.4)	0.907
disagree	19 (4.8)	51 (12.8)	70 (17.6)	
12. It is impossible to prevent gum disease with tooth brushing alone				
agree	63 (16.1)	192 (49.0)	255 (65.1)	0.281
disagree	41 (10.5)	96 (24.5)	137 (34.9)	
13. I put off going to the dentist until I have a toothache				
agree	53 (13.2)	136 (33.9)	189 (47.1)	0.823
disagree	57 (14.2)	155 (38.7)	212 (52.9)	
14. I have used a dye to see how clean my teeth are				
agree	8 (2.0)	22 (5.5)	30 (7.5)	0.927
disagree	101 (25.4)	267 (67.1)	368 (92.5)	
15. I use a toothbrush with hard bristles				
agree	42 (10.6)	142 (35.9)	184 (46.5)	0.034
disagree	69 (17.4)	143 (36.1)	212 (53.5)	
16. I don't feel I've brushed well unless I brush with strong strokes				
agree	68 (16.9)	143 (35.5)	211 (52.4)	0.034
disagree	43 (10.7)	149 (37.0)	192 (47.6)	
17. I feel I sometimes take too much time to brush my teeth				
agree	65 (16.1)	157 (39.0)	222 (55.1)	0.433
disagree	46 (11.4)	135 (33.5)	181 (44.9)	
18. I have had my dentist tell me that I brush very well				
agree	66 (16.8)	195 (49.5)	261 (66.2)	0.281
disagree	41 (10.4)	92 (23.4)	133 (33.8)	
19. I am satisfied with the appearance of my teeth				
agree	62 (15.5)	156 (38.9)	218 (54.4)	0.738
disagree	49 (12.2)	134 (33.4)	183 (45.6)	
20. I brush my teeth twice daily or more				
agree	78 (19.4)	268 (66.7)	346 (86.1)	0.0001
disagree	33 (8.2)	23 (5.7)	56 (13.9)	
21. I use dental floss every day				
agree	11 (2.7)	43 (10.7)	54 (13.4)	0.252
disagree	100 (24.9)	248 (61.7)	348 (86.6)	
22. I use mouthwash on regular basis				
agree	29 (7.3)	92 (23.0)	121 (30.3)	0.331
disagree	81 (20.3)	198 (49.5)	279 (69.8)	
23. I smoke cigarettes every day				
agree	27 (6.7)	67 (16.6)	94 (23.3)	0.793
disagree	84 (20.8)	225 (55.8)	309 (76.7)	

\*p value for Fisher's  $\chi^2$  test ( $p < 0.05$  was considered statistically significant); M – male; F – female.

**Table 3**  
**Mean decayed, missing, filled teeth (DMFT) scores and their decayed teeth (DT), missing teeth (MT) and filled teeth (FT) components in relation to the agreement/disagreement to the Hiroshima University Dental Behavioural Inventory (HU-DBI) items**

