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# EVALUATION OF A QUALITY OF LIFE MEASURE FOR CHILDREN WITH MALOCCLUSION

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## ABSTRACT

*Objective:* To explore the validity and reliability of the Child Perception Questionnaire as an oral health-related quality of life (OHRQoL) measure in adolescents with malocclusion.

*Design:* A cross-sectional study.

*Setting:* Orthodontic departments at Charles Clifford Dental Hospital (CCDH), Sheffield and Chesterfield Royal Hospital (CRH), Chesterfield. The control group was recruited from the Paediatric Department at CCDH and one General Dental Practice in Sheffield.

*Subjects and Methods:* The experimental group consisted of 116 patients aged 11 - 14 years about to commence orthodontic treatment. The control group consisted of 31 11-14 year-old patients with IOTN 1 and 2, and DMFT $\leq$ 2, with no history of orthodontic treatment. The children completed the Child Perception Questionnaire (CPQ), including global ratings of oral health and satisfaction. The child rated their own IOTN Aesthetic Component (AC) score.

*Outcome measures:* Total CPQ scores and responses in the four domains. Self-perceived AC scores and responses to global rating of oral health, life overall and satisfaction rating were recorded.

*Results:* There was a statistically significant difference between the malocclusion and control total CPQ scores ( $p=0.012$ ). These differences were significant for the emotional ( $p=0.006$ ) and social well-being ( $p=0.001$ ) health domains, and not significant for the oral symptoms and functional limitations health domains. There were significant correlations between the total CPQ score and overall well-being ( $p\leq 0.01$ ) and patient satisfaction ( $p\leq 0.01$ ).

*Conclusion:* Malocclusion has a negative impact on the OHRQoL of an adolescent. A shortened version of this form, specifically for prospective orthodontic patients may be beneficial as an additional measure to assess need for treatment, especially as some of the questions in the oral symptoms and functional limitations subscales of the current questionnaire are not relevant to orthodontic patients.

## INTRODUCTION

Orthodontists have developed a number of measures or indices to assess the severity of a malocclusion, the need for treatment, the perceived complexity of treatment and the quality of the result. These are usually based on assessing relevant occlusal features as defined by the profession either clinically or from a set of study models. Orthodontists are becoming aware of the need to evaluate the patients' own perceived need for treatment and measure the difference that orthodontic treatment might bring to patients' daily lives<sup>1</sup>. Methods of assessing Oral Health Related Quality of Life (OHRQoL) complement clinical indicators by detailing the functional and psychosocial disadvantages of disorders and provide a more complete picture of the health of the individual.

There has been limited research into the use of OHRQoL measures in individuals with malocclusion. One cross-sectional study was conducted in Brazil using the Oral Impacts on Daily Performance (OIDP) and the shortened version of Oral Health Impacts Profile (OHIP-14)<sup>2</sup>. This showed that adolescents (15-16 year olds) who had completed orthodontic treatment reported fewer oral health impacts on their daily life activities than those currently under treatment or those who had never had treatment. The authors concluded that more information about the adolescents' perceived satisfaction with their appearance was gleaned by combining the Index of Orthodontic Treatment Need (IOTN) with either of the two oral health-related quality of life measures.

Klages et al<sup>3</sup> developed a QoL measure to use with potential orthodontic patients called the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ). They tested this on 194 young adults aged 18 - 30 years, 70 percent of whom had undergone orthodontic treatment. They found the measure had good reliability and criterion validity for a young adult population, but recognised that if the measure is to be used on children and adolescents then it would require further testing.

Quality of Life measures developed for adults are not suitable for use with children. The majority of orthodontic patients are children and adolescents; therefore an appropriate OHRQoL measure for this age group is required. The Child Perception Questionnaire (CPQ) has been developed for use in children. This forms one component of the Child Oral Health Quality of Life Questionnaire and has been found to be valid and reliable in a Canadian<sup>4</sup> and UK<sup>5</sup> child population. The CPQ consists of 37 items organised into four health domains: oral symptoms, functional limitations, emotional and social well-being. Social well-being consists of sub-domains for schooling, peer interaction and leisure activities. Different variations of the questionnaire are available for age groups 6-7, 8-10 and 11-14. Age specific questionnaires are required, as these age groups are homogenous in terms of cognitive development<sup>4</sup>. The limitation of this questionnaire is that it was not specifically developed for use in patients with a malocclusion.

