Article

Development and Initial Validation of the Oral Health Activities Questionnaire

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Abstract: Background: The purpose of this study was to introduce a new Oral Health Activities Questionnaire (OHAQ, hereinafter) that examines different activities and behaviours related to the oral hygiene regimen of each analysed subject. Methods: A sample of 658 students was analysed to determine the OHAQ scale’s basic metric characteristics. To determine the construct validity of the OHAQ, descriptive statistics and correlation analysis, as well as differences testing, were applied to groups of subjects on the basis of self-reported oral status measures. Results: The dimensions of oral health activities were determined, and the scales for their measurement were constructed. Females and males differed in the OHAQ questionnaire measures. Significant but low intercorrelations were found among the measures. In the female and male subsample, four different oral health (OH, hereinafter) types of subjects were identified, exhibiting different characteristic behaviours regarding oral health. OHAQ scales showed good discriminant validity, revealing the differences related to specific self-reported oral status measures (e.g., frequency of toothache and the number of filled teeth). Conclusions: The OHAQ represents a satisfactory measurement instrument for determining the level of OH activities and for doing quick and reliable classifications of the participating subjects according to their OH activities and behaviours. The process of further validation and advancements of the OHAQ scales and measures should be continued through a clinical examination of subjects.

Keywords: oral hygiene; oral health status; orientation to DMD; regularity of tooth brushing; toothache; tooth fillings; university students

1. Introduction

Oral health is an important part of overall health [1]. Different factors, such as lifestyle, habits, diet, frequency of dental check-ups, and socioeconomic status, affect the oral health of an individual [2–4]. According to the First International Conference on Health Promotion held by the World Health Organisation (Ottawa, Canada, 1986), oral health promotion is a combination of health education, healthcare, and health policies that aim to advance the oral health of the general population. Caries and periodontal disease are highly behaviour-related and can be controlled by proper oral hygiene activities [5].

Appropriate oral hygiene implies the continuous implementation of two well-defined sets of behaviour: self-protection (oral hygiene, fluoride usage, and reduced intake of refined carbohydrates), and regular utilisation of dental services (oral health education, regular dental check-ups, and professional prophylaxis) [6].
The most effective and widespread method of oral hygiene is toothbrushing. Oral self-care, including toothbrushing and interdental cleaning, is important for preserving oral health and preventing oral diseases, because it disrupts and removes microbial plaque, thus preventing its accumulation on the teeth and the gingiva [7]. Inappropriate toothbrushing techniques may be ineffective in plaque removal and even cause hard tissue abrasions or gingival recessions [8]. Therefore, knowledge about oral hygiene, including the products, procedures, and behaviours, is an important factor in preventing oral diseases and achieving good oral health [8–10].

Different social factors, such as level of education, employment status, and work conditions, as well as other health-related habits, have also been shown to affect oral health. The improved oral health of regular dental patients seems to be more affected by professional care level than the patient’s knowledge about oral health [11]. Previous studies have shown that oral hygiene habits and attitudes are gender-related, with females having better dental health attitudes and behaviours [12].

Factors that influence the effectiveness and adequacy of the patients’ oral hygiene level include their knowledge, attitudes, and behaviour regarding oral disease prevention. Multiple studies compared oral health attitudes and behaviour in different countries among students, and most of them used the Hiroshima University Dental Behavioural Inventory (HU-DBI), developed by Kawamura [13–18]. This inventory consists of 20 dichotomous questions (agree/disagree) and aims to investigate the behaviour of patients during toothbrushing to predict their clinical outcomes. However, despite the widespread utilisation of this inventory, to date, no other tool has been developed to evaluate behaviours related to all the other oral health activities, such as dental flossing, interdental brushing, or the choice of toothpaste. Numerous studies used the HU-DBI questionnaire to investigate gender differences in oral health-related knowledge and behaviour among dental students worldwide [13–16,19,20]. Evidence on the oral health status in other population groups, such as children or older adults, is often based on national or regional epidemiological studies that employed the DMFT (decayed, missing, and filled teeth) index [21–23]. This study suggests the use of the Oral Health Activities Questionnaire (OHAQ) to broaden the available scientific findings and fill literature gaps by including students from various faculties.

Therefore, the purpose of this study was to develop and initially validate the OHAQ intended to identify oral hygiene-related activities and behaviours, in addition to the level of oral self-care within the population of university students, as well as to serve as a screening tool to detect individuals that might require immediate dental treatment.

2. Materials and Methods

2.1. Participants

A total of 658 students from the University of Split (Split, Croatia) were included in the study, 439 (66.7%) women and 219 (33.3%) men, whose mean age was 21.33 ± 2.61 years (age range 18 to 26 years). To calculate the minimum sample size, the Raosoft sample size calculator was used (Raosoft Sample Size Calculator). Therefore, with the estimated university student population size of 20,000, confidence level of 99%, margin of error of 5%, and response distribution of about 50%, the minimum effective sample size calculated for this investigation was 643. Representation of students from different faculties was as follows: Faculty of Economics (90 students, 13.7%), Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture (75 students, 11.4%), Faculty of Philosophy (78 students, 11.9%), Faculty of Kinesiology (53 students, 8.1%), School of Medicine (86 students, 13.1%), School of Dental Medicine (90 students, 13.7%), Faculty of Law (100 students, 15.2%), Faculty of Science (46 students, 7%), and the University Department of Health Studies (40 students, 6.1%). The students at the University of Split were invited to participate in this study at the beginning of the spring semester.
2.2. Development of the Oral Health Activities Questionnaire (OHAQ)

The OHAQ items were structured by first creating a wide pool of items related to oral hygiene and oral health practices. The items either corresponded with usual and expected behaviour or represented specific activities as the gold standard of oral hygiene. Initially, three dental medicine doctors (DMDs) with more than 15 years of clinical experience constructed the items of manifest behaviour and important oral hygiene activities in the form of statements or claims. The DMD expert group assessed the content validity of the OHAQ items to determine the unbiased relevance of the items to the overall oral health construct and the items’ ability to measure a specific oral hygiene activity using simple and easy-to-understand terminology. All items were given to a group of 25 nursing university students to rate each item according to two criteria: clarity and applicability. Those students were not included in the study sample. The items that were marked as unclear or not applicable were additionally revised by the team or excluded from further consideration. Each item was evaluated using a five-point Likert scale (1—completely false; 2—mostly false; 3—partially true; 4—mostly true; 5—completely true).

2.3. Self-Reported Oral Health Status Questionnaire

In addition to the OHAQ, all participants were asked to objectively evaluate their actual oral health status by providing assessments on a few additional questions. These additional questions were later used to evaluate the initial validity of the OHAQ, assuming that their actual oral health status, self-reported by the participants, was a consequence of their previous and presently applied oral health activities and behaviours. The questions used to determine the self-reported oral health status were divided into two groups. The first group consisted of questions in which respondents assessed the condition of their teeth, but also their experience in maintaining oral care: filled teeth, tooth extraction, root canal treatment, malocclusion, prosthetic treatment, orthodontic treatment, and dental crowns or veneers, by providing just “yes” or “no” answers. The respondents who answered “yes” were also asked to enter a numerical value (e.g., the number of filled teeth regardless of the reason for the specific filling) for those questions. In questions for which the respondents entered numerical value (questions about the number of filled teeth, the number of extracted teeth, the number of root canal-treated teeth), the entered number served as data in the database. For those who did not have such experiences, 0 (zero value) was entered. For questions to which the respondents could only give an affirmative or negative answer (malocclusion, prosthetic treatment, orthodontic treatment, and dental crowns or veneers), the values 0—no experience or 1—affirmative, has experience were entered in the database. The second group consisted of three questions concerning toothache frequency, the frequency of use of analgesics, and the frequency of use of antibiotics for dental reasons. Respondents rated them on a Likert scale with the answers offered: 1—never, 2—very rare, 3—rare, 4—sometimes, and 5—often. We assumed that a higher incidence in all these questions (e.g., higher number of filled teeth or more frequent toothache) could objectively represent poor and less desirable characteristics of individuals’ oral health status, as possible consequences of either previous or current lack or frequent improper application of adequate oral health activities.

2.4. Application of the OHAQ on a Sample of University Students

The study was conducted in full accordance with the World Medical Association Declaration of Helsinki and approved by the Ethics Committee of the University of Split, Department of Health Studies. The authors contacted the faculty of the University of Split to enlist potential participants. The questionnaire was applied in regular class groups, and students were asked by their faculty to remain in class at the end of a lecture to participate in this study voluntarily. The aim and purpose of the study were explained to the students, and they were given instructions on how to fill out the questionnaire. All of the students were asked to complete the OHAQ anonymously after having signed a separate consent form for participation in the study. The questionnaire was broader than the described variables in this study, and students filled it out in 15–20 min. As the students participated
voluntarily, a very small number of the questionnaires (less than 1% of the overall sample) were excluded from the analyses at the end of the study, mainly because the participants did not answer or unclearly answered several items in the questionnaire.

