

SCIENTIFIC
SECTION

Comparing a quality of life measure and the Aesthetic Component of the Index of Orthodontic Treatment Need (IOTN) in assessing orthodontic treatment need and concern

Y. V. Kok, P. Mageson, N. W. T. Harradine and A. J. Sprod
University of Bristol, UK

Objective: To compare the use of the Aesthetic Component (AC) of IOTN and the Child Perceptions Questionnaire (CPQ) in assessing orthodontic treatment need and concern.

Design: Cross-sectional observational study

Subjects and methods: The subjects were 204 children aged 10–12 years studying in 10 schools in Bristol, UK. They completed a questionnaire comprising the CPQ and questions regarding orthodontic concern. AC scores as rated by the child and by the calibrated examiner were recorded.

Main outcome measures: CPQ scores were calculated from the responses in the questionnaire. AC scores and responses to questions regarding orthodontic concern were recorded.

Results: The children gave themselves lower AC scores compared to the examiner ($p < 0.001$).

The only section of the CPQ that correlated significantly with Examiner AC was the emotional impacts section ($\rho = 0.151$). CPQ scores had a slightly higher correlation with self-perceived AC than Examiner AC. However, the correlations were still very low. The emotional impacts section of CPQ ($\rho = 0.332$) and overall CPQ score ($\rho = 0.282$) were better than the examiner AC ($\rho = 0.209$) at reflecting how bothered the children were by the alignment of their teeth, and how upset they would be if they couldn't receive orthodontic treatment ($\rho = 0.464, 0.428$ and 0.214 , respectively). Children with a normative need for orthodontic treatment, based on examiner AC did not have a worse oral health-related quality of life.

Conclusion(s): The CPQ and IOTN AC measure different attributes. There should be a shift towards using quality of life measures to supplement the IOTN in assessing the perceived need for orthodontic treatment.

Key words: Aesthetic component, child perceptions questionnaire, IOTN, Quality of life

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Introduction

Malocclusion and the index of orthodontic treatment need

Orthodontic treatment need is currently measured in the UK, mostly using the Index of Orthodontic Treatment Need (IOTN), which consists of the Dental Health Component (IOTN DHC) and the Aesthetic Component (IOTN AC).^{1,2}

The IOTN AC, being a clinician-based measure, has its limitations because it measures normative need,

rather than perceived need. This has been addressed to a degree by getting the patient to self-rate their IOTN AC.

Nevertheless, traditional (clinical) indices do not give any information on how malocclusion impacts on a patient's quality of life in terms of limited function and psychosocial well-being. As a result, indicators need to be developed further for use in orthodontics to be used in conjunction with the IOTN.³ Recently there has been increasing interest in the use of such indicators in dentistry, in the form of oral health-related quality of life (OHRqoL) measures.⁴

Address for correspondence: N. W. T. Harradine Division of Child Dental Health, Department of Oral and Dental Sciences, University of Bristol Dental School, Lower Maudlin Street, Bristol BS1 2LY, UK. Email: Nigel.Harradine@bristol.ac.uk
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Quality of life measures

Quality of life can be defined as being 'a person's sense of well-being that stems from satisfaction or dissatisfaction with the areas of life that are important to him/her'.⁵

At present, there is no single standard condition-specific OHRQoL measure used in orthodontics. However, recent studies have shown that the development of OHRQoL measures for orthodontic treatment is an attainable aim.⁶⁻⁹

There are only a small number of studies that have investigated the usefulness of OHRQoL measures alongside the IOTN in predicting orthodontic concern. Mandall *et al.*⁶ in 1999 developed a OHRQoL measure called the OASIS (Oral Aesthetic Subjective Impact Scale). The overall score is obtained by totaling the score for questions relating to the impact a malocclusion has on the child and the score for the child's self-perception of their IOTN AC. The results showed that untreated children with high OASIS scores (i.e. more negative aesthetic impact) were more likely to want orthodontic treatment than those with lower scores. The OASIS was found to reflect normative IOTN scores.⁸

The OHRQoL measure used in this study is the Child Perceptions Questionnaire (CPQ),¹⁰ which is described in more detail below.

