

**Changes in Adolescent's Oral Health Status: Responsiveness of the Child
Perception Questionnaire 11-14 (CPQ₁₁₋₁₄)**

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Key words: Oral-health-related- quality of life, dental caries, responsiveness, treatment
program, adolescents

Short title: Changes in Adolescent's Oral Health Status: Responsiveness of the CPQ₁₁₋₁₄

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ABSTRACT

Changes in oral health status following treatment should be assessed clinically as well as by patients' reported outcomes. This study investigated changes on oral-health-related-quality of life (OHRQoL) of adolescents enrolled in a comprehensive oral health care program for caries and gingival conditions. The sensitivity of the Child Perception Questionnaire (CPQ₁₁₋₁₄) to detect clinical changes, i.e. its responsiveness, was assessed. A total of 618 10-15-year adolescents answered the questionnaire before treatment and 560 at follow-up after 1 year. In the follow-up, two additional global transition judgement questions were asked. The adolescents were clinically and radiographically examined. At the baseline 374 adolescents needed only non-operative treatment whereas 274 needed non- and operative treatments. After 1 year the adolescents were regrouped according to the fulfillment of their treatment needs in Group 1 (n=363) needing/receiving non-operative treatment only; Group 2 (n=98) needing/receiving both non- and operative treatments; Group 3 (n=99) receiving non-operative treatment only, while needing also operative treatment. The CPQ₁₁₋₁₄ total mean change scores by the global transition judgment on self-perceived oral health status indicated significant differences ($p < 0.001$, ANOVA; internal responsiveness). The effect of the program for the treatment groups was significant ($p = 0.014$, ANCOVA; external responsiveness). The effect size was of moderate magnitude, indicating that adolescents, to a certain extent, perceived clinical meaningful change on their OHRQoL. In conclusion, an overall improvement of adolescents' OHRQoL was observed following 1-year oral health care program for caries and gingival conditions. The CPQ₁₁₋₁₄ seems appropriate for measuring long-term changes on adolescents' OHRQoL.

INTRODUCTION

It is becoming increasingly recognized that changes in oral health status following treatment should be assessed clinically as well as by patients' reported outcomes [Mashoto et al. 2010; Krisdapong et al. 2013; de Paula et al. 2015].

The concept of responsiveness was introduced in biomedical research to account for the sensitivity of an instrument to detect minimal but important clinical changes in (oral) health status [Guyatt et al. 1987; Slade and Spencer, 1994; Locker et al. 2004]. In this context, two aspects of the responsiveness seem to be of importance when treatment efficiency is assessed in longitudinal studies: internal and external responsiveness. Internal responsiveness refers to relating changes in scores over time to patients' global rating of change in their health and well-being, so called global transition judgments. External responsiveness refers to comparing scores on a measure prior to and following an intervention that is known to be effective in improving patient well-being [Locker et al. 2004, Tsakos et al. 2011, Kieffer et al. 2012].

The adverse impact of oral conditions on adolescents' oral- health-related-quality of life (OHRQoL) compromises eating, sleeping, school attendance, emotional and social well-being [Mashoto et al. 2010, Aimée et al. 2016, Vettore et al. 2019]. Different definitions and methods have been developed to assess responsiveness of OHRQoL measures in children and adolescents [Terwee et al. 2003, Anderson et al. 2004, Graynor et al. 2012, Locker et al. 2007, Lindeboom et al. 2005].

The Child Perception Questionnaire (CPQ₁₁₋₁₄) is a validated instrument developed to measure OHQoL of adolescents [Jokovic et al. 2002]. To date, few studies including adolescents assessed the long-term responsiveness of the CPQ₁₁₋₁₄. Changes associated with a basic dental treatment in Cambodian 8-14-year olds were evaluated after six months [Turton et al. 2015] whereas changes related to a supervised toothbrushing program in 10-13-year old New Zealander were assessed after 1-year [Foster Page et al. 2019]. In these studies, OHRQoL improved over time and the responsiveness was considered satisfactory [Turton et al. 2015] and acceptable [Foster Page et al. 2019]. The applicability of the CPQ₁₁₋₁₄ for long-term assessment of changes associated with a

comprehensive oral health care program for caries and gingival conditions has yet to be explored.

