SCIENTIFIC SECTION

Orthodontic treatment and its impact on oral health-related quality of life in Brazilian adolescents

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Objective: *To assess whether Brazilian adolescents who had completed orthodontic treatment had lower levels of impacts on their oral health-related quality of life.*

Design: *A cross-sectional study.*

Setting: *The study was conducted in public and private secondary schools in Bauru-SP, Brazil.*

Participants: *1675 randomly selected adolescents aged between 15 and 16 years.*

Methods: *Adolescents were clinically examined using the Index of Orthodontic Treatment Need (IOTN). Two oral health-related quality of life measures, namely the Oral Impacts on Daily Performance (OIDP) and the shortened version of the Oral Health Impacts Profile (OHIP-14) were used to assess adolescents' oral health-related impacts. Multiple logistic regression was used in the data analysis.*

Results: *A response rate of 100% was obtained. Adolescents who had completed orthodontic treatment had fewer oral health-related impacts compared to the other two groups. They were 1.85 times (95% CI 1.30 to 2.62) less likely to have an oral health impact on their daily life activities than adolescents currently under treatment or 1.43 (1.01 to 2.02) times than those who never had treatment.*

Conclusions: *Adolescents who had completed orthodontic treatment had a better oral health-related quality of life than those currently under treatment or those who never had treatment.*

Key words: *Adolescents, IOTN index, oral health-related quality of life, orthodontic treatment, orthodontic treatment need*

Introduction

Despite the fact that demand for orthodontic treatment is mostly related to personal concern about appearance and other psychosocial factors, measures of orthodontic need and outcomes of orthodontic treatment place relatively little emphasis on adolescents' perceptions of need and the difference that orthodontic care would bring to their daily lives. While quality of life measures are relatively common in medical research, similar research in dentistry is underdeveloped.[1] Traditionally, dental researchers have focused on clinician-based outcome measures at the expense of more subjective patient-based measures, such as perceived functional status and psychological well-being. Quality of life is a multidimensional concept that includes subjectively perceived physical, psychological and social function, as well as a sense of subjective well being.

Since the majority of dental care is about conditions that are seldom life threatening, there is a need to evaluate the impact of dental care on quality of life. In the two decades since Cohen and Jago[2] advocated the development of 'sociodental' indicators, there has been considerable methodological research leading to the development of questionnaires to measure dimensions of quality of life that relate to oral health.[3] Theoretical models have been developed to link concepts of disease, dysfunction and disability to health, oral health and quality of life.[4–6] By 1995, there were a number of instruments measuring oral health-related quality of life. However, the instruments had primarily been used in oral health surveys and relatively few had been utilized to evaluate outcomes of dental care. Reports from dental conferences have emphasized the need to incorporate quality of life into the evaluation of dental care.[7] However, there was a more fundamental methodological problem, namely that oral health outcome researchers had little involvement in the development or use of instruments to assess oral health-related quality of life.

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This also applies to research into the association of quality of life and malocclusion where sociodental research has not made a major contribution. In fact, the measurement of status before and after orthodontic treatment has largely been based upon traditional clinical measures, such as cephalometric measurement of dental occlusal features and occlusal indices.

More recently, a number of orthodontic need indices have been developed and used as outcome measures.[8,9] However, it is questionable whether there is a strong association between orthodontic indices and patients' perception of their oral health status.[10] Since the subject's perception is central to the assessment of overall need and satisfaction with treatment, it is important to establish what the patients' perceptions are. To capture that perception, a number of oral health-related quality of life measures have been developed in adults to assess the impact of the mouth on daily living and the quality of life.

Obviously, the clinical dimension is important. However, dimensions of dental impact and social function are as important as clinical measures, if not more so. In an attempt to redress the paucity of research into psychosocial aspects of the mouth and teeth, this study investigated the importance of the psychosocial outcomes of orthodontic treatment and compared them with the assessment of clinicians, using a well-established orthodontic measure.

The objective of the present study was to assess whether orthodontic treatment affected the levels of oral health-related quality of life impacts in Brazilian adolescents.

Material and methods

Study procedures

Ethical approval was obtained from the Ethics Committee of the Bauru Dental School of the University of Sao Paulo. In addition, a letter was sent to the parents/guardians of the participants to seek consent for their cooperation in the study. This letter also served to inform parents/guardians about the examination procedures and to assure them of the confidentiality of any information collected. Only adolescents whose parents gave written consent were included in the research.

