Oral Health Attitudes and Behavior of Dental Students at the University of Zagreb, Croatia

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Abstract: The aim of this study was to investigate oral health behavior and attitudes of dental students in years 1 to 6 at the University of Zagreb, Croatia. The Croatian version of the Hiroshima University-Dental Behavioral Inventory (HU-DBI) was administered to predoctoral dental students, and collected data were analyzed. A total of 503 students (22.3±2.6 mean age) completed the questionnaire. The response rate was 85.1 percent, and 72.4 percent of the respondents were female. These dental students’ answers to eleven out of twenty HU-DBI items differed significantly by academic year. The mean questionnaire score was 6.62±1.54, and the highest value of the HU-DBI score was in the fourth year (7.24±1.54). First-year students were most likely to have a toothbrush with hard bristles and felt they had not brushed well unless done with hard strokes. Students in the sixth year were least worried about visiting a dentist and most frequently put off going to a dentist until having a toothache, indicating that rise of knowledge contributes to higher self-confidence. The mean HU-DBI score for these students showed average value, pointing out the need for a comprehensive oral hygiene and preventive program from the start of dental school.

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Oral health is now widely recognized as an important part of overall health. Although there are more and more dental hygiene products available and awareness is rising every day, oral diseases are still one of the most prevalent problems in countries around the world. Oral self-care such as toothbrushing and flossing are important for preserving oral health and preventing oral diseases as they remove microbial plaque, preventing it from accumulating on teeth and gingiva. Studies have demonstrated that dental plaque is an important factor in the onset of hard and soft tissue diseases and that plaque reduction decreases the prevalence of dental caries, gingivitis, and periodontal diseases. The most effective and widespread way to control plaque at home is toothbrushing. In Western societies, brushing twice a day with fluoride toothpaste is now an integral part of most people’s daily oral hygiene routine. However, many factors such as brushing technique, frequency, duration, pressure, characteristics of toothbrush bristles, flossing, use of toothpaste, and training influence the effectiveness and safety of dental hygiene products. Inadequate toothbrushing techniques may be ineffective in plaque removal and may cause hard tissue abrasions or gingival recedences. Therefore, knowledge about oral hygiene products, procedures, and behavior are important factors in preventing oral disease and achieving good oral health.

Prevention of oral disease is the most accepted and effective method for ensuring oral health. Modifications of patients’ habits regarding oral hygiene maintenance and constant emphasis on prevention are two challenges confronting the modern dental practitioner. Dentists’ attitudes, proficiency, and knowledge are playing an important role not only in improving oral health of their patients but also in determining oral health of the population. Dental practitioners are competent to counsel on oral health and the most suitable daily oral hygiene procedures. Furthermore, they can induce and reinforce long-term motivation for self-prevention and may provide preventive care.

Dental students, as future oral health providers, are an important group to observe and follow through their academic years. Since knowledge and
awareness are associated with oral hygiene habits and health, it is important that dental students have positive attitudes towards preventive dentistry. Basic information about oral health, associated with adequate preventive procedures, is fundamental to promote preventive behavior.17

The improvement of dental health and behavior in dental students is an effective way to confirm the effectiveness of a dental curriculum.18 The Hiroshima University-Dental Behavioral Inventory (HU-DBI) is a questionnaire developed by Kawamura to understand patients’ perception of oral health.19 The HU-DBI was originally written in Japanese and later translated into English and found to have good test-retest reliability and translation validity.20 Since its first use in Japanese and English, the questionnaire has been translated into many languages and used in many dental and dental hygiene schools as an instrument for evaluating differences in students’ dental health behavior, attitudes, and perceptions.21,22 The HU-DBI is also considered to be a useful questionnaire that can provide cross-cultural comparisons of dental students around the world.23 Some studies have used it as a tool to compare the relationship between gender or dental caries status with oral health attitudes and behavior or differences between dental hygiene students and dental students.24-26

Several studies have researched the oral health attitudes and behavior of dental students in different academic years;27-30 but little is known about oral self-care among Croatian dental students. The aims of this study were to investigate oral health behavior and attitudes of dental students at the University of Zagreb, Croatia, using the HU-DBI questionnaire and to examine differences between students in different academic years.