Therefore, this study investigated possible changes on OHRQoL of adolescents enrolled in a comprehensive oral health care program for caries and gingival conditions. The internal and external long-term responsiveness of the CPQ₁₁₋₁₄ was assessed after 1 year. The null hypothesis was that a significant improvement in oral-health-related quality of life (OHRQoL) of adolescents would not be observed after 1-year program.

SUBJECTS AND METHODS

Ethics, study design and sample

The study protocol was approved by the Ethical Committee of the University of Brasília, Brazil (Brazilian register number 1.096.882). Parents and adolescents were informed about the study and signed written informed consent and assent, respectively.

The study is a controlled clinical trial with pre-test/post-test design. Details of inclusion and exclusion criteria, sample selection and sample size (n=618) were published previously [Aimée et al. 2017]. A total of 618 10-15-year olds were enrolled at baseline and 560 after 1 year.

Since sample size is a given in the present study, only a sensitivity analysis can be performed. Using a paired-samples t-test to compare changes in mean pre- to post-test scores, two-tailed testing, an alpha of 5%, a power of 90% and a sample size of 560, resulted in an effect size of about 0.14.

Study Procedures

Two mobile dental offices belonging to the University Hospital of Brasília (HUB), Brazil were installed at the school backyard for oral health examination and treatment of the adolescents during the study period.

Questionnaires

At baseline, a questionnaire filled out by parents requested information about family socio-demographic variables. Mother's level of education (technical or university; secondary schooling; primary schooling or less), employment status of the head of the

family (employed; unemployed; retired or other), family monthly income (from 1 to 4 minimum wages; less than 1 minimum wage) were reported.

At baseline and after 1-year follow-up the adolescents were asked to complete a self-applied questionnaire in small groups under supervision of the first author (NRA) before any clinical assessment. The questionnaire was designed to collect data about demographic (age and gender) and oral health behavior determinants: brushing frequency ($\geq$ twice per day; $\leq$ once per day), use of fluoride toothpaste (yes; no/don't know), consumption of soft drink (seldom; some times per week; at least once per day), consumption of sweets (seldom; some times per week; at least once per day), consumption of alcoholic beverages (no; yes), tobacco use ever (no; yes).

For assessment of OHRQoL, the Portuguese language version of the CPQ₁₁₋₁₄ for cross-cultural consistency was used [Barbosa et al. 2009]. The CPQ₁₁₋₁₄ measures several oral health dimensions including oral symptoms, functional limitation, emotional well-being and social well-being. The 16 questions of the CPQ₁₁₋₁₄ were answered on a five-point scale as never (score 0), once/twice (score 1), sometimes (score 2), often (score 3) and every day/almost every day (score 4). The possible total sum of scores given to each individual ranges from 0 to 64. A high score on OHRQoL (using a mean) indicated an adverse impact of oral health conditions.

At 1-year follow-up, the questionnaire included an additional measure of adolescents' oral health by means of two global items [Jokovic et al., 2002], i.e. the global transition judgments. Adolescents were asked to self-rate their oral health status after 1-year program (excellent, very good, good, fair, and poor), and to estimate the extent to which their oral health condition bothered them (not at all; little; somewhat; much; very much). Adolescents' oral health perception was assessed as having strong improvement, some improvement, stable, some deterioration or strong deterioration.

The questionnaires were answered in a Personal Digital Assistant (PDA- HP iPaq 116, Hewlett® Packard, USA).

Clinical and radiographic examinations

Prior to the clinical examination for dental caries, the participants received professional toothbrushing and flossing carried out by one examiner (HDM). The adolescents were clinically examined for caries by another examiner (JCC). Dental caries was clinically diagnosed according to its activity and severity [Carvalho et al. 2014, 2016, 2017]. Since non-cavitated lesions were unlikely to influence the OHRQoL of adolescents, these were

not included in the analysis of the present study. Caries experience was considered at D₃MFT/S level (D₃: the decayed component represented active and inactive cavitated lesions, M= missing due to caries, F: filled, T: tooth, S: surface).