2.5. Data Analysis

To determine the structure of oral health activities, principal component analysis was applied to the initial set of OHAQ items using Varimax orthogonal rotation and the Kaiser–Guttman criterion. This approach helped with the extraction of significant components. Afterward, separate subscales were constructed for each of the yielded OHAQ dimensions. Proper procedures for determining their metric characteristics (homogeneity, reliability, and sensitivity) were applied. Their internal consistency was assessed by calculating Cronbach's alpha coefficient. Several sensitivity indices were calculated: measures of dispersion (minimum and maximum values of the scale and median of results), the coefficient of the Kolmogorov–Smirnov goodness-of-fit test, and measures of distribution (skewness and kurtosis). Descriptive parameters were calculated for all OHAQ measures—scales on the total sample (subsamples). Continuous data were presented as the means ± standard deviations (mean ± SD) and median values. The data in the questions representing the oral status of the subjects were also analysed, whereas categorical variables were presented as observed frequencies and relative percentages. Correlation analysis was performed to determine the association between the OHAQ measures. Later, subjects from the sample were categorised into particular groups according to the number or the frequency values in some variables. Differences tests (Student’s t-test; Fisher’s post hoc least significant difference test, LSD; one-way ANOVA) were then applied to analyse the differences between the OHAQ groups and the self-reported oral health status groups of subjects. The K-means clustering method was used to determine the subjects' oral health types measured by the OHAQ questionnaire, with the number of clusters determined a priori. In determining the cluster memberships, the option with the smallest possible differences between members within a cluster and with the largest possible differences between different clusters was used, regardless of the frequency of members in each cluster. Finally, a chi-square test of association was used to calculate the correlation of two category variables and Cramer’s V coefficient was included in the analysis as an effect size index of the chi-square test. In all conducted statistical analyses, the lowest significance criterion was set at \( p < 0.05 \). Statistical analyses were performed using the statistical software package Statistica 14 (StatSoft Inc., Tulsa, OK, USA).

3. Results

Principal component analysis yielded five dimensions of oral health activities explaining the 51.1% of the total variance (Table 1).

These five dimensions related to the oral health activities questionnaire were the following: the first dimension, named basic oral hygiene activities (BOHA, hereinafter), involved six items that described the basic knowledge, manner, time, and instruments used by participants, or basic manifest behaviours when practising oral hygiene; the second dimension, named orientation to dental medicine doctor (ODMD, hereinafter), involved four items that described the regularity of dental scaling and dental check-ups; the third dimension, named regularity of tooth brushing (ROTB, hereinafter), involved three items that described when and how often patients brushed their teeth; the fourth dimension, named use of dental floss (FLOSS, hereinafter), involved two items; the fifth dimension, named additional and detail oral hygiene activities (ADOH, hereinafter), involved four items that described the use of additional oral hygiene products. Each component explained from approximately 8.7% to 12.0% of the variance of the questionnaire, and the basic oral hygiene activities component explained the greatest portion of the total variance.

Table 2 reports the basic metric characteristics of each OHAQ subscale and the descriptive characteristics of each item.
Table 1. Factor analysis of the Oral Health Activities Questionnaire items.

| Item                                                                 | Component * |
|----------------------------------------------------------------------|-------------|
|                                                                      | 1 2 3 4 5    |
| I am certain I brush my teeth properly                              | 0.68 0.01 0.17 0.03 −0.07 |
| I use small, circular rotations while tooth brushing                 | 0.63 0.14 −0.01 0.12 −0.06 |
| I replace my toothbrush every 3 months                              | 0.60 0.16 0.04 0.10 0.20 |
| I use fluoride toothpaste                                          | 0.48 0.13 0.11 0.00 0.39 |
| I brush my teeth for at least 3 min                                 | 0.42 0.17 0.23 0.16 0.16 |
| I brush my tongue when tooth brushing                               | 0.43 −0.12 0.16 0.18 0.33 |
| I have professional dental scaling at least once per year           | 0.01 0.74 0.03 0.28 0.16 |
| I have professional dental scaling regularly                        | 0.05 0.73 0.08 0.35 0.15 |
| I visit a doctor of dental medicine twice per year for regular check-ups | 0.20 0.60 0.27 0.04 0.04 |
| I visit a doctor of dental medicine mostly for regular check-ups   | 0.38 0.53 0.07 −0.16 0.06 |
| I brush my teeth at least three times per day                       | 0.10 0.11 0.81 0.13 0.17 |
| I brush my teeth after each meal                                    | 0.03 0.15 0.77 0.14 0.17 |
| I never omit evening tooth brushing                                 | 0.27 0.09 0.64 0.00 −0.18 |
| I use dental floss at least once per day                           | 0.18 0.18 0.15 0.82 0.05 |
| I use dental floss often during the day                            | 0.09 0.22 0.10 0.81 0.14 |
| I use interdental brushes                                          | 0.02 0.17 0.13 −0.06 0.66 |
| I use an electric toothbrush                                       | −0.20 0.14 −0.13 0.05 0.59 |
| When I brush my teeth, I intentionally massage the gingiva         | 0.17 0.00 0.07 0.27 0.50 |
| I use mouth rinse                                                   | 0.27 −0.02 0.07 0.30 0.36 |

Notes: * factor saturation; EIGEN—eigen value, characteristic variance of component; %—percentage of variance explained by component; Total %—total percentage of explained variance.

Table 2. Oral Health Activities Questionnaire scales.

| Basic Oral Hygiene Activities Scale | Items                                      | EIGEN | % VAR | Alpha | FS | Mean ± SD |
|-------------------------------------|--------------------------------------------|-------|-------|-------|----|-----------|
|                                     | I replace my toothbrush every 3 months     | 2.16  | 36.1  | 0.64  | −0.67 | 3.48 ± 1.30 |
|                                     | I am certain I brush my teeth properly     |       |       |       | −0.65 | 3.81 ± 1.03 |
|                                     | I use small, circular rotations while tooth brushing |       |       |       | −0.63 | 3.53 ± 1.17 |
|                                     | I use fluoride toothpaste                  |       |       |       | −0.60  | 3.22 ± 1.34 |
|                                     | I brush my teeth for at least 3 min        |       |       |       | −0.54  | 3.55 ± 1.13 |
|                                     | I brush my tongue when tooth brushing      |       |       |       | −0.50  | 3.44 ± 1.37 |

| Orientation to Dental Medicine Doctor Scale | Items                                      | EIGEN | % VAR | Alpha | FS | Mean ± SD |
|----------------------------------------------|--------------------------------------------|-------|-------|-------|----|-----------|
|                                              | I have professional dental scaling regularly | 2.06  | 51.5  | 0.68  | 0.83 | 2.34 ± 1.26 |
|                                              | I have professional dental scaling at least once per year |       |       |       | 0.81  | 2.64 ± 1.42 |
|                                              | I visit a doctor of dental medicine twice per year for regular check-ups |       |       |       | 0.66  | 3.47 ± 1.34 |
|                                              | I visit a doctor of dental medicine mostly for regular dental check-ups |       |       |       | 0.54  | 3.27 ± 1.27 |
As seen in Table 2, four of the five scales showed **satisfactory** metric characteristics for reliability and homogeneity: the **basic oral hygiene activities** scale, the **orientation to a doctor of dental medicine** scale, the **regularity of tooth brushing** scale, and the **use of dental floss** scale. These scales showed good **homogeneity** because all items of each scale were related to a single component, and their internal consistency coefficient (Cronbach’s α) varied from **conditionally satisfactory** (0.64) to **good** (0.84). In contrast, the **detailed oral health activities** scale showed a low and **unsatisfactory** level of internal consistency (Cronbach’s α: 0.42) and was excluded from further analyses.

The **sensitivity** of the scales, including the calculated sum of the OHAQ scales, was tested using the Kolmogorov–Smirnov test and coefficients of skewness and kurtosis to assess the normality of data distribution. Gender differences between the female and male subsample were calculated for each subscale. These data on **sensitivity** and gender differences are presented in Table 3.

### Table 3. Sensitivity and gender differences of OHAQ scales.

| Variable                              | Female Students (N = 439) | Male Students (N = 219) | t-Test | p   |
|---------------------------------------|--------------------------|-------------------------|--------|-----|
| **Mean ± SD**                         |                          |                         |        |     |
| Basic oral hygiene activities         | 3.62 ± 0.74              | 3.50 ± 0.96             |        |     |
| Orientation to DMD                    | 3.00 ± 0.96              | 3.00 ± 0.89             |        |     |
| Regularity of tooth brushing          | 3.73 ± 0.92              | 4.00 ± 0.89             |        |     |
| Use of dental floss                   | 2.52 ± 1.28              | 2.50 ± 0.87             |        |     |
| OHAQ Sum                              | 12.88 ± 2.81             | 12.58 ± 2.49            |        |     |

Notes: DMD, dental medicine doctor; mean ± SD—arithmetic mean and standard deviation; MED—median; SKEW—coefficient of asymmetry of distribution; KURT—coefficient of kurtosis of distribution; K–S D—Kolmogorov–Smirnov goodness-of-fit test; * significant K–S D test coefficient; t-test—t-test coefficient; p—significance of the t-test coefficient.

