Original Article

Factors influencing patient-reported quality of life in pretreatment orthognathic surgery patients

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ABSTRACT

Objective: To investigate the relationship between condition-specific quality of life (QoL) and occlusal/skeletal traits of pretreatment orthognathic surgery patients.

Materials and Methods: Patients referred for orthognathic surgery during the 2012–2014 period were asked to complete the Orthognathic Quality of Life Questionnaire (OQLQ) at consultation. Patient demographics, indices of treatment need, occlusal traits, and cephalometric variables were also recorded. Bivariate analyses were carried out between the OQLQ scores and the clinical measurements. Significant variables were added to a multivariate regression model to determine the effect of these predictive factors on OQLQ.

Results: One hundred and two patients were recruited. Initial analyses showed that gender and overjet were significantly associated with the overall OQLQ score. Being female increased the overall OQLQ score by 15.6 points when compared to males (95% confidence interval [CI], 7.4–23.8). Females also had significant associations in the social and awareness domains of the OQLQ. The magnitude of overjet away from normal values was associated with poorer overall QoL, with significant relationships in the esthetic and functional domains. The Index of Orthognathic Functional Treatment Need was significantly associated with the functional domain of OQLQ, with patients in category 5 scoring a mean of 10.0 points more than patients in category 4 (95% CI, 2.1–17.8). The Index of Complexity, Outcome and Need and other cephalometric variables were not associated with the OQLQ.

Conclusions: Females are more aware of their facial deformity and report a greater social detriment when compared to males. Patients with a higher orthognathic treatment need report greater functional disadvantage. (*Angle Orthod.* 0000;00:1–6.)

KEY WORDS: Dentofacial deformities/surgery; Quality of life; Questionnaires; Orthognathic surgical procedures

INTRODUCTION

Dentofacial deformity is strongly linked with psychosocial burden and societal disadvantage because of the way that both individuals and others perceive the variation in facial appearance.[1–3] Patients are reported to underperform in school, college, or the workplace and have difficulty forming relationships. The decision to proceed with orthognathic treatment is complex and often involves external influences, including the views and opinions of friends, family, and healthcare professionals.[4] While orthognathic surgery will produce a physical change, patients also expect nonphysical benefits, such as a improvements in self-confidence or lifestyle.[5] These benefits can be measured using assessments of patient-reported quality of life (QoL). Assessments of this type have been used throughout healthcare but can be particularly pertinent for interventions such as orthognathic surgery, in which a disease is not cured or life expectancy altered. The increasing use of QoL measures in orthognathic surgery highlights the importance of a patient-centered approach[6] and a shared–decision making process.[7]

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QoL measures also give consideration to indirect effects that may occur following treatment in addition to the physical changes traditionally recorded.[5]

A number of systematic reviews[1,8,9] have been conducted to summarize the research into QoL in orthognathic patients. The three most commonly used indices to measure QoL in orthognathic patients include (1) The Short Form Health Survey (SF-36), judged to be the most widely used patient-assessed outcome measure throughout the world[10]; (2) the Oral Health Impact Profile (OHIP-14); and (3) the Orthognathic Quality of Life Questionnaire (OQLQ).[9] Evidence suggests that the condition-specific OQLQ is the most valid and sensitive instrument to use for orthognathic patients.[11–13]

An insight into the relationship between clinically measured variables (used to assess the severity of the dentofacial deformity) and patient-reported QoL would give clinicians an understanding of which occlusal traits are associated with poorer QoL. In this respect, any treatment proposed can be made specific to better meet patient expectations. Therefore, the aim of this study is to investigate the relationship between patient-reported QoL, using the OQLQ, and traditional clinical measures within a cohort of patients with facial deformity who are preparing for orthognathic surgery.

MATERIALS AND METHODS

Ethics

This study fulfilled the criteria for a service evaluation, and approval to commence was provided by the Department of Innovation and Improvement, Cardiff and Vale University Health Board (Ref A/01). All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.