For the radiographic examination the adolescents wore a lead collar and apron to assure adequate protection during the exposure. Two digital phosphor-based bitewing views were taken (NRA). The severity of cavitated dentine lesions was radiographically defined as shallow when it showed radiolucency in the outer third of dentin. Moderate lesions had radiolucency in the middle third of dentin and severe lesions had radiolucency in the inner third of dentin or deeper [Mejare et al., 2004]. The occurrence and severity of cavitated lesions at the baseline and at 1-year follow-up examination were recorded and assessed (HDM). The examiners were blinded to the results of the questionnaires.

Test re-test reliability

The test-retest reliability of the CPQ₁₁₋₁₄ in 5% of the sample was assessed twice at both baseline examination and 1year follow-up (n=31). At the baseline examination it showed an intra-class correlation coefficient of 0.63. At 1-year follow-up the correlation coefficient was 0.70.

Inter- and intra-examiner reliability

Inter-examiner reliability for caries assessments (n=31) at baseline examination (JCC versus HDM) was 0.81 (95% CI 0.74-0.86, non-weighted Kappa). At 1-year follow-up (n=31) Kappa was 0.79 (95% CI 0.73-0.84, non-weighted Kappa). Intra-examiner reliability for radiographic assessments (HDM) at baseline examination (n=50) was 0.86 (95% CI 0.82-0.90, weighted Kappa) and at the 1-year follow-up (n=50) was 0.91 (95% CI 0.88-0.94) .

Treatment Program

Following baseline clinical and radiographic examinations, the examiners assessed the treatment needs and outlined a treatment planning for all adolescents who were then assigned to two groups. The control group was formed by adolescents who needed only non-operative treatment for caries and gingival conditions. The test group was formed by adolescents who needed both non- and operative treatments for caries and gingival conditions.

Non-operative treatment, offered to all adolescents, included educational and training activities focused on risk factors for development and arrest of caries, and for development and remission of gingivitis, together with appropriate brushing technique for posterior erupting teeth with gel 1.23% F⁻, professional tooth cleaning and scaling. This treatment, including distribution of toothbrush, toothpaste and dental floss kits, was administered every 3 months during the study. Further, individual training and/or professional tooth cleaning, topical fluoride application and therapeutic sealing were indicated for adolescents with active lesions and or gingivitis.

Operative treatment, such as root planning, filling, endodontics and extraction was carried out on an individual basis and with priority to treating acute conditions and relieving pain. The dentists carrying out the treatment were blinded to the results of the questionnaires.

Evaluation of the program

The program was evaluated considering not only the treatment needs of the adolescents at the baseline examination, but also the fulfillment of these needs after 1 year (Fig. 1).

The control, Group 1, was formed by adolescents who either had a complete sound dentition or had non-cavitated active/inactive caries lesions and gingivitis only at baseline examination. At 1-year follow-up these adolescents had all their caries treatment needs fulfilled by non-operative treatment.

The Test, Group 2, was formed by adolescents who had both non-cavitated and cavitated active/inactive caries lesions and gingivitis at baseline examination. At 1-year follow-up these adolescents had all their caries treatment needs fulfilled by non-operative and operative treatments.

The Test, Group 3, was formed by adolescents who had both non-cavitated and cavitated active/inactive caries lesions and gingivitis at baseline examination. At 1-year follow-up these adolescents had their caries treatment needs partially fulfilled by non-operative treatment, but not by operative treatment. Adolescents in Group 3 thus had one or more active cavitated lesions that remained untreated during the study period.

These groups were compared for the main outcome, long-term changes in oral-health-related quality of life, and for the secondary outcome, estimation of the effect of the program.

Statistical analysis

Descriptive statistics in terms of number, percentage, mean ($\pm$ standard deviation), were used to express the distribution of adolescents during the study period. The comparisons between two related groups at baseline and 1year follow-up data were tested using the χ^2 -test for dichotomous variables, and paired-samples t-test for continuous variables at a significance level of 5%. In order to report the magnitude of possible differences in mean scores using a standardized metric, effect sizes were calculated. Cohen's d_z was used for within subjects comparisons [Lakens 2013].