The participants were selected by a two-stage sampling method[11] and consisted of 1675 randomly selected adolescents aged between 15 and 16 years (951 females and 724 males). They were selected from a list of both public and private urban schools in the city of Bauru-SP, Brazil. Three groups were identified according to their orthodontic treatment history: treated, currently under treatment and untreated. The sample size was calculated to have a 90% power of demonstrating a statistically

significant difference in the prevalence of oral health impact on daily performances between two groups at the 5% level, if an odds ratio of 1.5 or more was observed. The overall oral health impact was estimated to be 30% for the purpose of the calculation of the sample size.

Instruments and measures

The data collected included socio-demographic data, history of orthodontic treatment, orthodontic treatment need and the overall oral health impacts of malocclusion on daily life. The data were collected through a dental clinical examination, self-completion questionnaire and a structured interview. Social class of the family is here defined by the income of the head of the family in combination with his/her level of education.[12] Within this classification system, 6 social classes were distinguished. For the purpose of the statistical analysis, these were reduced to two categories: high social class and low social class. Adolescents were clinically examined for orthodontic treatment need using the Dental Health Component of the Index of Orthodontic Treatment Need (IOTN).[8] All 1675 participants were examined by the principal author (CMO). In order to obtain accuracy in the use of the IOTN index, the researcher was trained and underwent a calibration exercise. The calibration exercise took place in the Department of Orthodontics at the University of Cardiff in July 1998. Data on adolescents' socio-demography were collected through a self-completion questionnaire. Two oral health-related quality of life measures, which had previously been used on Brazilian schoolchildren, namely the Oral Impacts on Daily Performance (OIDP)[13] and the shortened version of the Oral Health Impacts Profile (OHIP-14)[14] were used to assess adolescents' oral health-related impacts. The OHIP-14 measure was developed on older adults and subsequently adapted and validated for teenagers by Goes.[15]

Reliability

In order to assess the external reliability of the self-completion questionnaire and the structured interview, 168 adolescents (10% of the sample) answered the self-completion questionnaire twice and were interviewed on two consecutive days. Test-retest reliability was carried out on all questions of both oral health-related quality of life measures and the self-completion questionnaire. The correlation between the two sets of observations was calculated using intraclass correlation coefficient. The correlation coefficients were high in both oral health-related quality of life measures, 0.85 for the OIDP and 0.86 for the OHIP-14. It was also high for the self-completion questionnaire (0.83). The Cronbach's alpha (a) coefficient was adopted to assess the internal

consistency. The Cronbach's alpha was 0.84 for the OIDP and 0.85 for the OHIP-14. The standardized item alpha, where all items' variances were standardized, was 0.88 for the OIDP and 0.86 for the OHIP-14.

Statistical analysis

Data analysis was carried out on a personal computer using the Statistical Package for Social Sciences (1999) software for Windows version 10.0.[16] The association between orthodontic treatment status and overall oral health impact was examined using multiple regression analysis. For the OHIP-14, responses were made on a Likert-type scale and coded 4 = 'very often', 3 = 'fairly often', 2 = 'occasionally', 1 = 'hardly ever' and 0 = 'never'. A threshold of 'occasionally', 'fairly often' and 'very often' was used to dichotomize responses, thereby indicating adolescents who had experienced at least some oral health impact. In order to calculate the OHIP-14 total score, item response codes were multiplied by item weights and summed to produce sub-scales scores. Total OIDP scores were calculated by multiplying the frequency or duration of impacts and severity for each dimension and summing the nine dimensions. As OIDP and OHIP-14 scores were not normally distributed, the investigation of the ways that these measures were associated with several other variables was performed using logistic regression. The OIDP and the OHIP-14 scores were dichotomized into 'zero' and 'any value larger than zero', since the majority of participants had an OIDP or OHIP-14 score equal to zero. Before constructing the models, correlation between some of the independent variables was tested.

Multiple regression was used to adjust the relationship between orthodontic treatment status and overall oral health impact. All potential confounders, which had an association with the outcome variables in the simple regression at the 5% level, were included in the model. The inclusion of potential confounding variables in the model was done in separate stages. In each stage, a set of variables was entered simultaneously. The final step in the data analysis was to check for interactions between some of the variables that could distort the results.