Subjects

The sample consisted of consecutive new patients aged 16 years and older referred to the University Dental Hospital, Cardiff, UK, during a 15-month period from 2012 through 2014. These patients were judged by senior clinicians to have moderate-to-severe malocclusions, as categorized using Angle's Classification, for the skeletal pattern and required orthognathic surgery to correct the interarch relationships. Patients included as part of this study were UK residents and as such were offered orthognathic surgery within a public health service in which treatment is provided free at the point of use. Patients were excluded if they had been referred for or had reported temporomandibular disorder problems, had a history of sleep apnea, or reported or exhibited psychological disorders likely to confound QoL. Patients with syndromes or previous treatment for trauma were also excluded. As this was a pilot study, a formal hypothesis was not tested, and, therefore, no sample size calculation was performed. Instead, the sample was recruited and variables analyzed periodically until data saturation was reached (ie, further recruitment of participants would have no significant influence on the data).

Variables

Demographic explanatory variables, including patient age, gender, and malocclusion type, were recorded. The Index of Orthognathic Functional Treatment Need (IOFTN) was used to assess objective treatment need, with the single most severe occlusal or facial trait scored categorically from 1 to 5. Complexity of treatment was measured using the Index of Complexity, Outcome and Need (ICON), with a threshold for treatment of 43 points.

Pretreatment lateral cephalometric radiographs were traced and analyzed using Dolphin 10 Imaging & Management Solutions software. The severity of the dentofacial discrepancy was assessed via seven key cephalometric measurements: (1) ANB angle, (2) SNB angle, (3) lower facial height proportion, (4) upper incisor proclination, (5) Holdaway angle, (6) overbite, and (7) overjet. An overall radiographic severity value for each patient ranging from 0 to 7 was calculated by recording the number of traits that lay outside a range of two standard deviations from Eastman normal values.[14]

Patient-reported QoL was evaluated using the OQLQ. This condition-specific, self-completion questionnaire has been previously validated and contains 22 questions, rated on a 4-point Likert scale. Questions are spread across four domains that include social impediment, facial esthetics, oral function, and awareness of dentofacial deformity. Scores range from 0 to 88, with higher scores indicating poorer QoL and a greater patient-perceived need for treatment, although no threshold values are indicated.[15] Patients were given the OQLQ to complete prior to their consultation at the multidisciplinary clinic.

Reliability of Measurements

One operator calibrated in the use of IOFTN and ICON scored all occlusal indices and performed all cephalometric measurements. The intraoperator reliability of the IOFTN and ICON scores was assessed by rescoring 20% of the sample, randomly selected using an integer sequence (www.random.org) 6 months later. A second calibrated operator also scored the variables from the 20% random sample to account for interoperator reliability.

Statistical Methods

All statistical analyses were carried out using IBM SPSS Statistics (v. 20) software (SPSS Inc, Chicago, Ill). Descriptive statistics were produced for the demographic variables. Reliability was tested for the categorical IOFTN scores using cross-tabulation and Kappa statistics[16] and the Bland-Altman method for the continuous ICON scores.[17]

All occlusal and cephalometric values were designated as independent variables and the OQLQ scores as the dependent variable. Bivariate analyses were then carried out for the independent variables and the overall OQLQ score. Dichotomous independent variables were tested using an independent sample *t*-test, categorical variables were tested with a one-way analysis of variance (ANOVA), and continuous variables tested using linear regression. Prior to conducting the analyses, all continuous variables were checked for a normal distribution. The cephalometric variables were found to violate the assumption of normality as a result of the extremes of positive and negative readings. These values were all transformed to a positive magnitude away from accepted White norms.[14] The analyses were extended to include the four individual domains of the OQLQ as additional dependent variables. Significant variables were extracted and used within a multivariate linear regression model to investigate their predictive effect on the overall OQLQ score. The significance level was set at $P < .05$ for all statistical analyses.

RESULTS

Participants

A total of 102 patients were recruited to the study, 97% of whom were white British. The remaining 3% of patients were Asian British. The patient completion rate for the OQLQ was 100%. The sample had a median age of 21 years, and participants ranged from 16 to 59 years of age. Only seven patients in the cohort were above 40 years of age. The majority of patients were female (74%). A mix of malocclusions was observed, with Class III being most prevalent (51%), followed by Class II (38%) and, finally, Class I (11%). Exploration of the demographic variables confirmed bias in the sample (ie, age, gender, and malocclusion), and therefore subsequent statistical analyses were carried out using robust bootstrapping methods incorporating a bias-corrected and accelerated confidence interval.[18]