The comparisons of the multiple groups on changes in CPQ₁₁₋₁₄ total and subscale scores were performed by one-way ANOVA and by ANCOVA, in which the scores were adjusted based on differences from baseline data.

Internal responsiveness was assessed comparing the CPQ₁₁₋₁₄ total scale and subscale mean change scores by the change in the global item self-perceived oral health assessment during the study period, i.e., the Global Transition Judgment (ANOVA). Participants were categorized as having reported strong improvement (-2 to -4), some improvement (-1), stable (0), some deterioration (1) and strong deterioration (2 and 3).

External responsiveness was assessed by evaluating the effect of the program after 1 year. The three groups of adolescents (Fig. 1) were compared on the CPQ₁₁₋₁₄ scores at baseline (ANOVA) and, given possible differences, these groups were compared on the change in mean CPQ₁₁₋₁₄ score adjusted for differences at baseline using an ANCOVA.

Changes in CPQ₁₁₋₁₄ scores were expressed as effect size, based on a distribution-based method [Tsakos et al. 2012]. The reference values for effect sizes were small, clinically meaningful magnitude of change (≤ 0.2), moderate change (0.3-0.7) and large change (≥ 0.8) [Cohen 1992]. Data analyses were carried out using IBM SPSS Statistics (Version 21.0.01, USA).

Since not all variables were distributed normally (based on eyeballing histograms for the dependent variables) some analyses were repeated using non-parametric equivalents, which yielded identical conclusions. As such, we decided to report the results from the parametric tests as these are easier to interpret.

Missing data

At the baseline and 1-year follow-up, the adolescents filled out a self-completed questionnaire by using the PDA which did not allow missing data. No clinical or radiographic data were missing.

RESULTS

A total of 618 adolescents aged 10-15 years were included in baseline examination. At 1-year follow-up examination, 560 adolescents were included following 9.4% of attrition (Fig. 1). The reasons for attrition were due to adolescents moving to another municipality or school (n=46) and refusal to participate in the study (n=12).

Family socio-demographic variables were only recorded at baseline examination since these were considered valid for 1-year period. More than two thirds of adolescents had mothers with a level of education corresponding to primary schooling (62.8%) while technical or university schooling was limited to 5.3%. The head of the family was in 68.5% of cases employed. A total of 45.7% of families had a monthly income equivalent to one Brazilian monthly minimum wage or less.

Table 1 describes the distribution of adolescents according to oral health behavior and life style determinants as well as their oral health status at baseline and 1-year follow-up. The percentage of adolescents who perceived their oral health status as poor or very poor decreased simultaneously with an increased percentage of those who considered their oral health as fair during the study period.

Table 2 presents the baseline characteristics of the adolescents included in the baseline examination, divided into those who remained in the study and of those who were lost at follow-up after 1-year. A comparison between study completers (n=560) and loss at follow-up adolescents (n=58) indicated significant differences for the age groups with higher loss at follow-up in older adolescents ($p<0.001$) and for the number of cavitated lesions (D_3) in the dentition with higher loss of adolescents who presented at least five cavitated lesions at baseline ($p=0.002$).

At the baseline examination, only 11 adolescents scored 0 on the overall CPQ₁₁₋₁₄ increasing to 34 during the study period. The prevalence of CPQ₁₁₋₁₄, defined as the number of adolescents with at least one domain being impacted often or every day/almost every day, was 34.8 % at baseline and 24,1 % at the 1-year follow-up. The severity of impacts defined as the number of reported questions scored often or every day/almost every day were from 1 to 8 (33.1 %) and from 9 to 16 (1.7 %) at the baseline examination. The corresponding values at 1-year follow-up were from 1 to 8 (23.9 %) and from 9 to 16 (0.2 %). The mean D_3MFT/S scores at baseline examination (n=618) were 1.43 (SD $\pm$

2.05) and 2.43 (SD $\pm$ 4.11) and at 1-year follow-up (n=560) were 1.03 (SD $\pm$ 1.59) and 1.80 (SD $\pm$ 3.37), respectively.