Results

Descriptive data

Of the 21 schools selected all agreed to participate. A total of 1675 adolescents were invited to take part in the main study and the response rate was 100%. The sample consisted of 951 females (56.8%) and 724 males (43.2%). The high social class group was composed of 875 subjects (52.2%) and low social class of 800 (47.8%). The majority of the adolescents were satisfied with their dental appearance (77.6%). Dental trauma to anterior teeth was observed in 6.7% of adolescents. 65.9% were satisfied with the color of their teeth, and the majority (87.5%) was satisfied with the size of their teeth. A high level of self-esteem was reported by 53.1%, while 10.3% reported being teased because of their teeth.

In terms of orthodontic treatment status, 15.8% of the adolescents had completed orthodontic treatment, 63.3% never had orthodontic treatment and 21.3% were having orthodontic treatment at the time. Sixty-one per cent of the adolescents were clinically assessed as not needing orthodontic treatment, whilst 38.5% needed treatment according to the IOTN criteria. As shown in Table 1, adolescents who had completed orthodontic treatment had less normative need for orthodontic treatment, as assessed by IOTN, than those currently under treatment or who never had treatment ($p < 0.001$).

The prevalence of oral health impacts was high: 32.8% of adolescents reported having experienced one or more dental impacts on their daily life activities in the past 6 months according to the OIDP oral health-related quality of life measure and 43.0% according to the OHIP-14.

Adolescents who reported an oral health-related impact were asked what they perceived to be the specific cause of the impact. Position of teeth was reported as the most frequent specific cause for 8 of the 9 dimensions assessed by the OIDP. Eating was the only aspect in which position of teeth was not reported as the main cause of the impact. Dental pain was most frequently reported (51%) as a specific cause related to eating, followed by the position of the teeth (36%) and braces (13%).

Table 1 Frequency distribution of the IOTN dental health component grades and orthodontic treatment status in the sample of 1675 adolescents

IOTN grades	Treated *n* (%)	Untreated *n* (%)	Undergoing *n* (%)	χ^2 and *p* value*
No need (grades 1 and 2)	200 (19.4)	566 (54.9)	265 (25.7)	
Borderline need (grade 3)	44 (12.5)	261 (74.4)	46 (13.1)	$\chi^2 = 89.25$
Need (grades 4 and 5)	14 (4.8)	233 (79.5)	46 (15.7)	$p < 0.001$

*Chi squared test.

The relationship between overall oral health impact (OIDP) and adolescents' orthodontic treatment status

Overall, adolescents who never had orthodontic treatment reported more oral health impacts than those treated or currently under treatment. A statistically significant difference was found among the three groups concerning the reported OIDP impact, namely 'smiling, laughing and showing teeth without embarrassment' ($p < 0.001$; Table 2).

Adolescents who never had orthodontic treatment were 1.43 times (95% CI 1.01 to 2.02) more likely to report one or more dental impacts than those adolescents who had completed orthodontic treatment. Those who were currently under orthodontic treatment were 1.84 (1.25 to 2.72) times more likely to have an impact than those who had completed treatment (Table 3). Orthodontic treatment status remained significant after adjusting for all variables ($p = 0.008$; Table 3). The association between age and adolescent's overall oral health impact was of borderline significance ($p = 0.048$). Adolescents who were 15 years old were 1.27 times (95% CI 1.00 to 1.61) more likely to have had a dental impact than those aged 16 years (Table 3). Females experienced 1.25 times (95%

Table 2 Bivariate analysis of the relationship between reported impacts on the nine activities of the Oral Impact on Daily Performances measure (OIDP) and orthodontic treatment status in the sample of 1675 adolescents

Daily activity	Treated *n* (Mean Rank)	Undergoing *n* (Mean Rank)	Untreated *n* (Mean Rank)	*p* value*
Eating	258 (820.10)	357 (838.05)	1060 (842.34)	0.584
Speaking	258 (807.86)	357 (837.21)	1060 (845.60)	0.062
Cleaning teeth	258 (826.50)	357 (846.17)	1060 (838.05)	0.234
Sleeping	258 (835.50)	357 (840.20)	1060 (837.87)	0.448
Smiling	258 (768.17)	357 (830.70)	1060 (857.46)	0.001
Emotional stability	258 (836.18)	357 (833.50)	1060 (839.96)	0.528
School activities	258 (836.50)	357 (836.50)	1060 (838.87)	0.418
Contact with people	258 (840.01)	357 (833.50)	1060 (839.03)	0.286
Sport	258 (836.50)	357 (841.19)	1060 (837.29)	0.151

*Kruskal Wallis test.