The data confirmed the satisfactory **sensitivity** of the scales, as the values of skewness and kurtosis did not exceed the level of ±1.00, although some of the Kolmogorov–Smirnov
test coefficients were significant. Therefore, the authors assumed that this distribution allowed for the application of parametric statistical procedures to the results of the scales, with the expectation of a high level of probability that there would be no significant violations of the basic assumptions of parametric statistics. The results revealed statistically significant gender differences, as females obtained higher and more desirable results than the males in all the scales. The differences were more evident in the measures concerning the regularity of tooth brushing and basic oral hygiene activities.

Statistically significant intercorrelations were found among the measures in all four scales and both gender subsamples (Table 4). Correlations between the OHAQ scales and the sum OHAQ measure were positive and high, ranging from 0.64 to 0.77.

Table 4. Correlations between the OHAQ measures.

| Variable                          | Females (N = 439) | Males (N = 219) |
|-----------------------------------|-------------------|-----------------|
|                                   | Basic Oral        | Orientation     | Regularity of | Use of |
|                                   | Hygiene Activities| to DMD          | Tooth Brushing| Dental Floss |
| Basic oral hygiene activities     | 1.00              | 0.39 **         | 0.37 **       | 0.32 ** |
| Orientation to DMD                | 0.39 **           | 1.00            | 0.35 **       | 0.40 ** |
| Regularity of tooth brushing      | 0.37 **           | 0.35 **         | 1.00          | 0.28 ** |
| Use of dental floss               | 0.32 **           | 0.40 **         | 0.28 **       | 1.00   |
| OHAQ Sum                          | 0.66 **           | 0.74 **         | 0.67 **       | 0.77 ** |

| Variable                          | Basic Oral        | Orientation     | Regularity of | Use of |
|-----------------------------------|-------------------|-----------------|---------------|-------|
|                                   | Hygiene Activities| to DMD          | Tooth Brushing| Dental Floss |
| Basic oral hygiene activities     | 1.00              | 0.36 **         | 0.30 **       | 0.29 ** |
| Orientation to DMD                | 0.36 **           | 1.00            | 0.29 **       | 0.39 ** |
| Regularity of tooth brushing      | 0.30 **           | 0.29 **         | 1.00          | 0.21 * |
| Use of dental floss               | 0.29 **           | 0.39 **         | 0.21 *        | 1.00   |
| OHAQ Sum                          | 0.64 **           | 0.74 **         | 0.66 **       | 0.73 ** |

Notes: * p < 0.05; ** p < 0.001.

Table 5 shows the oral health types (OH types, hereinafter) of respondents by their expression of OHAQ measures, calculated separately for both gender subsamples. Within the subsamples of female and male respondents, all identified OH types differed significantly in the degree to which they were assessed on the OHAQ scales.

Four types of OH were identified in the female subsample:

- The first type, which included 19.6% of female students, was called the excellent OH type because their scores on all OHAQ scales were very high;
- The second type, which included 27.3% of female students, was identified as the good OH type without flossing because their scores on the three OHAQ scales were approximately high and the flossing score was extremely low;
- The third type, which included 27.3% of female students, was called the satisfactory OH type because their scores on all four OHAQ scales were approximately moderate;
- The fourth type, which included 25.7% of female students, was called the poor OH type because their assessments of the three OHAQ scales were low and the assessment of flossing was extremely low.

Four types of OH were identified in the male subsample:

- The first type, which included only 9.1% of male students, was called the excellent OH type because their scores on all OHAQ scales were very high;
The second type, which included 32.4% of male students, was called the good OH type without flossing because their ratings on the three OHAQ scales were approximately satisfactory and the flossing score was extremely low;

The third type, which included 30.1% of male students, was called the satisfactory OH type because their assessments on all four OHAQ scales were moderate;

The fourth type, which included 28.3% of male students, was referred to as the poor OH type because their scores on three OHAQ scales were low and their assessment of flossing was extremely low.

Table 5. OH types for female and male students.

| Variable                        | Female OH Types                  | Male OH Types                   | F   | P    |
|---------------------------------|----------------------------------|--------------------------------|------|------|
|                                 | Excellent (N = 86)               | Good (N = 120)                  | Satisfactory (N = 120) | Poor (N = 113) | F   | P    |
|                                 |                                  |                                |                  |                |     |      |
| Basic oral hygiene activities   | 4.22 ± 0.60                      | 3.83 ± 0.63                    | 3.49 ± 0.61      | 3.08 ± 0.65    | 60.52 | <0.001 |
| Orientation to DMD              | 4.01 ± 0.82                      | 3.26 ± 0.78                    | 2.78 ± 0.70      | 2.20 ± 0.61    | 109.15 | <0.001 |
| Regularity of tooth brushing    | 4.43 ± 0.53                      | 4.21 ± 0.60                    | 3.58 ± 0.75      | 2.85 ± 0.82    | 111.81 | <0.001 |
| Use of dental floss             | 4.35 ± 0.69                      | 1.61 ± 0.54                    | 3.17 ± 0.56      | 1.41 ± 0.51    | 587.78 | <0.001 |
| OHAQ Sum                        | 17.00 ± 1.37                     | 12.92 ± 1.41                   | 13.02 ± 1.13     | 9.54 ± 1.26    | 543.61 | <0.001 |
|                                 |                                  |                                |                  |                |     |      |
|                                 | Excellent (N = 20)               | Good (N = 71)                  | Satisfactory (N = 66) | Poor (N = 62) | F   | P    |
|                                 |                                  |                                |                  |                |     |      |
| Basic oral hygiene activities   | 4.24 ± 0.53                      | 3.32 ± 0.59                    | 3.16 ± 0.53      | 3.01 ± 0.61    | 24.42 | <0.001 |
| Orientation to DMD              | 3.93 ± 0.89                      | 2.86 ± 0.85                    | 2.97 ± 0.61      | 2.13 ± 0.69    | 33.38 | <0.001 |
| Regularity of tooth brushing    | 4.23 ± 0.77                      | 3.92 ± 0.65                    | 3.07 ± 0.63      | 2.25 ± 0.57    | 95.93 | <0.001 |
| Use of dental floss             | 3.85 ± 0.73                      | 1.36 ± 0.47                    | 2.89 ± 0.68      | 1.20 ± 0.36    | 213.85 | <0.001 |
| OHAQ Sum                        | 16.25 ± 1.51                     | 11.46 ± 1.39                   | 12.09 ± 1.27     | 8.59 ± 1.17    | 192.68 | <0.001 |

Notes: Data are presented as the mean ± SD; F—analysis of the variance coefficient; p—significance of the ANOVA coefficient.

The differences between the OH types for female and male students are presented in Figure 1. Although the OH types of respondents in both gender subsamples had the same names and similar structures, it is noticeable that the OHAQ measures in the female subsample were somewhat more pronounced.

Descriptive statistics of self-reported oral status measures are shown in Table 6 in three separate sections.

The first part of the table refers to the total number of teeth extracted and treated and the number of teeth with fillings. Although male and female students had, on average, <1 extracted tooth, <3 filled teeth, and <2 treated teeth, the measures of dispersion of these variables were high. This indicates a low frequency of students with a high number of extracted teeth, treated teeth, and teeth with fillings. The second part deals with questions about the respondents’ assessment of the frequency of toothache and the frequency of using analgesics and antibiotics for toothache, and both female and male students gave a low self-assessment on these variables, mostly very rarely or even less frequently. The third part refers to four questions in which respondents answered whether they had experienced malocclusion (F = 27.8%; M = 26%), orthodontic treatment (F = 45.6%; M = 37.4%), dental crowns or veneers (F = 5.7%; M = 5.5%), or prosthetic treatment (F = 2.3%; M = 2.7%).
One-way ANOVA (Table 7) was used to determine the differences between certain OH types of subjects in relation to the self-reported oral status variables. Variables prosthetic treatment and dental crowns or veneers were not included in this analysis due to very low incidence in the subsamples.