Kok et al<sup>6</sup> compared the CPQ outcomes from 174 schoolchildren in Bristol aged 10-12 years with an examiner and self reported IOTN aesthetic component (ac). They found that children who assessed themselves as in need of treatment with IOTN ac had significantly higher total CPQ scores and worse emotional impacts. Emotional, social and total CPQ scores were also correlated with the child's concern about how straight their teeth were and the degree of upset the child would experience if they were unable to receive orthodontic treatment.

O'Brien et al<sup>7</sup> also showed that the CPQ had some validity for perceived malocclusion amongst schoolchildren in the Greater Manchester and Lancashire regions of the UK. They found that children in the high need for treatment category of IOTN dental health component (dhc), as well as professional and self-perceived IOTN ac had significantly higher total CPQ scores, compared with children in the low treatment need category. The greater total CPQ scores in the treatment need group were accounted for by significantly increased impacts in the

emotional and social well being domains, but not in the functional limitation and oral symptom domains.

It is possible that some malocclusions have a greater adverse effect on OHRQoL than other types of malocclusion. Wong et al<sup>8</sup> found high CPQ scores in individuals with four or more missing teeth. They found a strong correlation between the number of missing primary and permanent teeth and the OHRQoL. Johal et al<sup>9</sup> discovered that children with an increased overjet (>6mm) or a spaced anterior dentition had statistically significant higher total CPQ scores than a group with class I incisors and well aligned anterior teeth; however they found no difference between the two malocclusion groups. They suggest that the impact of specific malocclusions needs further investigation.

The aim of this study was to explore the validity and reliability of the CPQ as an oral health-related quality of life measure in children aged 11-14 years with malocclusion. The null hypothesis tested is that there is no difference in the OHRQoL in children with or without malocclusion. A secondary outcome was to examine if there were any reported differences in OHRQoL between three common types of malocclusion.

## **METHOD**

This study was a cross-sectional investigation. Ethical approval was granted by the South Sheffield Research Ethics Committee and site specific issues were reviewed by the Research and Development Department at Chesterfield Royal Hospital (CRH).

The malocclusion sample consisted of patients, between the ages of 11 and 14 years, who were about to commence orthodontic treatment at Charles Clifford Dental Hospital (CCDH) or CRH. Only individuals presenting with one of three common occlusal traits based on their Index of Orthodontic Treatment Need (IOTN) dental health component (dhc) scores<sup>10</sup> were included:

- Crowding (IOTN dhc 4d) - at least one area of crowding of the upper and lower anterior teeth (canine-to-canine) with a contact point displacement of 4mm or more
- Overjet (IOTN dhc 4a or 5a) - an overjet greater than 6mm
- Hypodontia (IOTN dhc 4h or 5h) - at least one absent tooth (due to congenital absence or trauma) in the upper or lower arch

These malocclusions were chosen to ensure that there was a representative sample of the common malocclusions and also to act on the suggestion made by Johal et al<sup>9</sup> that the impact of specific malocclusions should be investigated. When two or more occlusal traits were present, the hierarchical acronym MOCDO was employed to determine the worst characteristic. MOCDO stands for Missing, Overjet, Crossbites, Displacements and Overbite. This represents the order in which occlusal features are examined during the clinical assessment to determine the grade of IOTN dhc. Patients with active dental disease, cleft lip and/or palate, a complicating medical history, or severe dental mottling were excluded from the study.

The non-malocclusion group consisted of adolescents, aged between 11 and 14 years, presenting with an IOTN dhc score of 1 or 2; no previous experience of orthodontic treatment; a DMFT of 2 or less and no active dental disease (i.e. decay = 0). The individuals were recruited from regular patients at one general dental practice in Sheffield or from the Paediatric Dentistry Department of CCDH, as part of a previous study assessing the reliability and validity of the Child Perception Questionnaire for 11-14 year old children in the UK<sup>5</sup>.