Table 3 Frequency distribution and results of simple and multiple logistic regression of the variables included in the study of adolescents' overall oral health impact according to the OIDP oral health-related quality of life measure ($n = 1675$)

	Impact *n* (%)	No impact *n* (%)	Unadjusted OR (95% CI)	*p*	Adjusted OR* (95% CI)	*p*
Orthodontic treatment status						
Treated	58 (22.5)	200 (77.5)	1	0.001	1	0.008
Having treatment	128 (35.9)	229 (64.1)	1.93 (1.34 to 2.77)	0.001	1.84 (1.25 to 2.72)	0.002
Untreated	363 (34.2)	697 (65.8)	1.80 (1.31 to 2.47)	0.001	1.43 (1.01 to 2.02)	0.045
Age						
16 years old	164 (29.0)	401 (71.0)	1		1	
15 years old	385 (34.7)	725 (65.3)	1.30 (1.04 to 1.62)	0.020	1.27 (1.00 to 1.61)	0.048
Gender						
Male	214 (29.6)	510 (70.4)	1		1	
Female	335 (35.2)	616 (64.8)	1.30 (1.05 to 1.60)	0.014	1.25 (0.99 to 1.57)	0.049
Social class						
High	259 (29.6)	616 (70.4)	1		1	
Low	290 (36.3)	510 (63.8)	1.35 (1.10 to 1.66)	0.004	1.14 (0.91 to 1.45)	0.244
IOTN/dental health component						
No/slight need	276 (26.8)	755 (73.2)	1	0.001	1	0.001
Moderate need	116 (33.0)	235 (67.0)	1.35 (1.04 to 1.75)	0.024	1.38 (1.04 to 1.82)	0.026
Need	157 (53.6)	136 (46.4)	3.16 (2.42 to 4.13)	0.001	2.65 (1.97 to 3.56)	0.001

*Adjusted for all variables shown.

CI 0.99 to 1.57) more dental impacts than males. The association between social class and adolescent's overall oral health impact was not significant ($p < 0.244$). The probability of reporting more dental impacts was higher among adolescents with a clinically-assessed need for orthodontic treatment according to the dental health component of the IOTN index (OR = 2.65, 95% CI 1.97 to 3.56).

The relationship between overall oral health impact (OHIP-14) and adolescents' orthodontic treatment status

Overall, adolescents who had completed orthodontic treatment experienced fewer oral health impacts according to the OHIP-14 measure than those who were under treatment or who never had orthodontic treatment. Statistically significant differences were found among the three groups concerning the reported impact on 12 out of the 14 daily activities of the OHIP-14 measure (Table 4).

The relationships between the OIDP and orthodontic treatment status were replicated using the OHIP-14. For example, adolescents who never had orthodontic treatment (OR = 1.39, 95% CI 1.01 to 1.90) and those who were under treatment (OR = 1.85, 95% CI 1.30 to 2.62) were more likely to report one or more dental impacts than those adolescents who had orthodontic treatment (Table 5). The association between gender and adolescent's overall oral health impact was of borderline significance ($p < 0.050$). Females were 1.22 times (95% CI 0.99 to 1.49) more likely to have had a dental impact than males (Table 5). Adolescents from low social class experienced 1.27 times (95% CI 1.03 to 1.56) more dental impacts than those from high social class. The association between age and adolescent's overall oral health impact was not significant ($p = 0.761$). The probability of reporting more OHIP oral health impacts was higher among adolescents with a need for orthodontic treatment according to the dental health component of the IOTN index (OR = 1.46, 95% CI 1.09 to 1.94).

Discussion

This research illustrates that adolescents who had orthodontic treatment in the past reported significantly fewer oral health impacts than those who were currently under treatment or who never had treatment.

It is now generally accepted that the measurement of oral health-related quality of life is an essential component of oral health surveys, clinical trials and studies evaluating the outcomes of preventive and therapeutic programs intended to improve oral health. The assessment of oral health-related quality of life has an important role to play in clinical practice.[17] Of all the dental treatments that require the use of oral health-related quality of life measures, the treatment of malocclusion, which has a large psychosocial component, calls for the use of these measures. Oral health-related quality of life measures can and should be used in the assessment of need and the outcomes of dental care. That was the basis for this study.