Internal Responsiveness

Table 3 shows the CPQ₁₁₋₁₄ total and subscale mean change scores during the study period by the global transition judgment on self-perceived oral health status. An overall improvement of oral-health-related quality of life of the adolescents was observed with a gradient in the expected direction across the five categories of the global transition judgment. This analysis included all adolescents, independently of the group to which they belonged. There were significant differences of the total ($p<0.001$, ANOVA) and subscale ($p<0.05$) mean changes scores within the five categories of global transition judgment. Adolescents reporting improvement had much higher mean change scores than those reporting stable condition and at least 3 times higher mean change scores than those reporting some deterioration. These results indicated that the CPQ₁₁₋₁₄ had internal responsiveness.

External responsiveness

In order to estimate the effect of the program after 1-year the three groups of adolescents were compared. Firstly, the mean CPQ₁₁₋₁₄ total and subscale scores at baseline and 1-year follow-up for all groups together were calculated (Table 4). Significant differences were observed for the total scale and subscale scores ($p<0.001$) with moderate effect size for all scale scores (-0.42).

Secondly, ANOVA was performed to identify baseline and 1-year follow-up differences between Group 1, Group 2 and Group 3 on the CPQ₁₁₋₁₄ total and subscale mean scores. The results showed significant baseline and 1-year follow-up differences between groups for total scores ($p\leq 0.004$) and for subscales oral symptoms, functional limitation and emotional wellbeing ($p<0.017$). On this basis, the mean scores were adjusted (ANCOVA) and the mean change scores between the three groups on CPQ₁₁₋₁₄ scores during the study period were calculated by subtraction of baseline scores from those of 1-year follow-up. Negative scores indicated improvement in oral-health-related quality of life (Table 5). The effect for the treatment groups was significant ($p= 0.049$). Post hoc analysis with adjustment for multiple comparisons showed that Group 3 had a significantly smaller improvement than Group 1 ($p=0.014$). The effect sizes for the change scores were moderate for Group 1 (-0.60), Group 2 (-0.54) and Group 3 (-0.32). The null hypothesis

that significant improvement in the CPQ₁₁₋₁₄ scores would not be observed after 1-year program was rejected.

DISCUSSION

In the present study an overall improvement of adolescents' OHRQoL was observed following 1-year implementation of the oral health care program for caries and gingival conditions ($p < 0.005$). The sensitivity of the CPQ₁₁₋₁₄ for detecting important clinical changes, i.e. its long-term responsiveness was demonstrated in accordance with studies in adolescents using different instruments [Mashoto et al. 2010, de Paula 2015]. Measures of responsiveness included its internal and external responsiveness and effect sizes for the CPQ₁₁₋₁₄ mean change scores.

The internal responsiveness was demonstrated through the CPQ₁₁₋₁₄ total mean change score by the Global Transition Judgment of all adolescents independently of the group to which they belonged, with a gradient in the expected direction across the five categories of the global transition judgment. One might question how adolescents perceiving their oral health status as stable or showing some deterioration could have a reduction in the CPQ₁₁₋₁₄ mean change scores. On the one hand, we assume that adolescents' perception was probably related to other conditions such as malocclusions, aesthetics or psychosocial aspects [Ferrando-Magraner et al. 2019; Vettore MV et al. 2019]. Also, adolescents with shallow cavitated caries lesions, gingivitis and normal occlusion were unlikely to experience discomfort or pain [Krisdapong et al. 2013], thus perceiving their oral health as stable following treatment. On the other hand, we consider that reduction in the CPQ₁₁₋₁₄ mean change scores were directly related to the effect of the oral health care treatment program implemented.