Aims

- To examine the relationship between examiner and child Aesthetic Component of IOTN and the Child Perceptions Questionnaire (CPQ).
- To establish the validity of IOTN AC or CPQ scores with respect to: (a) how bothered the child is by how straight his/her teeth are; (b) how upset s/he would be if he was unable to receive orthodontic treatment
- To determine whether children with a need for treatment have a worse oral health-related quality of life, when treatment need is based on: (a) normative examiner AC; (b) self-perceived AC; (c) the child's concern with his/her dental alignment; (d) how upset the child would be if unable to receive orthodontic treatment

Material and methods

The subjects were children aged 10–12 years studying in Bristol. This age group was chosen to provide sufficient subjects who had all or almost all their anterior adult teeth erupted and yet had not started orthodontic treatment. Out of 36 schools in the Bristol area that had been selected for convenience, 10 schools

agreed to take part in the study. Ethical approval had been obtained for the study. Appropriate positive consent was obtained from the child and the parent(s).

Sample size estimations indicated that a sample larger than 170 would be able to detect a correlation coefficient as low as 0.20 when the null hypothesis is that $r=0$, alpha is 0.05 and power is 0.80.¹¹ It was the schools' policy that all children who had consented to take part should be included. In practical terms, this meant that a sample was recruited that was larger than calculated as necessary for sufficient power.

Children who had returned a positive consent form were given a questionnaire and this was completed under the supervision of the class teacher. The children were then taken in small groups at a time to a separate room and rated their own IOTN AC score. They were not allowed to confer or discuss their scores.

The examiner then independently scored each child for AC. This was done on an individual basis and the child was not informed of his score. The examiner also asked if the child had already started receiving orthodontic treatment or had finished orthodontic treatment. Thus, the untreated children could be identified.

The authors did not undertake any re-testing in this study because of the high levels of reliability of this questionnaire previously reported by Locker.¹⁰ This indicates that the questionnaire is reliable and stable over short time periods. However, it should be acknowledged that a criticism of subjective measures of well-being or quality of life (such as OHRQoLs) is that people may adapt or habituate to their (health) conditions over time. Thus, they may respond with lower impact scores when a questionnaire is re-administered at a later time.¹² This is particularly important with conditions that may have an immediate large impact, such as the loss or fracture of an anterior tooth. Locker¹⁰ achieved a substantial to perfect level of intra-class correlation (0.9) with this questionnaire on samples with known chronic oral health conditions (developmental facial anomalies, malocclusions, dental caries). Due to the stability of responses reported in these 'treatment need' groups, the authors felt justified in not undertaking repeat measures in this study on a cross-section of children, many of whom would have no conditions requiring treatment, although it is acknowledged that ideally all studies would permit increased confidence in the robustness of the conclusions if these findings were replicated on each occasion. A further consideration in this context is that the decision by the patient to proceed with orthodontic treatment is usually taken on the single day of the consultation when it is offered.

Questionnaire

The questionnaire used in this study was the Child Perceptions Questionnaire (CPQ), which forms one component of the Child Oral Health Quality of Life Questionnaire, developed by Locker *et al*¹⁰ in 2002. It is aimed at children aged 11 to 14 years and consists of 37 questions, which assess the impacts of oral health on the child, on 5-point Likert scales. The questions are divided into four sections: oral symptoms, functional limitations, emotional impacts and social impacts. A high score indicates more negative impacts on quality of life. Four questions regarding orthodontic concern were added to the questionnaire. These were:

- Do you want to get treatment from a dentist to straighten your teeth, for example, with braces?
- Have you spoken to these people about getting your teeth straightened? Parents/guardians, brothers/sisters, friend(s), dentist, anybody else.
- How bothered are you about how straight your teeth are at the moment?
- How upset will you be if you are not able to get treatment from the dentist to straighten your teeth?