Adolescents and their parents were given information and invited to take part in the study on the first visit following removal from the treatment waiting list. No treatment was discussed at this appointment, but orthodontic records were taken for treatment planning at the subsequent appointment. At this next appointment the consent for the study was taken and adolescents were asked to complete the CPQ<sub>11-14</sub>, whilst their parents completed the parental form (PPQ<sub>11-</sub>

14). When the adolescent had completed the questionnaire, they were asked to rate their teeth using the IOTN aesthetic index photographs on a scale of 1 (straight teeth) to 10 (crooked teeth).

Reproducibility was assessed by asking a proportion of participants to complete a second questionnaire, which was posted to them at least two weeks after they had completed the first questionnaire.

### **Sample size**

The selected non-malocclusion sample<sup>5</sup> had a mean total CPQ of 15.2 (sd 10.1). In order to detect a mean total CPQ increase of thirty percent in the malocclusion group, it was determined that ninety patients would need to be recruited ( $\alpha = 0.05$ ;  $\beta = 0.90$ ), however because of the unequal numbers of participants in the non-malocclusion and malocclusion groups the proposed sample size was increased to 120, using the method outlined by Altman for calculating unequal sample sizes<sup>11</sup>. To obtain an even spread of malocclusions and to test the hypothesis of no difference between the three common malocclusion traits we proposed to recruit forty patients in each of the three malocclusion groups.

### **Data analysis**

The CPQ<sub>11-14</sub> consists of 37 items organized into four health domains. In addition, there were two questions to assess the adolescent's general rating of their oral health, including an overall assessment of the health of the teeth, lips, jaws and mouth and how the oral condition affects their life overall. A third question asked the participants in the malocclusion group whether they would describe their teeth as 'straight', 'crooked', 'goofy' or 'gappy' and a fourth question asked how satisfied they were with the appearance of their teeth.

The answers to the CPQ<sub>11-14</sub> questions were arranged on a five-point Likert scale ranging from 'never' to 'almost every day'. The responses were coded according to Jokovic et al<sup>4</sup>. The principal outcome measure was the total CPQ score, which was calculated by summing the



response codes for all 37 questions. Subscale scores were calculated by summing the responses to the questions in each of the four health domains.

The distribution of the data was examined and found not to be normally distributed. The null hypothesis that there is no difference in the CPQ scores between the malocclusion and non-malocclusion groups was therefore tested using the non-parametric Mann-Whitney test.

Discriminant validity was assessed by comparing overall and domain scores for the three malocclusion groups. The difference between the groups was tested using a Kruskal-Wallis due to the asymmetrical score distributions. Construct validity was assessed by comparing the association between the CPQ<sub>11-14</sub>, both total and domain, with the life overall rating, the global and satisfaction questions, as well as the patient determined aesthetic component using the Spearman's rank correlation coefficient.

The internal consistency reliability of the scale and domains was tested using Cronbach's alpha. Test-retest reliability was assessed using an intraclass correlation coefficient (ICC).

## **RESULTS**

One hundred and forty seven children participated in the study. The characteristics of the adolescents in the malocclusion group are shown in Table 1.

The scores for the total CPQ<sub>11-14</sub> and the four separate domains in the two groups are shown in Table 2. The median total CPQ<sub>11-14</sub> of the malocclusion group was 17.6 (IQR 17.7) ranging from 0 to 57. Only one participant had a zero CPQ score. There were no ceiling (i.e. maximum score) effects. The median total CPQ<sub>11-14</sub> score for the non-malocclusion group was 14 (IQR 11.1) ranging from 3 to 44. There were no floor (i.e. zero score) or ceiling effects observed. There was no difference between CPQ scores for male and female participants ( $P=0.529$ ).