The adolescents undergoing orthodontic treatment were more likely than those from the untreated group to report an oral health impact, which may suggest that the process of treatment causes oral health impacts and affect the quality of life of adolescents.

It is generally considered that patients benefit psychologically from orthodontic treatment through improved facial and dental appearance and the associated increased self-confidence that accompanies those changes. These findings were corroborated in a study that investigated the pre- and post-operative psychological characteristics of patients undergoing orthognathic treatment by Kiyak *et al*.[18] They found high levels of satisfaction following orthognathic surgery, and patients reported considerable improvements in their facial appearance and body image. The authors concluded that satisfaction following treatment was generally high, with patients viewing themselves more positively. This study indicates that the same may be true for orthodontic treatment.

Although the data regarding the type of orthodontic treatment that the adolescents who had completed treatment had was not analysed, our findings suggest that orthodontic treatment affects adolescents' daily life activities, particularly relating to smiling, speaking and eating. Subjective aspects such as dental aesthetics, self-perception of dental appearance, as well as attitudes toward malocclusion and orthodontic treatment are important factors in deciding to seek orthodontic treatment.[19] More technical aspects of malocclusion, such as dissatisfaction with ability to chew, were less often a reason for seeking treatment because problems with chewing may be less common among young adults than problems with dental appearance.[19] More adolescents who have never had orthodontic treatment experienced difficulties with 'eating and enjoying food' compared to those who had completed orthodontic treatment. Adolescents who never had orthodontic treatment were more concerned with aesthetics than with function.[19]

The appearance of the face plays an important psychosocial role in human life and interpersonal relationships. Furthermore, the features most commonly associated with facial attraction are the eyes and the mouth.[20] They are key elements in social interactions and social and interpersonal success in establishing relationships. Research on appearance and beauty challenges the assumption that beauty is an arbitrary cultural

Table 4 Frequency distribution of reported impacts on the 14 activities of the Oral Health Impact Profile measure (OHIP-14) and orthodontic treatment status in the sample of 1675 adolescents

Daily activity	Treated n (%)	Undergoing n (%)	Untreated n (%)	χ^2 and p value*
Had problem pronouncing words				
Impact	57 (18.2)	97 (31.0)	159 (50.8)	$\chi^2 = 28.36$
No impact	201 (14.8)	260 (19.1)	901 (66.2)	$p < 0.001$
Felt their sense of taste has worsened				
Impact	16 (10.8)	33 (22.3)	99 (66.9)	$\chi^2 = 2.63$
No impact	242 (15.8)	324 (21.2)	961 (62.9)	$p = 0.268$
Had a painful aching in the mouth				
Impact	185 (16.5)	270 (24.1)	667 (59.4)	$\chi^2 = 22.57$
No impact	73 (13.2)	87 (15.7)	393 (71.1)	$p < 0.001$
Found it uncomfortable to eat any food				
Impact	91 (12.8)	195 (27.3)	427 (59.9)	$\chi^2 = 29.10$
No impact	167 (17.4)	162 (16.8)	633 (65.8)	$p < 0.001$
Have been self-conscious				
Impact	75 (13.3)	158 (27.9)	333 (58.8)	$\chi^2 = 22.72$
No impact	183 (16.5)	199 (17.9)	727 (65.6)	$p < 0.001$
Felt tense				
Impact	77 (15.7)	140 (28.6)	273 (55.7)	$\chi^2 = 23.43$
No impact	181 (15.3)	217 (18.3)	787 (66.4)	$p < 0.001$
Had an unsatisfactory diet				
Impact	68 (18.8)	113 (31.2)	181 (50.0)	$\chi^2 = 37.55$
No impact	190 (14.5)	244 (18.6)	879 (66.9)	$p < 0.001$
Had to interrupt meals				
Impact	56 (13.6)	121 (29.3)	236 (57.1)	$\chi^2 = 20.87$
No impact	202 (16.0)	236 (18.7)	824 (65.3)	$p < 0.001$
Found it difficult to relax				
Impact	63 (16.3)	117 (30.2)	207 (53.5)	$\chi^2 = 26.66$
No impact	195 (15.1)	240 (18.6)	853 (66.2)	$p < 0.001$
Have been a bit embarrassed				
Impact	61 (13.8)	110 (24.9)	271 (61.3)	$\chi^2 = 4.96$
No impact	197 (16.0)	247 (20.0)	789 (64.0)	$p = 0.083$
Have been irritable with other people				
Impact	47 (15.3)	93 (30.2)	168 (54.5)	$\chi^2 = 18.52$
No impact	211 (15.4)	264 (19.3)	892 (65.3)	$p < 0.001$
Had difficulty doing usual jobs				
Impact	27 (13.8)	59 (30.1)	110 (56.1)	$\chi^2 = 10.22$
No impact	231 (15.6)	298 (20.1)	950 (64.2)	$p = 0.006$
Felt life in general less satisfying				
Impact	19 (10.1)	52 (27.5)	118 (62.4)	$\chi^2 = 7.82$
No impact	239 (16.1)	305 (20.5)	942 (63.4)	$p = 0.020$
Have been totally unable to function				
Impact	10 (7.9)	28 (22.0)	89 (70.1)	$\chi^2 = 6.09$
No impact	248 (16.0)	329 (21.3)	971 (62.7)	$p = 0.047$