The last two questions were on 5-point Likert scales.

The need for treatment was explored based on four different criteria:

- examiner AC ≥ 6 ;
- self-perceived AC ≥ 6 ;
- the child being bothered, very bothered, or extremely bothered by how straight his teeth are;
- the child being upset, very upset or extremely upset if he was unable to receive orthodontic treatment.

Data analysis

The data was analysed using SPSS version 10. A score for each health section of the CPQ, i.e. oral symptoms, functional limitations, emotional impacts and social impacts, was generated by adding up the response codes (i.e. 0–4) for the questions in that section. The overall CPQ score was calculated by adding up the score for each section.

Relationships between the variables were analysed using rank correlation (Spearman's rho). Differences were tested for significance using Chi-square, Wilcoxon signed ranks and Mann–Whitney tests.

Results

Sample

Children who were absent or otherwise engaged, and those who did not hand in completed positive consent

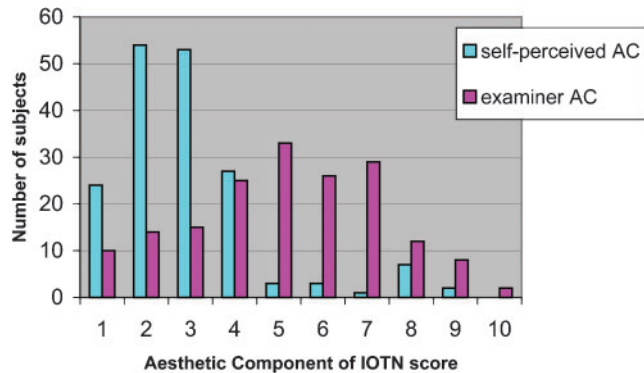


Figure 1 Frequency distribution of self-perceived and examiner AC scores

forms did not take part in the study, giving an overall participation rate of 63%.

There were 208 subjects in total: 92 boys, and 116 girls. A binomial test showed that there was no significant difference in the numbers of boys and girls ($p=0.111$). The mean age of the subjects was 11.7 years. Of the 208 subjects, 34 were in receipt of or had finished orthodontic treatment. Only the remaining 174 untreated children are discussed in this article.

Self-perceived and examiner AC scores

The frequency distribution of the Self-perceived and Examiner AC is shown in Figure 1. The AC scores as rated by the examiner and the child exhibit a modest correlation ($\rho=0.427$). However, the children tended to give themselves significantly lower scores compared with the examiner (Wilcoxon signed ranks test $p<0.001$). There was no tendency for one sex to underscore more than the other ($p=0.26$).

Questions about oral-health related quality of life

Most of the children felt that the health of their teeth, lips, jaws and mouth was good (81%). When asked how much the condition of their teeth, lips, jaws or mouth affects their life overall, the majority answered 'very little' (78%). Looking at the percentage responding 'often' or 'everyday or almost everyday' as an indicator, 21% of the children experienced one or more oral symptoms in the past 3 months, 49% had functional limitations, 16% had impacts on their emotional well-being and 17% had impacts on their social well-being.

Questions regarding orthodontic concern

Thirty-five per cent of untreated children wanted orthodontic treatment; 48% did not want treatment and 17% were not sure.