The external responsiveness of the CPQ₁₁₋₁₄ after 6 months was previously reported in 8-14-year-old Cambodians who received basic dental treatment for caries (Turton et al. 2015). Recently, external responsiveness after 1-year of the modified CPQ₁₁₋₁₄ was reported in 10-13-year-old New Zealander attending a supervised toothbrushing program [Foster Page et al. 2019]. Our results corroborate the long-term ability of CPQ₁₁₋₁₄ to identify changes in OHRQoL of adolescents benefiting from 1-year oral health care program for caries and gingival conditions. Nevertheless, Turton et al. [2015] only found

substantial changes in CPQ₁₁₋₁₄ scores of adolescents who had caries at baseline and those who developed one or more cavitated lesions over 6 months. In contrast, noteworthy changes in CPQ₁₁₋₁₄ scores were identified in adolescents included in the present clinical trial, independently of whether they had non-operative treatment needs or both non- and operative treatment needs. This difference is partially explained by the impact of non-operative treatment procedures on OHRQoL which was ensured for all adolescents every 3 months over 1-year period in our study.

In the present study, adolescents' treatment needs were objectively determined on the basis of clinical and radiographic assessments of both dental and periodontal status. A whole spectrum of caries status ranging from sound to severe forms was found in the sample studied. All adolescents needed non-operative treatment whereas about 40% also needed operative treatment from whom more than half presented moderate or severe caries lesions. Although the adolescents were from low socio-economic background, 60% did not present operative treatment needs for caries which may be partially explained by combined fluoride exposure from an early age [Casarin et al. 2007; Ricomini Filho et al. 2012; Aimée et al. 2016].

Of particular interest when analyzing the mean change scores in CPQ₁₁₋₁₄ total in relation to groups during the study period, is the fact that Group 3, whose treatment needs were partially fulfilled, also showed improvement in OHRQoL, although to a much lesser extent than Group 1 and Group 2. This improvement was probably related to other conditions than the operative treatment of caries lesions. The reason for not fulfilling the treatment needs of Group 3 was the limited number of dentists available to treat all adolescents included in the clinical trial.

Considering the different levels of treatment needs at the baseline examination, the observed changes in OHRQoL after 1 year were adjusted accordingly. One might have expected that Group 1 which needed non-operative treatment only would show a much lesser improvement than Group 2 which needed both non- and operative treatments. However, similar CPQ₁₁₋₁₄ mean change scores were identified for Group 1 and Group 2 whose treatment needs were fulfilled whereas these were significantly different from that of Group 3 which treatment needs were partially fulfilled. This observation may reflect how adolescents understood and perceived the benefits of the treatment program offered to them: Group 1 and Group 2 felt that the treatment received fulfilled their needs and improved their OHRQoL.

Effect size in our study was of a moderate magnitude for all groups. This indicates that adolescents, to certain extent, perceived clinical meaningful changes on their OHRQoL, and particularly in the domain of social well-being.

An acceptable percentage of participants were lost to follow-up (9.4%), however, some attrition bias may nevertheless have taken place. The loss in the follow-up group had relatively more adolescents from the older age group (13-15 yr), and relatively more adolescents with multiple cavitated lesions (≥ 5) at baseline. This may have affected the results as follows; study completers after one year had a better oral health status than the initial sample, not only because they followed the oral health care program, but also in part because more participants with multiple cavitated dentine lesions dropped out of the study. As such, this may have given an inflated estimate of the effectiveness of the oral health program. The influence of determinants (socio-economic status, maternal education, age of participants) to changes over time were not explored as these are not directly related to the aims of the present study.

In conclusion, an overall improvement of adolescents' OHRQoL was observed following 1-year oral health care program for caries and gingival conditions. The CPQ₁₁₋₁₄ was internally and externally sensitive to detect substantial clinical changes. The CPQ₁₁₋₁₄ seems to be appropriate for measuring long-term changes on adolescents' OHRQoL. Further information on the responsiveness of the CPQ₁₁₋₁₄ over longer period of time is warranted.

ACKNOWLEDGMENTS

The authors thank the support of the Brazilian National Council of Research (CNPq), Grant No 445982/2014-4.

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The authors declare no conflicts of interest.

LEGENDS

Figure 1 – Distribution of adolescents according to treatment needs at baseline (1st and 2nd rows) and treatment needs fulfilled after 1yr program (3rd row).