Materials and Methods

This study was conducted at the School of Dental Medicine, University of Zagreb, from March to May 2011. Participation was voluntary and anonymous, and the study was approved by the Ethics Committee of the School of Dental Medicine. The study included 503 undergraduate dental students in all six academic years. On the day of the survey, the students were asked to remain sitting in the classroom if they were willing to complete the questionnaire. The purpose of the study was explained to them, and written consent was obtained from each participant before they completed the questionnaire.

Students are enrolled in the School of Dental Medicine, University of Zagreb, based on their national graduation exam score and psychomotoric test. In the six-year curriculum, the first three are preclinical, and the last three are clinical. During the preclinical years, students attend basic science lectures and take laboratory courses. Starting with the fourth year, students provide care for patients. Although preventive dentistry should be an important part of the curriculum, there is no specific course on this subject at our school. Students learn most of the knowledge regarding preventive dentistry during courses in pedodontics, conservative dentistry, preclinical periodontology, and dental hygiene, which is an elective course. Since we are in the Department of Periodontology, we sought to better understand the oral health attitudes and behaviors of dental students before and after the preclinical periodontology course, which starts in the third year.

The HU-DBI questionnaire consists of twenty statements with agree-disagree responses, resulting in a quantitative estimate of oral health attitudes and behavior by the total of correct responses. The total HU-DBI score can be calculated based on the scoring system described by Kawamura, and the maximum possible score is 12.19 Only twelve items out of twenty are included for scoring, and one point is given for each correct answer. A higher score indicates better oral health attitude and behavior.

Until the time of our study, there had been no Croatian translation of the HU-DBI. Translating the survey into the Croatian language was done using only bilingual individuals. In the first step, three bilingual dental professionals translated the English HU-DBI into Croatian. The Croatian translation of the HU-DBI was then given to three bilingual experts for validation. When they verified the Croatian version of HU-DBI, the inventory was back-translated by two teachers who were not involved in the initial translation. Original and back-translated versions of the inventory were compared, and the linguistic equivalence was validated. Inventory agreement between the English and Croatian versions was measured by Cohen’s kappa coefficient on a sample of thirty bilingual dental researchers. The kappa coefficient for twenty inventory items ranged from 0.86 to 1.0. After achieving almost perfect agreement between the two versions, the inventory was ready for the study. In the questionnaire, students were also asked for demographic data: gender, age, smoking status (smoker, former smoker, or nonsmoker), and year of study.
The data were organized into Microsoft Excel spreadsheets (Microsoft Inc., USA) and statistically processed using SPSS 11.0 software (IBM Inc., USA). Differences between the groups were assessed by the chi-square test, Kruskal-Wallis test, student’s t-test, and ANOVA, and p-values less than 0.05 were considered statistically significant (p<0.05).

Results

Of the total of 591 dental students, the HU-DBI inventory was completed by 503 students, for a response rate of 85.1 percent. The response rate was highest in the first year (93.5 percent) and lowest in the second year (80.2 percent). The majority of respondents were women (72.4 percent female vs. 27.6 percent male), and the mean age was 22.3±2.6. The percentage of male students was lowest in the first year (15.1 percent) and highest in the fifth year (39.8 percent). The response rate and distribution of students by academic year, gender, and age are shown in Table 1.