For the female subsample, significant differences were found in two oral status variables: the number of filled teeth and frequency of toothache ($p < 0.01$). No significant differences were found in the male subsample, but the results of the analysis for three variables were very close to the criterion of significant difference. For two self-reported oral status variables (malocclusion and orthodontic treatment), additional nonparametric tests (Kruskal–Wallis test and median test) were performed to analyse the differences, and it was found that ANOVA and the nonparametric tests gave identical results.
Table 7. ANOVA of OH type groups by self-reported oral status measures.

| Variable                  | Female OH Types                  | Male OH types                  |
|---------------------------|----------------------------------|--------------------------------|
|                           | Excellent (N = 86)               | Good (N = 120)                 | Satisfactory (N = 120) | Poor (N = 113) | F     | P     |
| Tooth extraction          | 0.81 ± 1.23                      | 0.57 ± 1.02                    | 0.66 ± 1.15            | 0.77 ± 1.27    | 0.92  | 0.43  |
| Filled teeth              | 3.57 ± 2.76                      | 3.09 ± 2.23                    | 2.79 ± 2.25            | 2.39 ± 1.91    | 4.75  | 0.003 |
| Root canal treatment      | 1.20 ± 1.75                      | 1.49 ± 1.86                    | 1.25 ± 1.55            | 1.25 ± 1.54    | 0.70  | 0.55  |
| Toothache                 | 1.87 ± 0.84                      | 2.05 ± 0.86                    | 2.02 ± 0.81            | 2.34 ± 0.99    | 5.08  | 0.002 |
| Use of analgesics         | 1.45 ± 0.70                      | 1.42 ± 0.63                    | 1.42 ± 0.71            | 1.54 ± 0.81    | 0.66  | 0.57  |
| Use of antibiotics        | 1.36 ± 0.61                      | 1.33 ± 0.64                    | 1.34 ± 0.64            | 1.38 ± 0.76    | 0.11  | 0.95  |
| Malocclusion              | 0.22 ± 0.42                      | 0.33 ± 0.47                    | 0.26 ± 0.44            | 0.29 ± 0.46    | 1.02  | 0.38  |
| Orthodontic treatment     | 0.47 ± 0.50                      | 0.49 ± 0.50                    | 0.43 ± 0.50            | 0.43 ± 0.50    | 0.37  | 0.77  |

| Variable                  | Excellent (N = 20)               | Good (N = 71)                  | Satisfactory (N = 66) | Poor (N = 62) | F     | P     |
|---------------------------|----------------------------------|--------------------------------|-----------------------|---------------|-------|-------|
| Tooth extraction          | 0.40 ± 0.75                      | 0.45 ± 0.97                    | 0.58 ± 1.12            | 0.47 ± 1.16   | 0.24  | 0.87  |
| Filled teeth              | 2.10 ± 2.07                      | 2.14 ± 2.06                    | 2.61 ± 2.47            | 2.11 ± 2.35   | 0.69  | 0.56  |
| Root canal treatment      | 0.75 ± 1.25                      | 1.11 ± 1.32                    | 1.08 ± 1.19            | 0.87 ± 0.88   | 0.88  | 0.45  |
| Toothache                 | 1.55 ± 0.94                      | 2.04 ± 0.92                    | 2.05 ± 0.88            | 2.11 ± 0.91   | 2.04  | 0.11  |
| Use of analgesics         | 1.25 ± 0.76                      | 1.32 ± 0.55                    | 1.59 ± 0.86            | 1.35 ± 0.63   | 2.49  | 0.06  |
| Use of antibiotics        | 1.15 ± 0.37                      | 1.17 ± 0.38                    | 1.41 ± 0.74            | 1.26 ± 0.57   | 2.40  | 0.07  |
| Malocclusion              | 0.15 ± 0.37                      | 0.30 ± 0.46                    | 0.21 ± 0.41            | 0.31 ± 0.46   | 1.07  | 0.36  |
| Orthodontic treatment     | 0.25 ± 0.44                      | 0.42 ± 0.50                    | 0.33 ± 0.48            | 0.40 ± 0.49   | 0.90  | 0.44  |

Notes: Data are presented as the mean ± SD; F—analysis of the variance coefficient; p—significance of the ANOVA coefficient.

Fisher’s least significant difference (LSD) post hoc test was applied for some self-reported oral status variables. It was found that, in the female subsample, in the variable number of filled teeth, the excellent OH type differed significantly from the satisfactory and poor OH types, with females with excellent OH having more teeth with fillings than the other two OH types. Moreover, the good OH type differed from the poor OH type, with females with good OH having more teeth with fillings than the poor OH type. In the female subsample, the toothache frequency variable distinguished the poor OH type from all other OH types, with females with poor OH having the most frequent toothache.

In the malesubsample, the variable toothache was found to distinguish the excellent OH type from all other OH types, with excellent OH males being the least likely to have toothache. Furthermore, in male subjects, the use of analgesics variable distinguished the satisfactory OH type from all other types of OH, with men with satisfactory OH most frequently using analgesics for toothache. In the use of antibiotics variable, the satisfactory OH type differed from the good OH type, with men with satisfactory OH using antibiotics more frequently than men with good OH.

Since it was found that the different OH types of female and male respondents differed most in variables toothache and the number of filled teeth, additional analysis was performed for these two variables. These two variables were set as dependent variables, and a one-way ANOVA analysis of the differences was performed between different toothache and the number of filled teeth groups of subjects. Because of the very low frequency of specific groups, some groups for comparison were formed from several different outcomes (e.g., sometimes + often group for toothache, and six or more fills group for the number of filled teeth). The results of the analysis are presented in Table 8 for the female subsample and Table 9 for the male subsample.

Female respondents differed significantly in all OHAQ measures in terms of toothache frequency and in three of four OHAQ measures in terms of the number of filled teeth (except for the variable regularity of tooth brushing). It was observed that females who never experienced tooth pain practised such basic activities of oral hygiene more frequently and better than females who sometimes/often or rarely experienced tooth pain. Moreover, it was observed that females who very rarely experienced tooth pain practised such basic activities of oral hygiene more frequently and better than females who rarely experienced tooth pain.
Regarding orientation to a DMD, females who experienced toothache sometimes/often differed from the others, as shown by lower values.

Table 8. Analysis of variance of the OH status groups for female students.

| Variable | Frequency of toothache groups |  |  | F | p |
|----------|-------------------------------|---|---|---|---|
| Basic oral hygiene activities | | | |  | |
| Orientation to DMD | | | |  | |
| Very Rarely | 3.66 ± 0.71 | 3.38 ± 0.71 | 3.43 ± 0.71 | 5.11 | 0.002 |
| Rarely | 3.02 ± 0.96 | 2.97 ± 0.89 | 2.49 ± 0.81 | 4.63 | 0.003 |
| Sometimes + Often | 3.77 ± 0.89 | 3.52 ± 0.88 | 3.49 ± 0.84 | 2.92 | 0.034 |
| Number of filled teeth groups | | | |  | |
| Basic oral hygiene activities | | | |  | |
| Orientation to DMD | | | |  | |
| Very Rarely | 3.67 ± 0.77 | 3.74 ± 0.71 | 3.87 ± 0.78 | 6.35 | <0.001 |
| Rarely | 2.95 ± 0.96 | 2.92 ± 0.97 | 3.34 ± 0.88 | 2.62 | 0.050 |
| Sometimes + Often | 3.70 ± 0.98 | 3.70 ± 0.81 | 3.89 ± 0.85 | 0.66 | 0.58 |

Table 9. Analysis of variance of the OH status groups for male students.

| Variable | Frequency of toothache groups |  |  | F | p |
|----------|-------------------------------|---|---|---|---|
| Basic oral hygiene activities | | | |  | |
| Orientation to DMD | | | |  | |
| Very Rarely | 3.16 ± 0.65 | 3.16 ± 0.54 | 3.20 ± 0.68 | 4.16 | 0.007 |
| Rarely | 2.76 ± 0.83 | 2.64 ± 0.65 | 2.70 ± 1.11 | 0.97 | 0.41 |
| Sometimes + Often | 3.42 ± 1.04 | 3.00 ± 0.93 | 3.12 ± 1.19 | 1.76 | 0.16 |
| Number of filled teeth groups | | | |  | |
| Basic oral hygiene activities | | | |  | |
| Orientation to DMD | | | |  | |
| Very Rarely | 3.16 ± 1.07 | 1.97 ± 0.98 | 1.79 ± 1.05 | 0.41 | 0.75 |
| Rarely | 2.00 ± 1.12 | 2.02 ± 1.03 | 2.05 ± 1.12 | 1.93 ± 0.91 | 0.05 | 0.98 |

Notes: Data are presented as the mean ± SD; F—analysis of the variance coefficient; p—significance of the ANOVA coefficient.
Furthermore, according to the regularity of tooth brushing, females who never experienced toothache differed from those who sometimes/often or rarely experienced tooth pain, as shown by their higher values. Moreover, it was observed that females who very rarely experienced toothache reported regularity of tooth brushing higher than females who rarely experienced tooth pain. According to the use of dental floss, females who never experienced toothache differed from the others, and they used dental floss more often. Females with no or one filled tooth differed from the others in the lower level of basic oral hygiene activities; females with six or more filled teeth differed from the others in the more frequent use of dental floss and a higher level of orientation to a DMD.