Table 1 – Distribution of adolescents according to oral health behavior and life style determinants as well as their oral health status at baseline (n=618) and 1-year follow-up (n=560).

Table 2 – Comparison between the baseline characteristics of the adolescents who remained in the study after 1-year (n=560) and those who were lost to follow-up (n=58).

Table 3 - Comparison of CPQ₁₁₋₁₄ total scale and subscale mean change scores ($\pm$ sd) between baseline and 1-year follow-up by the Global Transition Judgment on self-perceived oral health status (n=560).

Table 4 – Mean change in CPQ₁₁₋₁₄ total and subscales scores compared at baseline and 1-year follow-up in relation to groups and for the whole sample (n=560). Unadjusted mean scores.

Table 5 – Mean change scores in CPQ₁₁₋₁₄ total in relation to groups during the study period.

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Table 1 – Distribution of adolescents according to oral health behavior and life style determinants as well as their oral health status at baseline (n=618) and 1-year follow-up (n=560).

Determinants	Category	Baseline (%)	1yr Follow-up (%)
Toothbrushing	≥ 2x day	527 (85.3)	493 (88.0)
	≤ 1x day	91 (14.7)	67 (12)
Soft drinks	Seldom /never	120 (19.4)	129 (23.0)
	> once per week	247 (40.0)	250 (44.6)
	≥ once per day	251 (40.6)	181 (32.4)
Sweets	Seldom/never	80 (12.9)	106 (18.9)
	> once per week	146 (23.6)	167 (29.8)
	≥ once per day	392 (63.4)	287 (51.3)
Alcohol	No	576 (93.2)	529 (94.5)
	Yes	42 (6.8)	31 (5.5)
Tobacco use ever	No	577 (93.4)	530 (94.6)
	Yes	41 (6.6)	30 (5.4)
Global item: Self-perceived oral health status	≥ Good	76 (12.3)	72 (12.9)
	Fair	187 (30.3)	227 (40.5)
	≤ Poor	355 (57.4)	261 (46.6)
Absolut scores of cavitated dentine lesions (D ₃ S)	D ₃ S=0	374 (60.5)	373 (66.6)
	D ₃ S=1-4	179 (29.0)	149 (26.6)
	D ₃ S≥5	65 (10.5)	38 (6.8)
Severity of cavitated dentine lesions (D ₃ S)	No lesions	374 (60.5)	373 (66.6)
	Only shallow lesions	102 (16.5)	81 (15.5)
	Moderate/deep lesions	142 (23.0)	106 (18.9)

Table 2 – Comparison between the baseline characteristics of the adolescents who remained in the study after 1-year (n=560) and those who were lost to follow-up (n=58).

Determinants	Category	Baseline sample (%)	1-yr sample (%)	Lost to Follow-up (%)	p *
Age	10-12	349 (56.5)	330 (58.9)	19 (32.8)	<0.001
	13-15	269 (43.5)	230 (41.1)	39 (67.2)	
Gender	Female	335 (54.2)	302 (53.9)	33 (56.9)	0.67
	Male	283 (45.8)	258 (46.1)	25 (43.1)	
Toothbrushing	≥ 2x day	527 (85.3)	479 (85.5)	48 (82.8)	0.57
	≤ 1x day	91 (14.7)	81 (14.5)	10 (17.2)	
CPQ ₁₁₋₁₄	Mean score ±SD)	11.7 (±9.3)	11.6 (± 9.2)	12.6 (±10.9)	0.44
Global item: Self-perceived oral health status	≥ Good	76 (12.3)	70 (12.5)	6 (10.3)	0.75
	Fair	187 (30.3)	171 (30.5)	16 (27.6)	
	≤ Poor	355 (57.4)	319 (57.0)	36 (62.1)	
Absolute scores of cavitated dentine lesions	D ₃ S=0	374 (60.5)	345 (61.6)	29 (50.0)	0.002
	D ₃ S=1-4	179 (29.0)	164 (29.3)	15 (25.9)	
	D ₃ S≥5	65 (10.5)	51 (9.1)	14 (24.1)	
Severity of cavitated dentine lesions	No	374 (60.5)	345 (61.6)	29 (50.0)	0.21
	Shallow	102 (16.5)	89 (15.9)	13 (22.4)	
	Moderate/deep	142 (23.0)	126 (22.5)	16 (27.6)	

* Comparison using the X²-test (for significant results the dark shaded cells indicate where frequencies deviate from an equal distribution); independent-samples t-test was used to compare mean CPQ₁₁₋₁₄ score.