Differences by Academic Year

Table 2 shows the percentage of agree responses according to academic years and the statistically significant levels of differences between academic years. The statistically significant differences (p<0.05) within agree responses were found on eleven items out of twenty. Students in the sixth year were found to be less worried about visiting the dentist than the students from other years (item 1, p<0.001). In addition, 20.8 percent of the sixth-year respondents agreed about putting off going to the dentist until they have a toothache, which was much more often than for students in years four and five (item 15, p=0.045). The statement that gums tend to bleed while brushing received the most agree responses from the third-year students (20.2 percent), and the difference was statistically significant from the fifth year students (item 2, p=0.020). Interestingly, there were no statistical differences across the academic years regarding items 3, 6, and 8 (I worry about the color of my teeth; I think that I cannot help having false teeth when I am old; and I think my teeth are getting worse despite my daily brushing).

A child-size toothbrush was significantly less used by students in the first and second years (4.7 and 2.4 percent, respectively) than those in the fifth year (18.4 percent) (item 5, p=0.003). The first-year students had the highest percentage of using toothbrushes with hard bristles (34.9 percent), and the difference was statistically significant from students in the fourth, fifth, and sixth years (item 17, p<0.001).

When we analyzed the statement about brushing each tooth carefully, statistically significant differences were found between the third-year students and students in the first, second, and fifth years (item 9, p=0.004). Furthermore, the third-year students had statistically significant differences compared with fourth- and sixth-year students on the statement about never being taught professionally how to brush (item 10, p=0.038).

The fourth-year students showed differences from the first-, second-, and fifth-year students in the opinion that they can clean their teeth well without using toothpaste (item 11, p<0.001). Students in the first year showed statistically significant differences compared with students in the fifth and sixth years in saying they feel they have not brushed well unless they use strong strokes (item 18, p=0.002). Furthermore, the feeling that sometimes it takes too much time to brush their teeth was mostly agreed to by the sixth-year students (26.4 percent), and this response was significantly higher than with the

<table>
<thead>
<tr>
<th>Academic Year</th>
<th>Total Number N (%)</th>
<th>Total Number of Males N (%)</th>
<th>Total Number of Females N (%)</th>
<th>Participating Students N (%)</th>
<th>Participants’ Mean Age±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>86 (17.1%)</td>
<td>13 (15.1%)</td>
<td>73 (84.9%)</td>
<td>86 (93.5%)</td>
<td>19.2±1.3</td>
</tr>
<tr>
<td>Year 2</td>
<td>85 (17.9%)</td>
<td>21 (24.7%)</td>
<td>64 (75.3%)</td>
<td>85 (90.2%)</td>
<td>20.9±1.2</td>
</tr>
<tr>
<td>Year 3</td>
<td>84 (16.7%)</td>
<td>18 (21.4%)</td>
<td>66 (78.6%)</td>
<td>84 (91.3%)</td>
<td>21.8±1.4</td>
</tr>
<tr>
<td>Year 4</td>
<td>73 (14.5%)</td>
<td>20 (27.4%)</td>
<td>53 (72.6%)</td>
<td>73 (86.9%)</td>
<td>23.0±1.5</td>
</tr>
<tr>
<td>Year 5</td>
<td>103 (20.5%)</td>
<td>41 (39.8%)</td>
<td>62 (60.2%)</td>
<td>103 (80.5%)</td>
<td>24.1±2.0</td>
</tr>
<tr>
<td>Year 6</td>
<td>72 (14.3%)</td>
<td>26 (36.1%)</td>
<td>46 (63.9%)</td>
<td>72 (80.9%)</td>
<td>24.8±2.6</td>
</tr>
<tr>
<td>Total</td>
<td>503 (100%)</td>
<td>139 (27.6%)</td>
<td>364 (72.4%)</td>
<td>503 (85.1%)</td>
<td>22.3±2.6</td>
</tr>
</tbody>
</table>

SD: standard deviation
This test revealed that only academic year had significant but small effect size on the HU-DBI total score ($F=3.021; p=0.011$; partial $\eta^2=0.03$). $F$-statistic for gender was insignificant ($\text{male }6.17\pm1.49; \text{female }6.58\pm1.56; F=0.002; p=0.986$), and the interaction between academic year and gender was also insignificant ($F=0.939; p=0.455$).