HU-DBI Item	DMFT	DT	MT	FT
1 agree/disagree	5.44**/6.69**	2.51/2.93	0.50/0.51	2.46*/3.26*
2 agree/disagree	6.80*/5.60*	3.32*/2.49*	0.81**/0.43**	2.75/2.69
3 agree/disagree	6.19/5.60	2.96/2.45	0.54/0.48	2.75/2.67
4 agree/disagree	6.44/5.71	3.22/2.54	0.58/0.48	2.69/2.71
5 agree/disagree	6.08/5.74	2.73/2.63	0.71*/0.42*	2.70/2.70
6 agree/disagree	7.18**/5.63**	3.93**/2.46**	0.52/0.50	2.78/2.69
7 agree/disagree	5.87/5.81	2.61/2.69	0.54/0.46	2.77/2.66
8 agree/disagree	5.59/5.94	2.67/2.64	0.42/0.53	2.53/2.79
9 agree/disagree	5.36/5.88	2.30/2.68	0.61/0.49	2.45/2.73
10 agree/disagree	5.85/5.61	2.65/2.65	0.49/0.61	2.73/2.45
11 agree/disagree	5.98/5.29	2.73/2.34	0.52/0.44	2.77/2.50
12 agree/disagree	5.89/5.77	2.75/2.38	0.53/0.45	2.63/2.96
13 agree/disagree	5.67/5.96	2.86/2.48	0.49/0.51	2.34*/2.99*
14 agree/disagree	7.23*/5.72*	3.40/2.56	0.63/0.49	3.31/2.68
15 agree/disagree	6.17/5.60	2.72/2.58	0.59/0.42	2.90/2.62
16 agree/disagree	6.15/5.49	2.99*/2.28*	0.62**/0.36**	2.57/2.87
17 agree/disagree	5.91/5.74	2.80/2.47	0.51/0.48	2.63/2.81
18 agree/disagree	5.42**/6.80**	2.43**/3.20**	0.40**/0.71**	2.62/2.91
19 agree/disagree	4.89***/6.96**	2.07***/3.35**	0.41*/0.61*	2.44*/3.01*
20 agree/disagree	5.92/5.39	2.68/2.54	0.50/0.50	2.75/2.44
21 agree/disagree	6.09/5.76	2.83/2.61	0.46/0.49	2.80/2.68
22 agree/disagree	6.61*/5.51*	3.02/2.49	0.57/0.47	3.03/2.59
23 agree/disagree	5.84/5.84	2.73/2.63	0.37/0.54	2.80/2.68

\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ .

Note: for HU-DBI items see Table 2.

**Table 4**  
**Correlation matrix for Oral Impacts on Daily Performances (OIDP) frequency scores (1–8)**

OIDP	Eating	Speaking	Cleaning teeth	Sleeping/relaxing	Showing teeth	Emotional status	Carrying out work	Enjoying social contact
Eating	1							
<i>r</i>								
<i>p</i>								
Speaking	0.267**	1						
<i>r</i>								
<i>p</i>	< 0.001							
Cleaning teeth	0.442**	0.300**	1					
<i>r</i>								
<i>p</i>	< 0.001	< 0.001						
Sleeping/relaxing	0.440**	0.399**	0.418**	1				
<i>r</i>								
<i>p</i>	< 0.001	< 0.001	< 0.001					
Showing teeth	0.147**	0.288**	0.231**	0.169**	1			
<i>r</i>								
<i>p</i>	0.003	< 0.001	< 0.001	0.001				
Emotional status	0.048	0.290**	0.167**	0.337**	0.160**	1		
<i>r</i>								
<i>p</i>	0.334	< 0.001	0.001	< 0.001	0.001			
Carrying out work	0.222**	0.277**	0.153**	0.283**	0.574**	0.283**	1	
<i>r</i>								
<i>p</i>	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001		
Enjoying social contact	0.100*	0.144**	0.161**	0.354**	0.207**	0.495**	0.308**	1
<i>r</i>								
<i>p</i>	0.044	0.004	0.001	< 0.001	< 0.001	< 0.001	< 0.001	

*r* – Pearson's correlation coefficient.

After OIDP score was dichotomized into 2 categories: 1) no oral impacts (OIDP score = 0) and 2) presence of oral impacts (OIDP score > 0), oral health behavior of subject who reported one or more oral impacts was compared with subjects with no oral impacts. Subjects with one or more oral impacts more frequently reported: gums bleeding during tooth brushing ( $\chi^2 = 10.28$ ;  $p = 0.001$ ); worries about the color of their teeth ( $\chi^2 = 9.18$ ;  $p = 0.002$ ); presence of white sticky deposits on their teeth ( $\chi^2 = 4.78$ ;  $p = 0.029$ ); belief that having false teeth was inevitable in older age ( $\chi^2 = 13.07$ ;  $p = 0.0001$ ); delaying to see the dentists until they had toothache ( $\chi^2 = 21.95$ ;  $p = 0.0001$ ); brushing their teeth by using strong strokes ( $\chi^2 = 19.30$ ;  $p = 0.0001$ ); less satisfaction with

extraction had greater oral impacts compared to those with no teeth extracted ( $F = 1.94$ ;  $p = 0.25$ ).