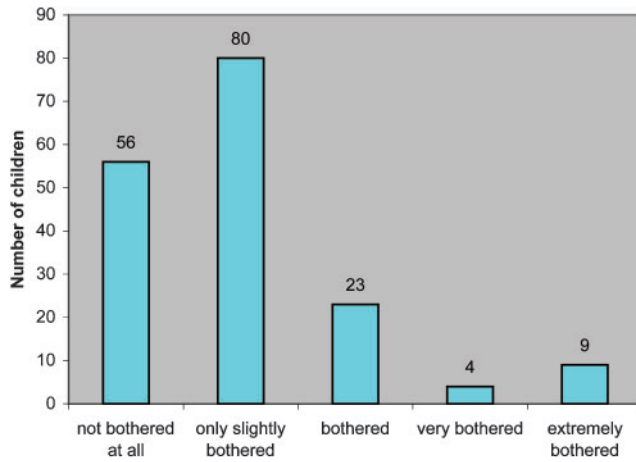


Figure 2 Frequency distribution of responses to the question 'How bothered are you about how straight your teeth are at the moment?'

Although most untreated children (46%) were only slightly concerned by the alignment of their teeth, there were 9 children who were extremely concerned (Figure 2). This somewhat bimodal pattern of distribution is not evident in the distribution of Examiner AC scores (Figure 1). Interestingly, of the untreated children who wanted orthodontic treatment, 33% would only be slightly upset if they couldn't receive that treatment. However, 8 children (13%) would be extremely upset. (Figure 3).

The people that the children tended to speak to about getting their teeth straightened were mostly their parents (51% of children) and their dentists (46%)

Aim 1. To examine the relationship between examiner and child AC scores, and Child Perceptions Questionnaire (CPQ) scores.

A very low, but statistically significant correlation was found between self-perceived AC scores and overall CPQ score ($\rho=0.184, p<0.005$; Table 1). The Examiner AC scores had lower correlation ($\rho=0.083, p=0.5$). Of all 4

Table 1 Correlations between CPQ scores and self-perceived and examiner

Aesthetic component scores	Self-perceived AC Spearman's Rho	Examiner AC
Oral symptoms score	0.171**	0.072
Functional limitations score	0.096	-0.003
Emotional impacts score	0.163**	0.151**
Social impacts score	0.115**	0.028
Overall CPQ score	0.184**	0.083

**Correlation is significant at the 0.05 level.

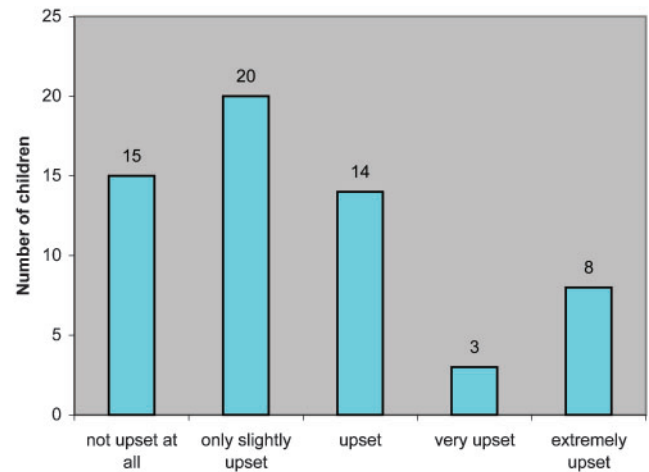


Figure 3 Frequency distribution of the responses to the question 'How upset will you be if you are not able to get treatment from the dentist to straighten you teeth?' for untreated children who wanted treatment

sections in the CPQ, the only section that had a significant correlation with Examiner AC was the emotional impacts section ($\rho= 0.151, p<0.005$).

Aim 2. To establish the validity of IOTN AC or CPQ scores with respect to:

- the child's concern with his/her dental alignment;
- how upset the child would be if unable to receive orthodontic treatment.

Of the 4 sections of the CPQ, it was the emotional impacts score that had the highest correlation with the responses for the two questions regarding orthodontic concern.

The emotional impacts section of CPQ was also better than both Self-perceived and Examiner AC at reflecting how bothered the child was about his malocclusion and how upset he would be if he was unable to receive orthodontic treatment. (Table 2).