Regarding the frequency of toothache among the female respondents, 25.7% of them answered that they never had toothache, and just 8.7% of them sometimes or often had toothache. The frequency of the number of filled teeth among females shows that 38.7% had no or only one filling in their teeth, and that 11.9% had six or more fillings.

Male subjects differed significantly in the OHAQ measure of toothache frequency in relation to the basic oral hygiene activities (BOHA) variable, but did not differ in relation to the number of filled teeth (Table 9).

According to basic oral hygiene activities, males who never experienced toothache differed from the others in their higher level of basic oral hygiene activities. Furthermore, according to the regularity of tooth brushing, males who never experienced toothache differed from those who have rarely experienced toothache, as shown by their higher values. Additionally, males with two or three filled teeth differed from those with no or one filled tooth and those with six or more filled teeth by their higher level of basic oral health activities. The frequency of toothache in male subjects showed that 30.6% of subjects never had toothache, and 6.4% had it sometimes or often. Regarding the frequency of filled teeth in male subjects (Table 9), 55.3% of respondents answered that they had no fillings or only one filling, whereas 10.5% had six or more fillings.

Considering the observed results of the OHAQ questionnaire and the findings on the differentiation of subjects with a different self-reported oral status in terms of their oral hygiene activities, especially in the female subsample, we wanted to increase the practical possibilities of this questionnaire; hence, an additional analysis was conducted. Specifically, the participating dental experts were asked to determine two cut-off values for the OHAQ sum variable (lower and upper cut-off limit), referred to as the two OHAQ index criteria. On the basis of these criteria, the following was determined: subjects with the OHAQ sum result lower than the lower limit could possibly be invited for an urgent examination at the DMD; subjects with the OHAQ sum result lower than the upper limit could possibly be recommended to visit the DMD of their choice or given a specific recommendation related to the lowest expressed OHAQ scale; subjects with the OHAQ sum result higher than the upper limit could possibly be given a confirmation of their excellent and high oral hygiene activities and habits. After a discussion within the dental expert group, two cut-off values were agreed upon: 11.00 as the lower cut-off value and 14.00 as the upper cut-off value.

In the male and female subsample, two categorical variables were compared. For the first variable, the OH type, OHAQ measures were used for classification into four different OH types, and, for the second variable, the OHAQ index, only one measure (OHAQ sum) was used for classification into three groups. Of course, the association of these measures was expected to be significant and positive, and the effect size of that association was expected to be very large. The results of the analysis are presented in Table 10.

The correlation analysis between the two categorical variables (OH types and OHAQ index) showed an extremely high correlation, which was to be expected since these are two different methods of classifying subjects into types/groups. Above the shaded fields on the diagonal of Table 10 are those subjects who may have been classified ‘incorrectly’ or ‘poorly’ (2.5% of females and 21% of males), as, for them, the OHAQ index classification was more rigorous than the classification of OH types. Below the shaded fields on the diagonal of Table 10 are those subjects who may have been classified ‘incorrectly’ or ‘poorly’ (15.5% % of females and 3.2% of males), as, for them, the OH types classification was more rigorous than the classification of OHAQ index.
Table 10. Association of OHAQ type and OHAQ index variables for female and male students.

| Female students | OHAQ index group | All | Test of Association |
|-----------------|------------------|-----|---------------------|
| OH type         | High             | Moderate | Low  | Chi-square test | 529.31 |
| Excellent       | 86               | 0     | 0   | df    6          | p <0.001|
| Good            | 26               | 88    | 6   | df    6          | p <0.001|
| Satisfactory    | 29               | 88    | 3   | df    6          | p <0.001|
| Poor            | 0                | 13    | 100 | df    6          | p <0.001|
| All             | 141              | 189   | 109 | df    6          | p <0.001|

| Male students | OHAQ index group | All | Test of Association |
|----------------|------------------|-----|---------------------|
| OH type        | High             | Moderate | Low  | Chi-square test | 241.68 |
| Excellent      | 20               | 0     | 0   | df    6          | p <0.001|
| Good           | 2                | 42    | 27  | df    6          | p <0.001|
| Satisfactory   | 4                | 43    | 19  | df    6          | p <0.001|
| Poor           | 0                | 1     | 61  | df    6          | p <0.001|
| All            | 26               | 86    | 107 | df    6          | p <0.001|

Notes: df—degrees of freedom; Cramer’s V—Cramer’s V effect size of the chi-square test; p—level of test significance.

4. Discussion

This study identified several significant findings: the outcome of this study is a questionnaire package that can assist clinicians in predicting students’ oral health activities by assessing some of their habits and attitudes through a questionnaire; the latent structure of oral health activities perceived by university students was determined, and those dimensions can be measured with the scales of the OHAQ questionnaire; female and male subsamples differed in the OHAQ questionnaire measures; for both female and male subsamples, different OH types of activities measured with the OHAQ questionnaire were identified, showing characteristic behaviours of certain clusters of respondents; the OHAQ measures were associated to some self-reported oral status measures, which additionally confirmed their initial validity; this study also raised several research questions and objectives that need to be explored in the future, but the construction of satisfactory oral health activity measures set the stage for conducting such research.

4.1. Dimensions of Oral Health Activities

Oral health activity items were found to project onto five latent dimensions (BOHA, ODMD, ROTB, FLOSS, and ADOH). Of the five constructed scales, four were found to have satisfactory metric properties. The ADOH scale with unsatisfactory metric properties (insufficient reliability) was excluded from the study and should be reviewed in more detail in future studies. The identified dimensions of oral health activities may provide directions for integrating and planning activities, as well as coordinating oral health prevention efforts, especially in the young population. Furthermore, the questionnaire could be a better instrument of choice for obtaining information about individual characteristics that are not found in clinical examinations, such as daily activities related to oral health [24]. In the literature, there are few examples of questionnaires that examine oral health attitudes and behaviours, and the most frequently used questionnaire is the HU-DBI developed by Kawamura [13–18], which focuses only on the tooth brushing technique and pays little attention to other oral health activities. From a clinical point of view, the OHAQ can be used as a guidance that will help a dentist diagnose a patient’s oral health profile. Overall, the recorded data demonstrate that the OHAQ scales have satisfactory metric characteristics and are able to measure oral health activities by four different scales, which show metric characteristics of reliability and homogeneity (their internal consistency varied from conditionally satisfactory to good). Furthermore, the data confirmed a satisfactory sensitivity of the four scales.

In both gender subsamples, significant and positive associations were found among the obtained values between all four OHAQ scales. The correlation coefficients were
significant but generally low. This finding indicates that each of the variables from the OHAQ questionnaire represents and explains only a very small portion of the common variance in the subsamples (from 4.4% to 16%) and that OHAQ scales measure relatively different areas of oral health activities. Associations between the OHAQ scales and the overall OHAQ sum result were positively significant and high. This finding shows that all OHAQ measures contribute to the overall measure, confirming the existence of a wide construct of oral health activities, and demonstrating the usefulness of the OHAQ sum result.

4.2. Frequencies and Gender Differences of Oral Health Activities

The results obtained on the total sample in this study of the four OHAQ measures are briefly presented and interpreted. More than 54% of students in Split brush their teeth for at least 3 min, change their toothbrush every 3 months, use fluoride toothpastes, and are confident that they know how to brush their teeth properly. Previous research in Croatia has shown that most students believe they know how to brush their teeth properly (78.8%), have received instructions on proper care (74.2%), and have been using the same toothbrush for less than 3 months (48.3%) [25]. Almost 70% of Croatian adolescents brush their teeth at least twice a day, and 30% of them use oral hygiene aids in addition to brushing, although 80% do not floss at all [5]. This study shows that about 70% of students at the University of Split use a safe approach to care, i.e., they apply measures that can contribute to better and safer care of the oral cavity and teeth, such as never skip evening brushing—74% or use fluoride toothpaste—41%. Preferably, toothpaste should contain fluoride, which promotes remineralisation and slows remineralisation of tooth structure, and antibacterial agents [26]. Regular check-ups, at least once a year, and tartar cleaning were not among the characteristics of the subjects in this study. Sociodemographic factors determine whether Chilean adolescents in Santiago go for a dental check-up, and adolescents who do not go for annual check-ups are mostly male, rarely brush their teeth, and have a low-income father and mother with only primary school education [27]. Furthermore, clinical examination revealed their poor oral health and that they were more likely to attend poorer schools. Research conducted in Mexico on dental students suggests that the main reason for poor prevention practices in dentistry is the lack of involvement of dentists [28]. In addition, efforts should be made to create positive attitudes towards oral health prevention and identify the need for education and training of oral health prevention experts [29].