*Chi squared test.

convention.[20] Ekman[21] has shown that many expressions of emotion are expressed by using the same facial expressions and movements across different cultures. Similarly, aspects of judging human beauty, such as geometric features of a face, are universally considered attractive and beautiful. Even very young infants stare longer at faces that adults consider attractive, which suggests that there is an evolutionary basis of what we consider beautiful.[22] Thus, it is not surprising that the adolescents who have never had orthodontic treatment with clinically assessed orthodontic needs, reported more oral health impacts than those who had treatment.

Table 5 Frequency distribution and results of simple and multiple logistic regression of the variables included in the study of adolescents' overall oral health impact according to the OHIP-14 oral health-related quality of life measure ($n = 1675$)

	Impact n (%)	No impact n (%)	Unadjusted OR (95% CI)	p	Adjusted OR* (95% CI)	p
Orthodontic treatment status						
Treated	78 (30.2)	180 (69.8)	1	0.001	1	0.002
Having treatment	167 (46.8)	190 (53.2)	2.02 (1.44 to 2.84)	0.001	1.85 (1.30 to 2.62)	0.001
Untreated	476 (44.9)	584 (55.1)	1.88 (1.40 to 2.51)	0.001	1.39 (1.01 to 1.90)	0.043
Age						
16 years old	236 (41.8)	329 (58.2)	1		1	
15 years old	485 (43.7)	625 (56.3)	1.08 (0.88 to 1.32)	0.450	1.03 (0.83 to 1.27)	0.761
Gender						
Male	288 (39.8)	436 (60.2)	1		1	
Female	433 (45.5)	518 (54.5)	1.26 (1.04 to 1.54)	0.019	1.22 (0.99 to 1.49)	0.050
Social class						
High	363 (41.5)	512 (58.5)	1		1	
Low	358 (44.8)	442 (55.2)	1.14 (0.94 to 1.38)	0.178	1.27 (1.03 to 1.56)	0.022
IOTN/Dental health component						
No/slight need	397 (38.5)	634 (61.5)	1	0.001	1	0.029
Moderate need	151 (43.0)	200 (57.0)	1.20 (0.94 to 1.54)	0.136	1.17 (0.91 to 1.52)	0.211
Need	173 (59.0)	120 (41.0)	2.30 (1.77 to 2.99)	0.001	1.46 (1.09 to 1.94)	0.009

*Adjusted for all variables shown.

Concern about appearance is the main factor motivating people to seek orthodontic treatment and is recognized as such by orthodontists. It has been estimated that 80% of orthodontic patients seek their services out of a concern for aesthetics, rather than health or function. Indeed, psychological factors, rather than the severity of the actual occlusal condition, determine demand for orthodontic treatment.[23] Thus, additional oral health-related quality of life information acquired from the subject would enhance normative orthodontic treatment need assessments.

Conclusions

Orthodontic treatment clearly reduced the oral health impacts among adolescents. However, orthodontic treatment may have negative impacts on quality of life during the treatment. Orthodontists should be aware of this impact caused by treatment and regularly remind patients of the positive outcomes. Normatively assessed need, using the IOTN system does not capture important psychosocial dimensions related to oral health-related quality of life. Oral health-related quality of life measures encapsulate more aspects of adolescents' perceptions about their mouths and teeth. Inconsistencies between normative orthodontic need as assessed by IOTN, and psychosocial and oral health-related quality of life measures should be addressed by developing a more comprehensive measure of orthodontic need.