Table 4 shows comparisons of the HU-DBI score (mean±SD) by academic year. The HU-DBI score is derived from the twelve scored items shown in Table 2.

### Table 2. HU-DBI questionnaire items and percentage of “agree” responses by academic year

<table>
<thead>
<tr>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I don’t worry much about visiting the dentist.</td>
</tr>
<tr>
<td>2. My gums tend to bleed when I brush my teeth. (D)</td>
</tr>
<tr>
<td>3. I worry about the color of my teeth.</td>
</tr>
<tr>
<td>4. I have noticed some white sticky deposits on my teeth. (A)</td>
</tr>
<tr>
<td>5. I use a child-sized toothbrush.</td>
</tr>
<tr>
<td>6. I think that I cannot help having false teeth when I am old. (D)</td>
</tr>
<tr>
<td>7. I am bothered by the color of my gums,</td>
</tr>
<tr>
<td>8. I think my teeth are getting worse despite my daily brushing. (D)</td>
</tr>
<tr>
<td>9. I brush each of my teeth carefully. (A)</td>
</tr>
<tr>
<td>10. I have never been taught professionally how to brush. (D)</td>
</tr>
<tr>
<td>11. I think I can clean my teeth well without using toothpaste. (A)</td>
</tr>
<tr>
<td>12. I often check my teeth in a mirror after brushing. (A)</td>
</tr>
<tr>
<td>13. I worry about having bad breath.</td>
</tr>
<tr>
<td>14. It is impossible to prevent gum disease with tooth brushing alone. (D)</td>
</tr>
<tr>
<td>15. I put off going to the dentist until I have toothache. (D)</td>
</tr>
<tr>
<td>16. I have used a dye to see how clean my teeth are. (A)</td>
</tr>
<tr>
<td>17. I use a toothbrush which has hard bristles.</td>
</tr>
<tr>
<td>18. I don’t feel I’ve brushed well unless with strong strokes.</td>
</tr>
<tr>
<td>19. I feel I sometimes take too much time to brush my teeth. (A)</td>
</tr>
<tr>
<td>20. I have had my dentist tell me that I brush very well.</td>
</tr>
</tbody>
</table>

Note: In the calculation of the HU-DBI score, one point was given for each of the agree responses marked with (A), and one point was given for each of the disagree responses marked with (D).

Kruskal-Wallis tests were done between years of study:
- *Difference is statistically significant from 6th year (p<0.05).*
- *Difference is statistically significant from 1st year (p<0.05).*
- *Difference is statistically significant from 2nd year (p<0.05).*
- *Difference is statistically significant from 3rd year (p<0.05).*
- *Difference is statistically significant from 4th year (p<0.05).*
- *Difference is statistically significant from 5th year (p<0.05).*
- *Difference is statistically significant from 1st year (p<0.05).*

*Significant difference (p<0.05); these numbers are in bold.

first- and second-year students (item 19, $p=0.037$). Finally, only 11.8 percent of the second-year students said they have used dye to see how clean their teeth are; this was significantly lower than the fifth-year students where agreement reached 32 percent (item 16, $p=0.004$).

**HU-DBI Scores by Academic Year and Gender**

A two-way ANOVA (Levene’s Test $F=0.338; p=0.977$) was performed to examine the influence of academic year and gender (independent variables) on HU-DBI total score (dependent variable) (Table 3). This test revealed that only academic year had significant but small effect size on the HU-DBI total score ($F=3.021; p=0.011$; partial $\eta^2=0.03$). F-statistic for gender was insignificant (male $6.17\pm1.49$; female $6.58\pm1.56$; $F=0.002; p=0.986$), and the interaction between academic year and gender was also insignificant ($F=0.939; p=0.455$).

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Data on students’ behavior and attitudes regarding oral health through the curriculum had been missing in Croatia, and the HU-DBI questionnaire seemed the most appropriate tool to use for that assessment. Although the majority of our students speak the English language, the questionnaire was translated into Croatian to remain a reliable tool for our survey.