Aim 3. To determine whether children with a need for treatment have a worse oral health-related quality of life, when treatment need is based on:

- normative examiner AC;
- self-perceived AC;
- the child's concern with his/her dental alignment;
- how upset the child would be if unable to receive orthodontic treatment.

Children with a need for treatment based on normative examiner $AC \geq 6$ did not have significantly higher CPQ scores (i.e. worse quality of life), compared with children with examiner $AC \leq 5$ (Table 3).

Table 2 Correlations between 2 questions regarding orthodontic concern and Aesthetic component and CPQ scores. The variables are listed in order, from highest correlation to lowest

How bothered the child is by how straight his teeth are Variable	rho	How upset the child would be if he was unable to receive orthodontic treatment Variable	rho
Emotional impacts section of CPQ	0.332	Emotional impacts section of CPQ	0.464
Self-perceived AC	0.303	Overall CPQ score	0.428
Overall CPQ score:	0.282	Self-perceived AC	0.258
Examiner AC	0.209	Examiner AC	0.214

All of the correlations shown are significant at the 0.05 level.

However, the other three measures of motivation for treatment all showed significant relationships with the oral health quality of life. The children identified as needing treatment based on self-perceived AC had significantly worse emotional impacts ($p < 0.05$) and a higher overall CPQ score ($p < 0.05$). Children who expressed concern with their dental alignment had worse emotional ($p < 0.001$) and social ($p < 0.001$) impacts and a higher overall CPQ score ($p < 0.001$) when compared with children who were only slightly bothered or not bothered at all. Similarly, children who said that they would be upset, very upset or extremely upset if unable to receive orthodontic treatment had worse emotional ($p < 0.001$) and social ($p < 0.001$) impacts and a higher overall CPQ score ($p < 0.001$).

In addition, children who wanted treatment had significantly worse oral symptoms ($p < 0.01$), emotional ($p < 0.01$) and social ($p < 0.005$) impacts, and a higher

overall CPQ score ($p < 0.005$), when compared with children who didn't want treatment.

Discussion

This study revealed that the CPQ had a degree of validity in our study population, as it was related to the children's concern with their dentition. We shall discuss these results with respect to

- AC;
- the child's concern with his/her malocclusion.

AC scores

The discrepancy between normative (examiner-derived) and perceived need by the patient for orthodontic

Table 3 Treatment need could be determined based on different criteria: examiner AC, self-perceived AC, how bothered the child was about how straight his teeth are and how upset he would be if unable to receive orthodontic treatment. The difference in quality of life scores between children with a need for treatment and no need for treatment (for the 4 different criteria) was tested for significance using Mann-Whitney tests. The values for p are shown

	Criteria for determining treatment need			
	Treatment need	Examiner AC ≥ 6	Self-perceived AC ≥ 6	Bothered, Very bothered or extremely bothered by how straight his teeth are
No treatment need	Examiner AC ≤ 5	Self-perceived AC ≤ 5	Not bothered at all or only slightly bothered	Not upset at all or only slightly upset
	$p <$	$p <$	$p <$	$p <$
Oral symptoms score	0.607	0.063	0.224	0.071
Functional limitations score	0.879	0.062	0.119	0.076
Emotional impacts score	0.095	0.011**	0.001***	0.001***
Social impacts score	0.694	0.267	0.001***	0.001***
Overall CPQ score	0.475	0.017**	0.001***	0.001***

**Correlation is significant at the < 0.05 level.

***Correlation is significant at the < 0.001 level.

treatment that has been shown in other studies^{8,13,14} was very evident in this study. The children tended to give themselves lower IOTN AC scores when compared with the examiner.

Normative AC scores only correlated significantly with the scores for the emotional impacts section (and not the oral symptoms, functional limitations or social impacts sections) of the CPQ. This supports the view that the possession of a malocclusion has more impact on one's emotional well-being than on actual dental health or function.^{15,16} The correlation, however, was very low. In addition, self-perceived AC only had a slightly higher correlation with CPQ scores. These low correlations suggest that the IOTN AC and the CPQ are not merely different measures measuring the same attributes. Similarly, Mandall *et al.*⁸ found a low correlation between normative IOTN AC and the OASIS OhrQoL measure ($\rho=0.24$).