In the present sample, gender differences were found, and females showed better results than males on all OHAQ scales. Compared to males, females brushed their teeth more often, showed a better basic approach to oral hygiene, used dental floss, and attended dental check-ups more often. However, a national survey-based study on Estonian dental students’ oral health-related knowledge, attitudes, and behaviours showed that there was no single significant difference between females and males in any item. Nevertheless, females had higher assessments than males in items brushing without toothpaste and post-brushing checking [17]. Moreover, a study on the Croatian adolescents sample in cities revealed that oral health was influenced by various demographic and social factors, including gender, and the study confirmed previous findings that oral hygiene-related attitudes and behaviours in adolescents are gender-related (e.g., females attached more importance to oral health and hygiene than males) [5]. A study conducted on Turkish dental students revealed a significant difference between improvement in oral health behaviours and oral hygiene habits and increasing educational level, and dental hygiene was better in females than in males [30]. Male health science students in Kuwait showed good oral health knowledge but poor practice and habits compared to their female peers [31]. Kuwaiti female students brushed their teeth more often than male students, were more aware and concerned about oral health problems, and invested more in oral hygiene than male students [32].

It can be concluded that the observed gender differences in oral health activities and behaviours among students from this study additionally confirm the literature findings [5,30–32].
4.3. Types of Oral Health Activities

In both males and females, four different types of oral health activities were identified: excellent, good, satisfactory, and poor OH type. The structure of the identified OH types in the female subsample and the male subsample had many similarities and shared some basic characteristics and relationships between the scores on OHAQ scales. Although the OH types in the female and male subsample had identical names, there were substantial differences between them in the frequency or in the ‘extent’ of certain OH activities. The differences between female and male OH types could be attributed to the previously determined gender differences on all OHAQ scales. These differences are consistent with other findings in the literature that detected gender differences, with either different behaviours or different frequencies of certain behaviours [5,28–31].

Furthermore, significant findings were the relative frequencies and basic characteristics of the identified OH types. In the female subsample, the relative frequencies of OH types were excellent—19.6%, good—27.3%, satisfactory—27.3%, and poor—25.7%. In the male subsample, the relative frequencies of OH types were excellent—9.1%, good—32.4%, satisfactory—30.1%, and poor—28.3%. The excellent OH type in the female subsample was about twice as numerous as the same OH type in the male subsample, and relative values of the other OH types were less pronounced. Given the basic characteristics of the identified OH types, it was justified to assume that only the members of the two excellent types would have high-quality OH care in all the areas needed (regularity of tooth brushing, application of basic activities, orientation to DMD, and use of dental floss). All other OH types in both subsamples need certain improvements and changes in their behaviours, to a greater or lesser extent, to achieve excellent OH care. For example, members of the good OH type should increase the frequency of flossing despite the very good characteristics of regular tooth brushing and basic OH activities. Members of the satisfactory OH type should increase the frequency of all their OH activities, orientation to DMD, and other activities measured by the OHAQ scales. Members of the poor OH type should significantly change their behaviours related to performing OH activities, as their behaviours were very undesirable and of poor quality.

Comparison of the identified OH types in the female subsample to the self-reported oral status measures revealed significant differences between different OH type groups in two oral status measures: toothache and the number of filled teeth. It was found that increased quality of OH activities was associated with an increased number of filled teeth. Thus, females with a better and preferred OH type had a higher number of filled teeth. This was opposite to the expectation expressed at the beginning of this study that a higher number could objectively represent poor and less desirable characteristics of individual oral health status, but it was indeed very understandable and easy to interpret. Females who take better care of their OH are also more likely to go for regular DMD check-ups and take the necessary measures (such as dental fillings) to maintain their oral health and prevent further discomfort or impairment. It was found that increased quality of OH activities was associated with a lower incidence of toothache. Females belonging to the least desirable, poor OH type had an incidence of toothache higher than all other females. In the male subsample, differences were found between OH type groups in some self-reported oral status variables. Males with the excellent OH type had the lowest incidence of toothache of all the OH types. Males with the satisfactory OH type had the highest frequency of use of analgesics for toothache of all the OH types. Considering the characteristics of the satisfactory OH type, they might be advised to change their behaviour so that, instead of taking analgesics frequently, they focus on brushing their teeth more often and visit the DMD more frequently.

Lastly, it is reasonable to argue that the OH types identified by OHAQ questionnaire in the male and female subsamples can allow a better designing, adapting, or modulating of future education or prevention programs to a specific and targeted part of the adolescent population. For example, students (or other users of the questionnaire) may be directed or invited to different educational programs solely on the basis of questionnaire classification or the determined ‘membership’ in a particular OH gender type.
4.4. Self-Reported Oral Health Status and OHAQ Measures

Self-reported oral health status showed that male and female students had, on average, <1 extracted tooth, <3 filled teeth, and <2 treated teeth. As expected, higher incidences of the extracted teeth, filled teeth, and treated teeth had significantly lower frequencies among students. Furthermore, both female and male students rated the frequency of toothache and the use of analgesics and antibiotics for their teeth as low. A study on self-reported oral health status stated that the behaviour, consciousness, and oral health status of medical and dental students were not optimistic [33]. A study on Iraqi dental students showed that they had quite good behaviour and attitude toward oral health. However, the authors believed that additional focus needs to be placed on the anticipatory and behavioural aspects of oral self-help practice [34].

A review of the literature on the validity of self-reported oral health measures revealed that the findings are somewhat contradictory and differ in terms of variables used in individual studies. Findings that indicate that such measures have poor validity mainly relate to the variables that measure assessment of dental caries [35], specific periodontal variables [35–37], and normative dental treatment needs [38]. However, there is evidence that self-reported oral health status measures accurately provide number of teeth [35,36,39–43], presence of fillings [35], use of dental prosthesis [36], periodontal disease [39,44–46], orofacial pain [47], root canal treatment (RCT) [35,37], and orthodontic and endodontic needs [38]. These validity-supporting authors also stated the following reasons and benefits for using self-reported oral health measures: for great cost and time savings [35,46], as a valid method to determine the number of teeth in national health surveys [39], as accurate diagnostics for predicting orthodontic and endodontic needs [38], as a valid reflection of the clinical status [40], as a valuable tool for epidemiological studies and surveillance of periodontal health in the adult population [36,45], and as possible guidance for people in making improvements in their lifestyle [48]. According to the previous claims, we conclude that it was reasonable to assume that self-reported oral health measures could be a useful and good basis for the implementation of a rapid and rough classification of students’ oral health status, as well as for the initial validation of the OHAQ measures. Of course, in future studies involving the OHAQ questionnaire and for further validation of the questionnaire, it is recommended to use oral status measures determined by clinical examination.

On the basis of the present findings, oral health activities are related to the frequency of toothache. A regular level of basic oral hygiene activities appears to be related to a lower incidence of toothache in the entire population, independently of gender. In females, the orientation to a DMD, the use of dental floss, and the regularity of tooth brushing are also significantly correlated with the frequency of toothache. These findings are consistent with other data from the literature [49,50]. From a more general point of view, it was expected that the oral health activities and behaviour scales presented in this study could differentiate subjects with insufficient oral health activities and high-risk behaviour for toothache. The scales showed good discriminant predictive value in differentiating subjects according to their frequency of toothache. Regarding the number of filled teeth, basic oral health activities were higher in females with six or more filled teeth than in those with fewer fillings. Furthermore, the orientation to a DMD and the use of dental floss were more frequent in female students with six or more tooth fillings. A possible explanation for this observation is that the experiences of female students with six or more filled teeth probably reflect some behavioural alterations and more frequent and higher-quality practices of basic oral hygiene activities in comparison to females with only one or no filled teeth. It is reasonable to conclude that these findings further confirm good discriminant validity of the OHAQ in relation to self-reported oral status measures (e.g., frequency of toothache and number of filled teeth).

4.5. Usage of the OHAQ Index Criteria

By using the OH types classification, all subjects were classified into four different OH types (excellent, good, satisfactory, and poor), and, by using the expert-established OHAQ index criteria, all students were divided into three different groups (with high, moderate,
or low overall OHAQ results). Considering these two different classifications of subjects, we (the authors of the study) noticed a “problem” in the central part of the classifications, representing the good and satisfactory OH types and the moderate OHAQ index group. A large percentage of females were below the diagonal (15.5%), and a small percentage were above the diagonal (2.5%) of these two classifications. Exactly the opposite, a large percentage of males were above the diagonal (21%), and a small percentage were below the diagonal (3.2%) of these two classifications. From these observed differences in the classifications of females and males, it can be concluded that the OHAQ index criteria established by the experts were ‘permissive’ for the female subsample and ‘severe’ for the male subsample. As an outcome of gender differences in OHAQ measures and of these expert-established criteria, male subjects tended to be assigned to a lower OHAQ index group, whereas female subjects tended to be assigned to a higher OHAQ index group.