One-quarter of the children in the malocclusion group rated the health of their teeth, lips, jaws and mouth (global oral health question) as 'fair' or 'poor'. The condition of their teeth, lips, jaws and mouth affected their life (life overall question) 'a lot' or 'very much' in 9.3 percent of cases and 38.6 percent of children were dissatisfied or very dissatisfied with the appearance of their teeth.

### **CPQ Validity**

The results of the Mann-Whitney test comparing the CPQ scores of the malocclusion with the non-malocclusion groups are shown in Table 2. There was a statistically significant difference between the malocclusion and non-malocclusion groups total CPQ scores ( $p=0.012$ ). There was also a significant difference between the malocclusion and non-malocclusion scores for the emotional ( $p=0.006$ ) and social well-being health domains ( $p<0.001$ ). There were no significant differences between the oral symptoms and functional limitations of the malocclusion and non-malocclusion groups.

The results of the Kruskal-Wallis test to analyse differences between the malocclusion sub groups are shown in Table 3. There were no statistically significant differences between the malocclusion subgroups in the overall and subscale CPQ scores.

Construct validity was assessed using correlations between the total and domain CPQ scores in the malocclusion group and the questions concerning life overall, global ratings of oral health, patient satisfaction and patient determined aesthetic component (Table 4).

### *Life overall rating*

The malocclusion group as a whole showed significant correlations between the CPQ and life overall rating for the total score and the subscales, except for the functional limitations domain (Table 4). Patients in the crowding and increased overjet groups showed significant correlations for the emotional ( $r_s = 0.40$  and  $0.47$ ) and social subscale scores ( $r_s = 0.41$  and

0.46). Patients in the hypodontia group showed a significant correlation with the emotional subscale only. ( $r_s = 0.50$ ).

#### *Global rating of oral health*

There were no significant correlations observed between the total or domain CPQ scores and the global ratings of oral health, with the exception of the emotional subscale in the hypodontia group ( $r_s = 0.36$ ).

#### *Patient satisfaction*

There were significant correlations between the total and subscale CPQ scores and the responses to the patient satisfaction question in the malocclusion group as a whole, except for the oral symptoms subscale. Patient dissatisfaction with the appearance of their teeth correlated highly with the CPQ emotional subscale in the crowding ( $r_s = 0.30$ ), overjet and hypodontia groups ( $r_s = 0.52$  and  $0.53$ ) and the social subscale in the overjet group ( $r_s = 0.41$ ).

#### *Aesthetic component*

There were no significant correlations between any of the total or sub-domain CPQ scores and the patient determined aesthetic component, with the exception of the emotional subscale in the hypodontia group ( $r_s = 0.37$ ).

#### *Child Description*

There were discrepancies between the clinician determined categories, based on the IOTN dhc hierarchical scale and the patient's assessment of their own teeth. Patients were asked which of the following best described their teeth; straight, crooked, goofy or gappy. The results are shown in Table 5. Individuals assigned by the clinician to the Crowding group were more likely to agree with the IOTN dhc grading compared with the other two groups. Just over one half of children in the increased overjet group (53%) described their teeth as 'goofy'. Twenty one percent described their teeth as 'crooked' and 21 percent described them as 'gappy'. Sixty-six percent of the hypodontia group described their teeth as 'gappy', whereas 23 percent

described their teeth as 'crooked'. Individuals were re-grouped according to how they perceived their malocclusion e.g. a subject with an increased overjet was regrouped to the Hypodontia group if they described their teeth as 'gappy'. Following re-grouping, there remained no statistical differences in the CPQ scores between the three malocclusion groups.

### **CPQ reliability**

Internal consistency was assessed on the total malocclusion sample using Cronbach's alpha. This was 0.90 for the total CPQ and ranged from 0.62 to 0.90 for the subscales (Table 6) indicating acceptable to good internal consistency. The Cronbach's alphas for the separate malocclusion groups were 0.88 for the crowding group, 0.92 for the increased overjet group and 0.91 for the hypodontia group. Thirty four children completed a second questionnaire to assess test-retest reliability, however 16 reported that there had been a change in their oral health and the effect on their life overall since they had completed the first questionnaire, therefore these were excluded from the analysis. The intraclass correlation coefficient (ICC) for the total CPQ was 0.87 (95% CI=0.65-0.95)..