Table 3 - Comparison of CPQ₁₁₋₁₄ total scale and subscale mean change scores ($\pm$ sd) between baseline and 1-year follow-up by the Global Transition Judgment on self-perceived oral health status (n=560).

Global Transition Judgment	CPQ ₁₁₋₁₄	Oral symptoms	Functional limitation	Emotional well being	Social well being	N
Strong imp.	-7,53 (10.7)	-1,23 (2.8)	-1,77 (2.8)	-2,86 (3.9)	-1,93 (3.7)	43
Some imp.	-4,89 (7.5)	-1,00 (2.8)	-1,11 (2.6)	-2,41 (2.9)	-1,19 (2.3)	157
Stable	-3,04 (8.4)	-0,76 (2.7)	-0,93 (2.9)	-1,70 (3.1)	-0,67 (2.4)	255
Some det.	-1,97 (7.6)	-0,14 (2.4)	-0,63 (2.6)	-1,29 (2.5)	-0,58 (2.7)	73
Strong det.	0,53 (8.2)	0,19 (2.6)	0,38 (2.9)	-0,56 (2.9)	-0,59 (2.6)	32
p-value*	< 0.001	0.04	0.02	0.001	0.01	

Global Transition Judgment: imp. = improvement; det. = deterioration; * one-way ANOVA comparing the multiple groups on changes in CPQ₁₁₋₁₄ total and subscale scores

Table 4 – Mean CPQ₁₁₋₁₄ Total and subscale scores at baseline and 1-year follow-up in relation to groups and for the whole sample (n=560). Unadjusted mean scores.

CPQ ₁₁₋₁₄	Baseline			1-year Follow-up		
	Number	Mean	SD	Mean	SD	ES*
CPQ ₁₁₋₁₄ Total						
Group 1	363	10.8	8.5	7.3	7.0	
Group 2	98	12.3	9.7	8.3	8.4	
Group 3	99	14.1	10.2	10.5	8.1	
Total	560	11.6	9.2	8.1	7.6	0.42
Oral symptoms						
Group 1	363	3.9	2.4	3.2	2.1	
Group 2	98	4.3	2.5	3.5	2.3	
Group 3	99	4.8	2.6	4.0	2.4	
Total	560	4.2	2.5	3.4	2.2	0.27
Functional limitation						
Group 1	363	2.3	2.5	1.3	2.1	
Group 2	98	2.8	2.9	1.8	2.5	
Group 3	99	3.2	3.2	2.6	2.6	
Total	560	2.6	2.8	1.7	2.3	0.33
Emotional wellbeing						
Group 1	363	2.6	3.2	1.7	2.7	
Group 2	98	3.2	3.7	2.0	3.0	
Group 3	99	3.7	3.4	2.7	3.3	
Total	560	2.9	3.3	1.9	2.9	0.33
Social wellbeing						
Group 1	363	1.8	2.6	1.0	2.0	
Group 2	98	1.8	2.5	1.0	1.8	
Group 3	99	2.5	3.0	1.7	2.1	
Total	560	2.0	2.7	1.1	2.0	0.35

*ES= effect size: all differences were significant at $p < 0.001$ paired-samples t-tests

Table 5 – Mean change scores in CPQ₁₁₋₁₄ total in relation to groups during the study period.

Treatment groups	Number	Unadjusted		Adjusted*		
		Mean	SD	Mean	SD	ES
Group 1	363	-3.5	8.2	-3.9	6.5	-0.60
Group 2	98	-3.9	8.9	-3.5	6.5	-0.54
Group 3	99	-3.6	8.5	-2.1	6.5	-0.32

* The effect for the treatment groups were significant at $p=0.049$, ANCOVA.

ES= effect size