Oral health-related quality of life was better among adolescents who self-rated their oral health as good (OIDP =  $1.47 \pm 2.80$ ), compared with those who perceived their oral health as moderately good (OIDP =  $2.44 \pm 3.53$ ), or poor (OIDP =  $4.55 \pm 5.99$ ;  $F = 10.81$ ;  $p = 0.001$ ).

Correlation among HU- DBI, OIDP and MDAS score, DMFT score, DMFT components and presence of gingival inflammation were represented in Table 5. Logistic regression showed that MDAS score, HU-DBI index and worrying about the color of the teeth predominantly affected OIDP score.

**Table 5**  
**Correlation of Hiroshima University Dental Behavioural Inventory (HU-DBI) score, Oral Impacts on Daily Performances (OIDP) and Modified Dental Anxiety Scale (MDAS) score, decayed, missing, filled teeth (DMFT) score and its components, and presence of gingival inflammation**

		DBI	Gingivitis	OIDP	MDAS	DMFT	DT	MT	FT
DBI	<i>r</i>	1							
	<i>p</i>								
	<i>n</i>	404							
Gingivitis	<i>r</i>	-0.0248	1						
	<i>p</i>	0.6208							
	<i>n</i>	400	400						
OIDP	<i>r</i>	-0.1526	-0.0586	1					
	<i>p</i>	0.0021	0.2420						
	<i>n</i>	404	400	404					
MDAS	<i>r</i>	-0.1789	-0.0581	0.1045	1				
	<i>p</i>	0.0003	0.2463	0.0358					
	<i>n</i>	404	400	404	404				
DMFT	<i>r</i>	-0.0166	-0.3256	0.0629	0.0451	1			
	<i>p</i>	0.7401	< 0.0001	0.2069	0.3655				
	<i>n</i>	404	400	404	404	404			
DT	<i>r</i>	-0.0799	-0.5272	0.1339	0.1215	0.6028	1		
	<i>p</i>	0.1088	< 0.0001	0.0070	0.0146	< 0.0001			
	<i>n</i>	404	400	404	404	401	404		
MT	<i>r</i>	-0.0384	-0.0508	0.0827	0.0512	0.4430	0.0600	1	
	<i>p</i>	0.4430	0.3125	0.0980	0.3065	< 0.0001	0.2304		
	<i>n</i>	401	397	401	401	401	401	401	
FT	<i>r</i>	0.0639	0.0600	-0.0619	-0.0702	0.6736	-0.1372	0.2351	1
	<i>p</i>	0.2017	0.2328	0.2163	0.1604	< 0.0001	0.0059	< 0.0001	
	<i>n</i>	401	397	401	401	401	401	399	401

**DBI – Dental Behavioural Inventory; DT – decayed teeth; MT – missing teeth; FT – filled teeth; *r* – Pearson's Correlation coefficient; *p* – *p* value for Fisher's  $\chi^2$  test; *n* – the number of respondents/students.**

the appearance of their teeth ( $\chi^2 = 28.06$ ;  $p = 0.0001$ ).

No significant differences regarding dental visits pattern, brushing frequency, use of dental floss and mouth washes and smoking habit were obtained in subjects who reported one or more oral impacts compared to those with no impacts.

Adolescents who had untreated decayed teeth had greater mean OIDP score compared to those with fully treated teeth ( $F = 6.39$ ;  $p = 0.42$ ). Those with positive history of tooth

## Discussion

The participants of this study, were randomly selected from the population of secondary schools in Belgrade. Thus, they might have captured the variety of characteristics of 15-year-old adolescents attending secondary schools in the Serbian capital.

In our study adolescents reported acceptable oral hygiene behavior, with 86% of adolescents brushing teeth

twice a day, but high prevalence of gingivitis indicated inadequate brushing. In a study of brushing behavior in children from 32 European countries and North America, authors reported that percentage of children who brush their teeth more than once a day ranged from 16% to 80% among boys and from 26% to 89% among girls, with tendency to increase with child age in some countries, and decrease in other countries<sup>9</sup>.