## **DISCUSSION**

This study shows that 11-14 year-old children with malocclusion reported significantly more impacts and hence a worse quality of life compared with a non-malocclusion group with no or minimal malocclusion according to IOTN. There were no significant differences in the quality of life between the three malocclusion groups studied namely children with an increased overjet (>6mm), crowding of the anterior teeth (contact point displacement  $\geq 4$ mm) or with at least one absent tooth.

The results of this study agree with several previous investigations that malocclusion has a significant impact on the OHRQoL of children as measured using the Child Perceptions Questionnaire <sup>4, 6-9, 12</sup>. The questionnaire has now been shown to be valid and reliable in a

number of different countries including Canada<sup>4</sup>, the United Kingdom<sup>6, 7, 9</sup>, Hong Kong<sup>8</sup> and Saudi Arabia<sup>12</sup>.

The main impacts on Quality of Life for the malocclusion groups in this study were recorded in the emotional and social well-being domains of the questionnaire. O'Brien et al<sup>7</sup> found similar results when they compared CPQ scores and the need for orthodontic treatment as measured by the dental health and aesthetic components of IOTN, in a population of schoolchildren in the Greater Manchester and Lancashire regions of the UK. This suggests that the most significant impact of malocclusion on Quality of Life is psycho-social, rather than due to oral or functional problems.

There was further confirmation of this when the construct validity of the CPQ in this study was examined. Construct validity examines whether the measure being used (the CPQ questionnaire) measures the outcome we wished it to measure (OHRQoL in adolescents with malocclusion). This was tested by asking the adolescent to complete four general questions and observations concerning their teeth, including (a) a general rating of their oral health; (b) the extent to which their oral condition affected their overall well-being; (c) how satisfied they were with their dental appearance and (d) the perception of the appearance of their teeth using the aesthetic component of IOTN.

The correlations between the CPQ scores and the two questions (b) and (c) were significant in both the emotional and social subscales, demonstrating good construct validity. The correlations were not significant for the oral symptoms and functional limitations domains, suggesting poor construct validity for these questions. This is not surprising as the CPQ was not developed specifically to measure the impact of orthodontic problems and some of the questions in the functional and oral symptoms subscales are not necessarily relevant to patients with malocclusion. For example, questions about pain, bad breath, food being stuck in the top of the mouth, and trouble sleeping might not address the concerns of the prospective

orthodontic patient. Questions in the emotional and social subscales about shyness, embarrassment, being upset, avoided smiling or laughing are more relevant to the problems of an orthodontic patient.

Kok *et al*<sup>6</sup> used different questions to test the construct validity of the CPQ in their sample of 174 school children, but with the same results as this study. They asked participants firstly how bothered they were by how straight the teeth were and secondly how upset they would be if they were unable to receive orthodontic treatment. They found significant correlations between these questions and the total CPQ, but again this was due to higher impacts in the emotional and social well-being domains and not the oral symptoms and functional limitations domains.

Interestingly there were low correlations between the CPQ scores and the general rating of oral health. Three quarters of the children in this study reported good, very good or excellent health of teeth, lips, jaws and mouth. Despite this 41 percent reported that the condition of their teeth, lips or jaws had some impact on their life overall. This may reflect the difficulties children may have with the concept of 'oral health' in relation to malocclusion and may be referring to gingival health and caries status rather than malocclusion.

This study found no significant differences in the total number of impacts or in the four subscales between the three malocclusion types. It could be argued that whereas the sample size was sufficient to detect a significant difference between the malocclusion and the non-malocclusion groups, it was underpowered with regard to finding a difference between the malocclusion groups. The group with the highest total CPQ score was the overjet group; however this group also showed a wide range of responses, from a minimum total CPQ score of 2 to a maximum of 55. We believe that this large variation in outcome would make it difficult to obtain a large enough sample to detect a significant difference between this group and other malocclusions.