While studies in the past have shown that the IOTN AC is of some value in assessing treatment need,^{17,18} this study highlights its definite limitations in reflecting a child's motivation and concern for orthodontic treatment. The frequency distribution of normative AC scores, which fitted a normal distribution, was not replicated in the distribution showing how bothered the children were by their malocclusion, which had a more bimodal distribution. This suggests that concern about a malocclusion isn't closely related to the severity of that malocclusion in terms of aesthetics (as measured by the IOTN AC).

Furthermore, the emotional impacts section of CPQ was better than both self-perceived and examiner AC at reflecting how the children's concern over their malocclusion and how upset they would be if they were unable to receive orthodontic treatment. The untreated children who wanted orthodontic treatment had a significantly worse OhrQoL score compared with those who did not. Other OhrQoL measures have also been shown to reflect this difference.^{6,8,9}

A further point is that, whilst this study showed that the quality of life measure was better than IOTN AC at predicting orthodontic concern, it is not known whether it is also better at predicting actual uptake of treatment. A recent study by Mandall *et al.*¹⁹ found that the normative IOTN, self-perceived IOTN AC and teasing history adequately predicted the use of orthodontic services and it was not of additional benefit to collect OhrQoL information, such as utility score and OASIS. This could be because there are other factors besides quality of life and dental aesthetics, that influence the uptake of treatment, such as the availability of services.^{19,20,21}

Child's perception of need

It is generally accepted that the main justification for providing orthodontic treatment is to improve dental appearance to have a beneficial effect on the patient's psychological and social well-being.^{16,22-26} However, this study showed that children with a need for treatment, as assessed by the examiner AC, did not have a worse psychosocial quality of life than those with a low AC score. When the need for treatment was determined by a more consumer-based approach, i.e. by establishing the children's concern with their malocclusion, the children with a need for treatment did have a worse quality of life. This suggests that if orthodontic treatment need were based solely on IOTN AC, many patients who do not actually have a psychosocial need for treatment would be treated. This has implications in any situation of prioritizing patients for free or subsidized treatment. This study strongly suggests that it is more appropriate to supplement normative indices, such as examiner AC, with an orthodontic quality of life measure to identify patients with a clear psychosocial need.

Finally, it should be noted that although the CPQ (emotional impacts section) appears to reflect subjects' concerns about malocclusions and perceived need for orthodontic treatment, the CPQ does not reveal the subject's perception of the actual cause of any of the impacts which are scored. This is a limitation of this measure, as the scores may be related to a variety of oral health conditions and not necessarily specific to a subjects' malocclusion. Future development of this or other OhrQoL measures for use in orthodontics needs to be able to discriminate with greater certainty between impacts due to malocclusions and impacts due to other oral conditions.

Conclusions

- The CPQ had validity with respect to the children's concern with their dentition.
- The association between CPQ and the Aesthetic Component of IOTN was low. This suggests that the CPQ and IOTN AC may be measuring different attributes.
- There should be a shift towards using OhrQoL measures such as the CPQ in assessing perceived orthodontic need and concern.
- Current OhrQoL measures should be refined for specific use in identifying orthodontics needs.

Authors and contributors

Y. V. Kok was responsible for several aspects of the study design, much of the data collection, data entry, data

analysis and interpretation and drafting. P. Mageson was responsible for much of the data collection, especially the IOTN scoring, data entry, data analysis and interpretation and drafting. N. W. T. Harradine was responsible for conception and design of the study, administrative support, critical revision and final approval of the article. A. J. Sprod was responsible for logistic support, aspects of design, including subject recruitment, data analysis and interpretation, critical revision. Nigel Harradine is the guarantor.

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