Our study revealed that nearly half of subjects postponed dental visit until toothache appear, and 67% of adolescents reported at least one dental visit within past year. Symptom related dental visits prevailed over regular check-ups. In The Serbian Population Health Survey conducted by the Serbian Ministry of Health in 2006<sup>10</sup>, decrease in dental visits once a year, from 36.8% to 30.7% from 2000 to 2006, but also the increase in the number of regular dental check-ups, were reported. However, compared to the year of 2000, the percentage of children and youth who visited a dentist in the previous year, increased from 58.9% to 63.7%.

In the Central and Eastern European countries, increased prevalence of dental caries in school children and adolescents is associated with inconsistent implementation of preventive measures and lack of organized health promotion activities<sup>11</sup>. Also, high prevalence of caries in developing countries may be partly explained by the fact that the health system of these countries is still in transition<sup>12</sup>. Unfortunately, since health promotion activities in Serbia are not systematically and consistently implemented and the health care system is oriented toward treatment rather than prevention of oral diseases, high DMFT score in 15-year-old adolescents is not surprising.

Adolescents oral health status determined in this study, in terms of realized risk of developing caries and periodontal disease, is characterized by high prevalence of dental disease (with 91% of adolescents with DMFT > 0), with 45% of untreated dental decay (DT/DMFT). In a total sample, mean DMFT score was 5.84. Some other studies reported that average DMFT score in group of 15 years old subjects was 1.8

in Germany<sup>13</sup>, 3.19 in Greece<sup>14</sup>, 4.3 in Slovenia<sup>15</sup>, and 6.6 in Bosnia<sup>16</sup>.

Better oral health-related behaviors were associated with better dental status. OIDP score was affected by dental behavior, dental anxiety levels and clinical parameters of oral health. Consistent with the results reported in OIDP surveys<sup>17,18</sup>, difficulty with eating and enjoying food and cleaning teeth were the impacts most frequently reported. Untreated dental caries and history of tooth extraction were related to higher oral impact score indicating good discriminant validity of Serbian version of OIDP scale. Higher OIDP score was related with poor self-perceived oral health. Adolescents mostly rated their oral health as good, similarly to previous findings<sup>19</sup>. Östberg et al.<sup>20</sup> reported that adolescents usually gave insufficient priority to oral health, e.g. tooth cleaning, fluoride supplements and diet habits, being unaware of their own respectively regarding oral health.

Our findings might be useful in setting oral health goals and determining treatment needs in population of Serbian adolescents, as suggested by other authors<sup>21</sup>. Organization of oral health care should be planned on the basis of dental care needs. The information most commonly used in the organization of oral health care, is population dental caries experience and prevalence of clinically detectable oral health problems. However, service planning should include wider, psychosocial determinants of oral health<sup>22</sup>, since they could affect people's everyday life in a significant manner.

## Conclusion

Oral health-related quality of life in adolescents in Belgrade was affected by their behavior, dental anxiety and oral health state. Public health policies that address adolescents with poor oral health might be helpful in improving both clinical and psychosocial determinants of oral health as well as their oral health-related quality of life.