There were discrepancies between the clinician determined categories, based on the IOTN dhc hierarchical scale and the patient's description of their own teeth. This may be due to the fact that the child had crowding as well as an increased overjet, and it was the crowding which was of main concern to the child. On the other hand, an increased overjet may be accompanied by spacing of the anterior teeth, which the child may describe as a 'gappy' appearance and again might be their major concern. The IOTN dhc hierarchical scale is essentially the profession's view as to the functional and dental health reasons for needing orthodontic treatment<sup>10</sup> and by implication the perceived disadvantage of leaving the patient with a malocclusion<sup>13</sup>. This might not accurately reflect the main concern of the patient.

It has been suggested that measures of OHRQoL could be used to complement existing methods of determining need for orthodontic treatment. O'Brien et al<sup>7</sup> found a significant difference in the total CPQ and the social well-being domain, between children in IOTN dhc groups 2 and 3 and those in IOTN dhc groups 4 and 5. They also found a significant difference in the total CPQ scores and the emotional and social well-being domains between adolescents placed in two groups according to the clinicians rating of their IOTN ac score of either 1-5 or 6-10.

This study found no significant correlation between the adolescent's rating of their own IOTN aesthetic component and CPQ. Kok et al<sup>6</sup> found statistically significant, but very low correlations between self-perceived AC and CPQ. O'Brien et al<sup>7</sup> found a statistically significant difference, but only after grouping the IOTN ac into two groups, 1-3 and 4-10 and the result was only significant for the total CPQ and the emotional and social well-being domains. It appears that the association between CPQ and self-perceived AC of IOTN is low, as adolescents found the concept of using the scale to rate their own teeth quite difficult.

The questionnaire showed strong internal consistency for this study sample. The CPQ Cronbach's alpha scores for the total scale (0.90) and subscales (0.62-0.90) were comparable

to that obtained by Jokovic et al<sup>4</sup> (0.91), Marshman et al<sup>5</sup> (0.87) and O'Brien et al<sup>7</sup> (0.90). This provides further evidence that the questionnaire has good internal reproducibility. It was disappointing that nearly half the children had to be excluded from the analysis because they reported changes in oral health and/or effect of oral health on life overall within a two week period of completing the first questionnaire and the re-test. One reason for this might be that the children received oral hygiene instruction following their first visit, which caused a change to their gingival health. Also by having records taken of their teeth, the adolescents might have been made more aware of their oral health. Although there is good evidence that this OHRQoL measure has sufficient validity and test-retest reliability in cross sectional samples of children with malocclusion; longitudinal validity, with the ability to detect minimally important clinical changes needs to be established i.e. the responsiveness of the questionnaire needs to be assessed<sup>14</sup>.

The strength of this study is that it confirms what has been found in previous studies looking at the Oral Health Related Quality of Life of children with malocclusion using this measure. The perceived weakness might be the sample size, however this is of the same order as previous studies in this area<sup>4-6</sup>.

As a generic measure, the CPQ is useful to allow comparisons between the OHRQoL in orthodontic patients and patients with other oral and oro-facial disorders. The generic form also has greater potential to capture unforeseen effects, which may go undetected by a specific instrument. However the development of a shortened or a condition-specific form specifically for prospective orthodontic patients may be beneficial as an additional measure to assess need, especially as some of the questions in the oral symptoms and functional limitations subscales are not relevant. McGrath et al<sup>15</sup> recommended that a measure should contain the minimum number of questions to capture the concept adequately so as to minimise the burden on study participants and the costs of data collection. An OHRQoL measure specific to orthodontics would have the potential to be more responsive or sensitive to clinically important



changes in health, for example as a result of orthodontic intervention. Although Locker<sup>16</sup> challenged the distinction made between general and oral health, orthodontic patients tend to be young and fit and therefore the development of an OHRQoL measure specific to orthodontic patients may be suitable.