The overall results of our study, according to the mean value of the HU-DBI score, showed a similar HU-DBI score for Croatian dental students (6.62±1.54) as students in studies conducted in Greece and Turkey (6.86±1.83 and 6.53±1.99, respectively). A higher HU-DBI score was found in Britain and Japan (7.33 and 7.40±2.55, respectively), indicating that dental students in those two countries report better oral health behavior and attitudes than students in Croatia. When we compared dental students in Croatia with students in China and India (5.07 and 6.06±1.71, respectively), the Croatian students had a higher HU-DBI score.

Kruskal-Wallis tests were done to compare the percentage of agree responses with smoking habits, and only one statistically significant difference was found. The test showed that nonsmokers check their teeth in a mirror after brushing more often than former smokers (p=0.010, data not shown).

Discussion

Dental students are future oral health providers and educators. Since they have that role in our society, it is interesting to analyze and compare oral health attitudes and behavior of dental students in different years of study. Recent studies confirmed that progression through the curriculum, and the consequent rise in knowledge, is associated with improved oral health behavior and attitudes among dental students in higher academic years. Data on students’ behavior and attitudes regarding oral health through the curriculum had been missing in Croatia, and the HU-DBI questionnaire seemed the most appropriate tool to use for that assessment. Although the majority of our students speak the English language, the questionnaire was translated into Croatian to remain a reliable tool for our survey.

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It seems that cultural differences between Western and Eastern societies play a certain role in students’ attitudes toward and perceptions of oral health behavior. These cultural differences could best be described with the mean HU-DBI score of first-year students. First-year students are just beginning...
their dental education, so courses have not yet had an impact on their oral health behaviors and attitudes and, as a result, the biggest role is played by their previous experience, education, and cultural heritage. In our study, the HU-DBI score of the first-year Croatian dental students (6.12±1.54) suggests a higher level of dental health awareness on entry than that of Chinese students (4.31). When comparing Croatian first-year students with Greek and British first-year students (6.04±1.68 and 6.61, respectively), a similar HU-DBI score is reached.28,30 Such a difference probably lies in the fact that culture determines attitude, beliefs, and behavior. For example, 78 percent of Chinese and 68 percent of Indian dental students said they do not worry about visiting the dentist, whereas only 23.5 percent of Croatian students agreed with that statement.27,30 The same contrast was observed with the statement that they put off going to the dentist until having a toothache: 54 percent of Chinese and 68 percent of Indian students agreed, and only 13.7 percent of Croatian students agreed with that opinion.27,30 Kiyak31 reported similar findings when comparing dental behavior and beliefs between Pacific Asians and Caucasians. These findings confirm different perceptions of dealing with health between the Asian and the European way. Schwartz and Lo32 reported that Asian people are likely to seek professional help only when home remedies fail. Furthermore, in a recent survey of a Chinese population, it was concluded that more than 50 percent of the rural adult population preferred to either ignore symptoms such as gingival bleeding or try traditional treatments before approaching dental surgeons.35

An interesting aspect of the total HU-DBI score is the possibility of analyzing the average score of dental students from different academic years. Rong et al.36 reported that dental students have significantly better oral health attitudes and behavior in their final academic year when compared with the first-year students. Our results also showed that oral health behavior and attitudes of the Croatian dental students were significantly better in year six then in year one. This could be explained with an increasing level of knowledge, and it is in accordance with studies conducted in England, Greece, and Japan. The HU-DBI score in Britain went from 6.61 in the first year to 8 in the last year, in Greece from 6.04±1.68 to 8.17±1.4, and in Japan from 6.52±2.20 to 10.04±1.55.28,30 In Croatia, the difference between the first- and sixth-year HU-DBI scores was statistically significant (6.12±1.54 to 7.00±1.52, p=0.003); however, the value did not show such a big difference as in the previously mentioned countries. This observation is an important finding for our dental school, indicating a need for course improvement and placing more emphasis on prevention and oral hygiene courses.