Nevertheless, we believe that the OHAQ index criteria were well established and that the observed discrepancy was due to the previously determined gender differences in all the OHAQ measures. Of course, it could be recommended for these OHAQ index criteria to be tested further in practice so that additional specific expert-defined criteria can be developed for each of the four OHAQ measures. Systematic reviews have shown that oral health education has a positive impact on the health, knowledge, and practical behaviour of children and adolescents [51,52]. However, the authors did not find a similar index or criterion for a rapid and rough classification of adolescents.

4.6. Limitations of the Study

This study is a cross-sectional study that based its findings on participants’ self-reports. Moreover, one limitation might be the way the OHAQ construct was measured. The OHAQ measures had only a conditionally satisfactory level of reliability, and the process of their advancement has to be continued. It is necessary to increase the number of items in the scales in future studies. Furthermore, it is necessary to reconsider the measurement of the ADOH subscale in a more detailed way. Perhaps a possibility of using some particular items from that scale as a single item construct should be considered. Although the literature confirms the satisfactory validity of self-reported oral health measures, we think it is necessary to perform an additional validation of OHAQ measures through a clinical examination of subjects. In this research, the implementation of clinical examination of subjects was not conducted due to the application of a developing questionnaire entirely in classrooms at the end of a lecture, and the filling out of the questionnaire was carried out anonymously. Furthermore, for future research, it will be necessary to verify the proposed categorisation based on the OHAQ index criteria, as well as provide additional criteria for each OHAQ measure. In addition to completing the questionnaire, it is necessary to invite students to an examination by a DMD to determine their oral status and to invite them to participate in educational OH programs. It is also possible to check the relationships between the OHAQ measures and some other possibly valuable measures, such as measures of body image (general teeth satisfaction), OH attitudes, sources of OH behaviours, self-esteem, and the traits of optimism and hope.

5. Conclusions

The construct validity of the OHAQ questionnaire was found to be good, considering the satisfactory metric properties of its scales. Good construct validity manifested itself in several important findings: the scales of the OHAQ questionnaire measured relatively independent domains of OH yet contributed significantly and to a large extent to the explanation of the overall measure of OH activities; the questionnaire scales showed good discriminant validity, revealing both gender differences and differences related to specific elements of subjects’ self-reported oral status measures (e.g., frequency of toothache and the number of filled teeth); on the basis of the OHAQ measures, it was possible to identify different OH types in both gender subsamples, with significant differences found in their OH behaviours and habits. It is reasonable to conclude that by measuring all four OHAQ measures, it could be
possible to get a good and broad insight into OH activities and behaviours of the subjects. Furthermore, there is a need for additional validation in future research of OHAQ measures through a clinical examination of subjects, which was not performed in the present study because of the anonymous administration of the OHAQ questionnaire among students.

The OHAQ questionnaire accomplished the set goal, which was to provide a tool for quick, short, and good classification of subjects based on their OH activities and behaviours. It is recommended to be used both in future research (while improving the metric properties of the OHAQ scales) and in practice, both for rapidly classifying subjects and for measuring the possible impact of oral care educational programs implemented in pre-, post-, and possible follow-up tests.

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References
1. Marchetti, E.; Monaco, A.; Proacccini, L.; Mummolo, S.; Gatto, R.; Tété, S.; Baldini, A.; Tecco, S.; Marzo, G. Periodontal disease: The influence of metabolic syndrome. Nutr. Metab. 2012, 9, 88. [CrossRef] [PubMed]
2. Baldini, A.; Nota, A.; Cioffi, C.; Ballanti, F.; Cozza, P. Infrared thermographic analysis of craniofacial muscles in military pilots affected by bruxism. Aerosp. Med. Hum. Perform. 2015, 86, 374–378. [CrossRef] [PubMed]
3. Baldini, A.; Nota, A.; Cravino, G.; Cioffi, C.; Rinaldi, A.; Cozza, P. Influence of vision and dental occlusion on body posture in pilots. Aviat. Space Environ. Med. 2013, 84, 823–827. [CrossRef] [PubMed]
4. Leao, A.; Sheiham, A. Relationship between clinical dental status and subjective impacts on daily living. J. Dent. Res. 1995, 74, 1408–1413. [CrossRef]
5. Pellizzer, C.; Pejda, S.; Špalj, S.; Plančak, D. Unrealistic Optimism and Demographic Influence on Oral Health-Related Behaviour and Perception in Adolescents in Croatia. Acta Stomatol. Croat. Int. J. Oral Sci. Dent. Med. 2007, 41, 215.
6. Schou, L.; Blinkhorn, A.S. Oral Health Promotion; Oxford University Press: Oxford, UK, 1993.
7. Choo, A.; Delac, D.M.; Messer, L.B. Oral hygiene measures and promotion: Review and considerations. Aust. Dent. J. 2001, 46, 166–173. [CrossRef]
8. Badovinac, A.; Božić, D.; Vučinac, I.; Vošilgaj, J.; Vražić, D.; Plančak, D. Oral health attitudes and behavior of dental students at the University of Zagreb, Croatia. J. Dent. Educ. 2013, 77, 1171–1178. [CrossRef]
9. Marchetti, E.; Mummolo, S.; Di Mattia, J.; Casalena, F.; Di Martino, S.; Mattei, A.; Marzo, G. Efficacy of essential oil mouthwash with and without alcohol: A 3-day plaque accumulation model. Trials 2011, 12, 262. [CrossRef]
10. Marchetti, E.; Tecco, S.; Caterini, E.; Casalena, F.; Quinzii, V.; Mattei, A.; Marzo, G. Alcohol-free essential oils containing mouthrinse efficacy on three-day supragingival plaque regrowth: A randomized crossover clinical trial. Trials 2017, 18, 154. [CrossRef]
11. Bader, J.D.; Shugars, D.A.; Bonito, A.J. A systematic review of selected caries prevention and management methods. Community Dent. Oral Epidemiol. 2001, 29, 399–411. [CrossRef]
12. Ostberg, A.L.; Halling, A.; Lindblad, U. A gender perspective of self-perceived oral health in adolescents: Associations with attitudes and behaviours. Community Dent. Health 2001, 18, 110–116. [PubMed]
13. Kawamura, M.; Honkala, E.; Widström, E.; Komabayashi, T. Cross-cultural differences of self-reported oral health behaviour in Japanese and Finnish dental students. Int. Dent. J. 2000, 50, 46–50. [CrossRef] [PubMed]
14. Kawamura, M.; Spadafora, A.; Kim, K.J.; Komabayashi, T. Comparison of United States and Korean dental hygiene students using the Hiroshima university-dental behavioural inventory(HU-DBI). Int. Dent. J. 2002, 52, 156–162. [CrossRef] [PubMed]
15. Kawamura, M.; Yip, H.K.; Hu, D.Y.; Komabayashi, T. A cross-cultural comparison of dental health attitudes and behaviour among freshman dental students in Japan, Hong Kong and West China. *Int. Dent. J.* 2001, 51, 159–163. [CrossRef]

16. Komabayashi, T.; Kwan, S.Y.; Hu, D.Y.; Kajiwara, K.; Sasahara, H.; Kawamura, M. A comparative study of oral health attitudes and behaviour using the Hiroshima University—Dental Behavioural Inventory (HU-DBI) between dental students in Britain and China. *J. Oral Sci.* 2005, 47, 1–7. [CrossRef]

17. Riad, A.; Pöld, A.; Olak, J.; Howaldt, H.P.; Klugar, M.; Krsek, M.; Attia, S. Estonian Dental Students’ Oral Health-Related Knowledge, Attitudes and Behaviours (KAB): National Survey-Based Study. *Int. J. Environ. Res. Public Health* 2022, 19, 1908. [CrossRef]

19. Kawamura, M.; Iwamoto, Y.; Wright, F.A. A comparison of self-reported dental health attitudes and behavior between selected Japanese and Australian students. *J. Dent. Educ.* 1997, 61, 354–360. [CrossRef]

20. Polychronopoulou, A.; Kawamura, M. Oral self-care behaviours: Comparing Greek and Japanese dental students. *Eur. J. Dent. Educ. Off. J. Assoc. Dent. Educ. Eur.* 2005, 9, 164–170. [CrossRef]

21. Khan, S.Q. Dental caries in Arab League countries: A systematic review and meta-analysis. *Int. Dent. J.* 2014, 64, 173–180. [CrossRef]

22. Kazeminia, M.; Abdi, A.; Shohaimi, S.; Jalali, R.; Vaisi-Raygani, A.; Salari, N.; Mohammadi, M. Dental caries in primary and permanent teeth in children’s worldwide, 1995 to 2019: A systematic review and meta-analysis. *Head Face Med.* 2020, 16, 22. [CrossRef] [PubMed]