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Contributors

Dr Cesar de Oliveira and Professor Aubrey Sheiham both met the criteria for authorship based on substantial contribution to conception and design, analysis and interpretation of data, drafting the article, revising it critically for important intellectual content and on final approval of the version to be published. Dr Cesar de Oliveira is the guarantor.

References

1. Hatch JP, Rugh JD, Clark GM, Keeling SD, Tiner BD, Bays RA. Health-related quality of life following orthognathic surgery. *Int J Adult Orthod Orthognath Surg* 1998; **13**: 67–77.
2. Cohen L, Jago J. Toward the formulation of sociodental indicators. *Int J Health Serv* 1976; **6**: 681–7.
3. Gift HC. Quality of life — an outcome of oral health care? *J Public Health Dent* 1996; **56**: 67–8.
4. Locker D. Measuring oral health: a conceptual framework. *Community Dent Health* 1988; **5**: 3–18.

5. Gift HC, Atchison KA. Oral health, health, and health-related quality of life. *Med Care* 1995; **33**: NS57–NS77.

6. Slade GD, Strauss RP, Atchison KA, Kressin NR, Locker D, Reisine ST. Conference summary: assessing oral health outcomes, measuring health status and quality of life. *Community Dent Health* 1998; **15**: 3–7.

7. Kressin NR. Introduction: symposium on self-reported assessments of oral health outcomes. *J Dent Educ* 1996; **60**: 485–7.

8. Brook PH, Shaw WC. The development of an orthodontic priority index. *Eur J Orthod* 1989; **11**: 309–20.

9. Daniels C, Richmond S. The development of the index of complexity, outcome and need (ICON). *J Orthod* 2000; **27**(2): 149–62.

10. Shaw WC. Factors influencing the desire for orthodontic treatment. *Eur J Orthod* 1981; **3**: 151–62.

11. Kirkwood BR. *Essentials of Medical Statistics*. London: Blackwell, 1988.

12. Lombardi C, Bronfman M, Facchini LA, Victora CG, Barros FC, Beria JU, *et al*. Operacionalização do conceito de classe social em estudos epidemiológicos. *Rev Saúde Pública* 1988; **22**: 253–65.

13. Adulyanon S, Vourapukjaru J, Sheiham A. Oral impacts affecting daily performance in a low dental disease Thai population. *Community Dent Oral Epidemiol* 1996; **24**: 385–9.

14. Slade GD. Derivation and validation of a short-form oral health impact profile. *Community Dent Oral Epidemiol* 1997; **25**: 284–90.

15. Goes PSA. The prevalence and impact of dental pain in Brazilian schoolchildren and their families. PhD Thesis, University of London, 2001.

16. SPSS Incorporated. *SPSS for Windows*, Version 10.0. Chicago: SPSS, 1999.

17. Locker D, Matear D, Stephens M, Lawrence H, Payne B. Comparison of the GOHAI and OHIP-14 as measures of the oral health-related quality of life of the elderly. *Community Dent Oral Epidemiol* 2001; **29**: 373–81.

18. Kiyak HA, Hohl T, West RA, McNeill RW. Psychological changes in orthognathic surgery patients: a 24-month follow-up. *J Oral Maxillofac Surg* 1984; **42**(8): 506–512.

19. Tuominen ML, Tuominen RJ. Factors associated with subjective need for orthodontic treatment among Finnish university applicants. *Acta Odontol Scand* 1994; **52**: 106–10.

20. Etcoff N. *Survival of the Prettiest. the Science of Beauty*. London: Little, Brown and Company, 1999.

21. Ekman P. Universality of emotional expression? A personal history of the dispute. In: Charles Darwin. *The Expression of the Emotions in Man and Animals: the definitive edition*. 3rd Edn. New York: Oxford University Press, 1998, pp. 363–93.

22. Langlois JH, Ritter JM, Roggman LA, Vaughn LS. Facial diversity and infant preferences for attractive faces. *Dev Psychol* 1991; **27**: 79–84.

23. Albino JE, Cunat JJ, Fox RN, Tedesco LA. Variables discriminating individuals who seek orthodontic treatment. *J Dent Res* 1981; **60**: 1661–7.