The highest HU-DBI score in our dental school was observed in students in the fourth year (7.24±1.54.). This could be explained by the fact that the preclinical periodontology course has just finished. The course places strong emphasis on plaque control techniques, and the students are studying for the preclinical periodontology exam. Some of the topics covered in the preclinical periodontology course are toothbrushing techniques, recommended kinds of toothbrushes, bristle hardness, and ways to control the efficacy of toothbrushing. When HU-DBI statements regarding these subjects were analyzed (items 5, 10, 12, 16, and 17), a significant difference was seen in each item, showing an impact of the periodontology course. Similar findings were reported by Polychronopoulou and Kawamura.28

When comparing first- and final-year students, a progression in self-confidence was also noticed. A good example is the first item of HU-DBI (I don’t worry much about visiting the dentist): 47.2 percent of sixth-year students agreed with the statement, while only 18.6 percent of first-year students did. Furthermore, self-care practice was also rising from year to year. Students in the higher academic years were more likely to use a dye to check how clean their teeth are and to feel they have brushed well without hard strokes. Although the very low percentage of students (5.4 percent) who said they have noticed white sticky deposits on their teeth was surprising, it could be explained by the high percentage (88.5 percent) of students who said they check their teeth in a mirror after brushing. This could indicate high awareness of oral hygiene habits, which in our students led to a low percentage of students whose gums tend to bleed when brushing (10.1 percent). These findings suggest that education affects self-confidence and subsequent behavior and attitude of students.

Although we expected a significant difference in the HU-DBI score between genders, the results did not show this. Females are often considered to take better care of their bodies and appearance than males and to be more concerned about visiting a professional for any problem or advice. That kind of attitude is also expected regarding dental visits and oral health behavior. Ostberg et al.37 found that girls aged thirteen to eighteen were better on behavioral measures and that they showed more interest in oral health than boys at the same age. Although a study
in Romania revealed behavioral and attitude differences between genders among dental students, our study did not confirm that assessment. Similar results to ours were reported in Australia and India. It should be noted that 72.4 percent of dental students in our school are females, and such a large gender difference was not found in the other studies.

Our study revealed average oral health behaviors and attitudes among these dental students at the University of Zagreb, as well as significant differences in oral health behavior and attitudes between first-year and final-year students. Self-report is considered an important predictor of behavior, and behavior together with knowledge plays an important role in forming attitudes toward patients. Since ours was a cross-sectional survey, the results cannot be sufficient for curricular changes, but can be a good indicator of necessary changes in the undergraduate curriculum, primarily in preventive dentistry and oral hygiene courses. These courses should be placed at the beginning of the curriculum, preparing students for their first contact with patients and making them aware of their role in society as oral health promoters and role models. Since the elective course in oral hygiene seemed to have had a low impact on students’ oral health attitude and behavior, it would be prudent to change the status of the course from elective to mandatory.

Oral health and habits are very much affected by education, socioeconomic status, and culture. Future studies that include clinical examination, parents’ profession, questions regarding oral hygiene products and frequencies, and socioeconomic status are needed. It would also be useful to compare additional differences in oral health behavior, habits, and beliefs among the same dental students when they are in their first and last academic years.

**Conclusion**

Based on the results, the following conclusions can be drawn from this research into the oral health behavior and attitude of Croatian dental students. Although statistically significant, there was a relatively small progress in the HU-DBI score between first-year and last-year students. The course that might have the greatest influence on oral health and behavior was the preclinical periodontology course. Gender did not have an influence on the HU-DBI score. The oral hygiene course should be comprehensively revised and perhaps made mandatory at the start of dental school since as an elective course it seems to be having little influence on students’ oral health behaviors and attitudes. Consideration should also be given to making preventive dentistry an independent course in the curriculum.

**REFERENCES**