## CONCLUSIONS

- Adolescents with malocclusion had a significantly higher total CPQ score, and hence lower Oral Health Related Quality of Life compared to a non-malocclusion group.
- The higher impacts were principally in the questions relating to social and emotional well-being.
- The questionnaire did not discriminate between three malocclusion groups: - crowding, increased overjet and hypodontia.
- The development of a short form, more specifically related to problems with malocclusion, may be beneficial for assessment of treatment need
- Longitudinal analysis is required to show that the data exhibits sensitivity to change over time, e.g. before and after orthodontic treatment, thereby establishing the responsiveness of the CPQ questionnaire in children with malocclusion.

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## Tables

Table 1

Characteristics of children in the malocclusion and control groups

		Malocclusion (n=116)	Control (n=31)
<b>Subgroups</b>	Crowding	47 (40.5%)	
	Overjet	34 (29.3%)	
	Hypodontia	35 (30.2%)	
<b>Gender of child</b>	Boy	48 (41.4%)	15 (48.4%)
	Girl	68 (58.6%)	16 (51.6%)
<b>Age of child</b>	11	15 (12.9%)	11 (35.5%)
	12	28 (24.1%)	7 (22.6%)
	13	26 (22.4%)	8 (25.8%)
	14	47 (40.5%)	5 (16.1%)

**Table 2**

Total and subscale CPQ<sub>11-14</sub> scores by Malocclusion and Control groups and p value from the Mann-Whitney test

	<b>Malocclusion (n=116)</b>	<b>Control (n=31)</b>	
	Median (IQR)	Median (IQR)	<b>P</b>
<b>Total CPQ</b>	17.6 (17.7)	14.0 (11.1)	<b>0.012*</b>
<b>Subscales</b>			
Oral symptoms	5.0 (3.0)	4.0 (4.0)	<b>0.971</b>
Functional limitation	5.0 (6.0)	4.0 (5.0)	<b>0.191</b>
Emotional well-being	4.4 (7.0)	2.0 (6.0)	<b>0.006**</b>
Social well-being	3.0 (6.0)	1.5 (3.0)	<b>0.001**</b>

**Table 3**

Discriminant validity - Total and subscale CPQ<sub>11-14</sub> scores by malocclusion subgroup and p value from the Kruskal-Wallis test

	<b>Crowding (n=47)</b>	<b>Overjet (n=34)</b>	<b>Hypodontia (n=35)</b>	
	Median (IQR)	Median (IQR)	Median (IQR)	<b>p</b>
<b>Total CPQ</b>	17.1(14)	20 (27.8)	18 (16)	<b>0.797</b>
<b>Subscales</b>				
Oral symptoms	4 (4)	5 (5)	5 (4)	<b>0.696</b>
Functional limitations	5 (5.4)	6 (8)	5 (5)	<b>0.414</b>
Emotional well-being	4 (7)	5 (9.7)	5 (6)	<b>0.469</b>
Social well-being	3 (4)	4 (8.5)	3 (8)	<b>0.831</b>

**Table 4**

Total Spearman's rank correlation coefficients between the total and subscale CPQ<sub>11-14</sub> scores and the life overall, global and patient satisfaction questions, as well as the patient determined aesthetic component (N = 116)

	<b>Life Overall</b>	<b>Global</b>	<b>Patient Satisfaction</b>	<b>Aesthetic Component</b>
<b>Total CPQ</b>	0.397**	0.158	0.362**	0.100
<b>Subscales</b>				
Oral symptoms	0.219*	0.149	0.145	0.015
Functional limitations	0.107	0.172	0.189*	0.073
Emotional well-being	0.437**	0.142	0.411**	0.170
Social well-being	0.382**	-0.023	0.307**	0.030

\*\* Correlation significant at 0.01 level

\* Correlation significant at 0.05 level

**Table 5**

Reliability of the total and subscale CPQ 11-14 scores (n = 18)

	<b>No. of items</b>	<b>Cronbach's alpha</b>
<b>Total CPQ</b>	37	0.90
<b>Subscales</b>		
Oral symptoms	6	0.66
Functional limitations	9	0.62
Emotional well-being	9	0.90
Social well-being	13	0.78