23. Hugoson, A.; Koch, G.; Göthberg, C.; Helkimo, A.N.; Lundin, S.A.; Norderyd, O.; Sjödin, B.; Sondell, K. Oral health of individuals aged 3–80 years in Jönköping, Sweden during 30 years (1973–2003). I. Review of findings on dental care habits and knowledge of oral health. *Swed. Dent. J.* 2005, 29, 125–138. [PubMed]

24. Zukanović, A. Caries risk assessment models in caries prediction. *Acta Med. Acad.* 2013, 42, 198–208. [CrossRef]

25. Mostarčić, K.I.; Šimat, S.; Matijević, J.; Krmek-Jukić, S.J.A.S.C. Comparison of Oral Hygiene Habits of the 4th Year Students of Different Faculties of University of Zagreb. *Acta Stomatol. Croat.* 2009, 43, 310–318. [CrossRef]

26. Jensen, O.; Gabre, P.; Sköld, U.M.; Birkhed, D. Is the use of fluoride toothpaste optimal? Knowledge, attitudes and behaviour concerning fluoride toothpaste and toothbrushing in different age groups in Sweden. *Community Dent. Oral Epidemiol.* 2012, 40, 175–184. [CrossRef] [PubMed]

27. Lopez, R.; Baelum, V. Factors associated with dental attendance among adolescents in Santiago, Chile. *BMC Oral Health* 2007, 7, 4. [CrossRef] [PubMed]

28. Aguilar-Díaz, F.C.; Ponce-Cruz, Y.R.; Mortellaro, C.; Giaiommolo, M.; Manfredi, B.; Khijmatgar, S.; Biagi, R.; Greco Lucchina, A.; Del Fabbro, M. Knowledge, practices and perceptions regarding oral health preventive measures among Mexican dental students: A cross-sectional survey study. *J. Biol. Regul. Homeost. Agents* 2021, 35, 163–171. [CrossRef] [PubMed]

29. Pinar Erdem, A.; Peker, K.; Kuru, S.; Sepet, E. Evaluation of Final-Year Turkish Dental Students’ Knowledge, Attitude, and Self-Perceived Competency towards Preventive Dentistry. *BioMed Res. Int.* 2019, 2019, 2346061. [CrossRef]

30. Peker, I.; Alkurt, M.T. Oral Health Attitudes and Behavior among a Group of Turkish Dental Students. *Eur. J. Dent.* 2009, 3, 24–31. [CrossRef]

31. Al-Ansari, J.; Honkala, E.; Honkala, S. Oral health knowledge and behavior among male health sciences college students in Kuwait. *BMC Oral Health* 2003, 3, 2. [CrossRef] [PubMed]

32. Al-Hussaini, R.; Al-Kandari, M.; Hamadi, T.; Al-Mutawa, A.; Honkala, S.; Memon, A. Dental health knowledge, attitudes and behaviour among students at the Kuwait University Health Sciences Centre. *Med. Princ. Pract. Int. J. Kuwait Univ. Health Sci. Cent.* 2013, 12, 260–265. [CrossRef] [PubMed]

33. Yao, K.; Yao, Y.; Shen, X.; Lu, C.; Guo, Q. Assessment of the oral health behavior, knowledge and status among dental and medical undergraduate students: A cross-sectional study. *BMC Oral Health* 2019, 19, 26. [CrossRef] [PubMed]

34. Karem Hassan, B.; Jabbar Ali, B.; Mahmood Alwan, A.; Badeia, R.A. Self-Reported Oral Health Attitudes and Behaviors, and Gingival Status of Dental Students. *Clin. Cosmet. Investig. Dent.* 2020, 12, 225–232. [CrossRef] [PubMed]

35. Pitiphat, W.; García, R.J.; Douglass, C.W.; Joshipura, K.J. Validation of self-reported oral health measures. *J. Public Health Dent.* 2002, 62, 122–128. [CrossRef] [PubMed]

36. Buhlin, K.; Gustafsson, A.; Andersson, K.; Häkansson, J.; Klinge, B. Validity and limitations of self-reported periodontal health. *Community Dent. Oral Epidemiol.* 2002, 30, 431–437. [CrossRef] [PubMed]

37. Franciscoatto, G.J.; Kopp, B.T.F.; Hoppe, C.B.; Oliveira, J.A.P.; Haas, A.N.; Grecca, F.S.; Rossi-Fedele, G.; Gomes, M.S. Validation of self-reported history of root canal treatment in a southern Brazilian subpopulation. *Braz. Oral Res.* 2019, 33, e007. [CrossRef]

38. Farmer, J.; Ramraj, C.; Azarpazhooh, A.; Dempster, L.; Ravaghi, V.; Quiñonez, C. Comparing self-reported and clinically diagnosed unmet dental treatment needs using a nationally representative survey. *J. Public Health Dent.* 2017, 77, 295–301. [CrossRef]

39. Margozzini, P.; Berrios, R.; Cantarutti, C.; Veliz, C.; Ortuno, D. Validity of the self-reported number of teeth in Chilean adults. *BMC Oral Health* 2019, 19, 99. [CrossRef]

40. Matsui, D.; Yamamoto, T.; Nishigaki, M.; Miyatani, F.; Watanabe, I.; Koyama, T.; Ozaki, E.; Kuriyama, N.; Kanamura, N.; Watanabe, Y. Validity of self-reported number of teeth and oral health variables. *BMC Oral Health* 2016, 17, 17. [CrossRef]
41. Douglass, C.W.; Berlin, J.; Tennstedt, S. The validity of self-reported oral health status in the elderly. J. Public Health Dent. 1991, 51, 220–222. [CrossRef]
42. Ueno, M.; Zaitsu, T.; Shinada, K.; Ohara, S.; Kawaguchi, Y. Validity of the self-reported number of natural teeth in Japanese adults. J. Investig. Clin. Dent. 2010, 1, 79–84. [CrossRef] [PubMed]
43. Høvik, H.; Kolberg, M.; Gjøra, L.; Nymoen, L.C.; Skudutyte-Rysstad, R.; Hove, L.H.; Sun, Y.Q.; Fagerhaug, T.N. The validity of self-reported number of teeth and edentulousness among Norwegian older adults, the HUNT Study. BMC Oral Health 2022, 22, 82. [CrossRef] [PubMed]
44. Abbood, H.M.; Hinz, J.; Cherukara, G.; Macfarlane, T.V. Validity of Self-Reported Periodontal Disease: A Systematic Review and Meta-Analysis. J. Periodontol. 2016, 87, 1474–1483. [CrossRef] [PubMed]
45. Eke, P.I.; Dye, B. Assessment of self-report measures for predicting population prevalence of periodontitis. J. Periodontol. 2009, 80, 1371–1379. [CrossRef]
46. Ho, A.W.; Grossi, S.G.; Dunford, R.G.; Genco, R.J. Reliability of a self-reported health questionnaire in a periodontal disease study. J. Periodontal. Res. 1997, 32, 646–650. [CrossRef]
47. Nilsson, I.M.; List, T.; Drangsholt, M. The reliability and validity of self-reported temporomandibular disorder pain in adolescents. J. Orofac. Pain 2006, 20, 138–144.
48. Liu, Y. The relationship between lifestyle and self-reported oral health among American adults. Int. Dent. J. 2014, 64, 46–51. [CrossRef]
49. Obregón-Rodríguez, N.; Fernández-Riveiro, P.; Piñeiro-Lamas, M.; Smyth-Chamosa, E.; Montes-Martínez, A.; Suárez-Cunqueiro, M.M. Prevalence and caries-related risk factors in schoolchildren of 12- and 15-year-old: A cross-sectional study. BMC Oral Health 2019, 19, 120. [CrossRef]
50. Zhang, M.; Lan, J.; Zhang, T.; Sun, W.; Liu, P.; Wang, Z. Oral health and caries/gingivitis-associated factors of adolescents aged 12–15 in Shandong province, China: A cross-sectional Oral Health Survey. BMC Oral Health 2021, 21, 288. [CrossRef]
51. Bramantoro, T.; Santos, C.M.A.; Hariyani, N.; Setyowati, D.; Zulfiana, A.A.; Nor, N.A.M.; Nagy, A.; Pratamawari, D.N.P.; Irmalia, W.R. Effectiveness of the school-based oral health promotion programmes from preschool to high school: A systematic review. PLoS ONE 2021, 16, e0256007. [CrossRef]
52. Geetha Priya, P.R.; Asokan, S.; Janani, R.G.; Kandasvamy, D. Effectiveness of school dental health education on the oral health status and knowledge of children: A systematic review. Indian J. Dent. Res. Off. Publ. Indian Soc. Dent. Res. 2019, 30, 437–449. [CrossRef] [PubMed]