## REFERENCES

1. Brukiene V, Aleksejuniene J. An overview of oral health promotion in adolescents. *Int J Paediatr Dent* 2009; 19(3): 163–71.
2. Kawabata K, Kawamura M, Miyagi M, Aoyama H, Inamoto Y. The dental health behavior of university students and test-retest reliability of the HU-DBI. *J Dent Health* 1990; 67(40): 474–5.
3. Komabayashi T, Kawamura M, Kim K, Wright FA, Declerck D, Goiás MC, et al. The hierarchical cluster analysis of oral health attitudes and behaviour using the Hiroshima University: Dental Behavioural Inventory (HU-DBI) among final year dental students in 17 countries. *Int Dent J* 2006; 56(5): 310–6.
4. Kumar S, Motwani K, Dak N, Balasubramanyam G, Duraiswamy P, Kulkarni S. Dental health behaviour in relation to caries status among medical and dental undergraduate students of Udaipur district, India. *Int J Dent Hyg* 2010; 8(2): 86–94.
5. Adulyanon S, Vourapukjarn J, Sheiham A. Oral impacts affecting daily performance in a low dental disease Thai population. *Community Dent Oral Epidemiol* 1996; 24(6): 385–9.
6. Stancić I, Kulić J, Tihacek-Sojić L, Stojanović Z. Applicability of a Serbian version of the "Oral Impacts on Daily Performance (OIDP)" index: Assessment of oral health-related quality of life. *Vojnosanit Pregl* 2012; 69(2): 175–80. (Serbian)
7. Kawamura M, Sasahara H, Kawabata K, Inamoto Y, Konishi K, Wright FA. Relationship between CPITN and oral health behaviour in Japanese adults. *Aust Dent J* 1993; 38(5): 381–8.
8. Humphris GM, Morrison T, Lindsay SJ. The Modified Dental Anxiety Scale: validation and United Kingdom norms. *Community Dent Health* 1995; 12(3): 143–50.
9. Maes L, Vereecken C, Vanobbergen J, Honkala S. Tooth brushing and social characteristics of families in 32 countries. *Int Dent J* 2006; 56(3): 159–67.
10. Ministry of Health of the Republic of Serbia. National Health Survey Serbia, 2006. Final report. Belgrade: Ministry of Health of the Republic of Serbia; 2007.
11. Watt RG, Marinho VC. Does oral health promotion improve oral hygiene and gingival health. *Periodontol* 2000 2005; 37: 35–47.
12. Petersen PE. The World Oral Health Report 2003: Continuous improvement of oral health in the 21st century: The approach of the WHO Global Oral Health Programme. *Community Dent Oral Epidemiol* 2003; 31(Suppl 1): 3–24.
13. Schiffner U, Hoffmann T, Kerschbaum T, Micheelis W. Oral health in German children, adolescents, adults and senior citizens in 2005. *Community Dent Health* 2009; 26(1): 18–22.

14. Oulis CJ, Tsinidou K, Vadiakas G, Mamai-Homata E, Polychronopoulou A, Athanasouli T. Caries prevalence of 5, 12 and 15-year-old Greek children: a national pathfinder survey. *Community Dent Health* 2012; 29(1): 29–32.
15. Vrbic V. Reasons for the caries decline in Slovenia. *Community Dent Oral Epidemiol* 2000; 28(2): 126–32.
16. Đorđević S, Ivanović T, Žužga A, Nogo-Živanović D, Kulić L. Prevalence of Caries and Gingivitis among School Children in the Municipality of Foča. *Stom Glas S* 2012; 59(1): 22–6.
17. Åström A, Okullo I. Validity and reliability of the Oral Impacts on Daily Performance (OIDP) frequency scale: A cross-sectional study of adolescents in Uganda. *BMC Oral Health* 2003; 3(1): 5.
18. Masalu JR, Åström AN. Applicability of an abbreviated version of the oral impacts on daily performances (OIDP) scale for use among Tanzanian students. *Community Dent Oral Epidemiol* 2003; 31(1): 7–14.
19. Andersson P, Hakeberg M, Karlberg G, Östberg A. Clinical correlates of oral impacts on daily performances. *Int J Dent Hygiene* 2010; 8: 219–26.
20. Ostberg A, Jarkman K, Lindblad U, Halling A. Adolescents' perceptions of oral health and influencing factors: A qualitative study. *Acta Odontol Scand* 2002; 60(3): 167–73.
21. Krisdapong S, Prasertsom P, Rattanasimsa K, Adulyanon S, Sheiham A. Using associations between oral diseases and oral health-related quality of life in a nationally representative sample to propose oral health goals for 12-year-old children in Thailand. *Int Dent J* 2012; 62(6): 320–30.
22. Gherunpong S, Tsakos G, Sheiham A. A sociodental approach to assessing dental needs of children: Concept and models *Int J Paediatr Dent* 2006; 16(2): 81–8.

Received on October 27, 2015.

Revised on December 03, 2015.

Accepted on April 27, 2016.

Online First November, 2016.