Reliability of Measurements

The reliability of the IOFTN was very good, with Kappa scores of 0.91 for intraoperator testing and of 0.82 for interoperator testing. The Bland-Altman plots showed a mean difference in intraoperator scores for the ICON of 1.2 points, with 95% limits of agreement between −8.6 and 11.0. Mean difference for interoperator scores was −0.7, with 95% limits of agreement at −11.6 to 10.2. This represents a maximum random error of 11.6 points, which is below the level of clinical significance for the ICON, set at ±18 points.[19]

Descriptive Data

OQLQ scores ranged from 8 to 88, with a mean of 53.5 (standard deviation [SD] = 18.7, 95% confidence interval [CI] = 49.9–57.2). Individual domain scores showed that esthetics scored the highest, with a mean of 15.6 (SD = 4.5). The remaining three domains were more closely grouped, although the functional domain had the lowest mean score at 10.3 (SD = 5.8).

Treatment Need and Complexity Analyses

All patients were eligible for orthognathic treatment under the IOFTN guidelines, scoring 3 and over. All patients scored above the 43-point ICON treatment-need threshold. ICON scores ranged from 58 to 111, with a mean of 83.1 (SD = 12.1, 95% CI = 80.7–85.5). A significant proportion of patients (72%) were in the highest treatment complexity group (>77 ICON points).

Cephalometric analysis gave a mean severity score for the entire cohort of 3.6 (SD = 1.3) traits out of 7. Class III patients scored a higher mean and median severity when compared to Class I and Class II patients, but this was not considered statistically significant with a one-way ANOVA ($P = .010$).

Independent Variable Significance Testing

The *P*-values obtained from the bivariate significance tests are shown in Table 1. Values that were significant for an association with the overall OQLQ score were gender and starting overjet. Females reported higher scores than males (12.6 points; 95% CI = 2.0–17.2) and showed a significant association in the social ($P = .016$) and awareness ($P = .013$) domains of the OQLQ. The magnitude of overjet away from white normal values was associated with poorer overall QoL, with significant relationships in the esthetic ($P = .017$) and functional domains ($P = .002$).

When considering the functional domain as a separate dependent variable, significant associations were seen with overjet ($P = .002$) and overbite ($P = .028$) and the IOFTN score ($P = .006$). ICON and radiographic severity score were not associated with any aspect of patient-reported QoL.

When using the significant variables within a multivariate linear regression model (Table 2), the IOFTN

Table 1. Individual Variable Significance Testing, Expressed as *P*-Values. Bold Values Represent Significant Findings ($P < .05$)[a]

	Dependent Variables				
Independent Variables	OQLQ Total	OQLQ Social	OQLQ Esthetic	OQLQ Function	OQLQ Awareness
Gender	**.015**	**.016**	.100	.186	**.013**
Age	.534	.573	.114	.413	.531
Malocclusion[b]	.393	.560	.398	.170	.675
AOB[c]	.100	.822	.953	**.049**	.300
IOFTN	.064	.113	.149	**.006**	.782
ICON	.905	.981	.219	.129	.022
Cephalometric severity score	.419	.703	.417	.092	.445
SNB	.357	.268	.212	.406	.099
ANB	.142	.315	.061	.086	.626
Lower face height	.317	.309	.587	.617	.264
Overjet	**.032**	.175	**.017**	**.002**	.639
Overbite	.762	.708	.285	**.028**	.450
U1 proclination	.757	.977	.876	.150	.148
Holdaway angle	.177	.211	.206	.278	.913

[a] IOFTN indicates Index of Functional Treatment Need; OQLQ, Orthognathic Quality of Life Questionnaire; and ICON, Index of Complexity, Need and Outcome.

[b] Malocclusion categorized as Class I/II/III.

[c] AOB = anterior open bite, classified as yes/no.

category becomes a significant predictor for the overall OQLQ score ($P = .013$), with category 5 patients scoring a mean of 10.0 points (95% CI = 2.1–17.8) more than category 4 (Table 2). Being female increases the OQLQ by 15.6 points when compared to males (95% CI = 7.4–23.9). While overjet was shown to be significant predictor of OQLQ score ($P = .049$), the effect was small, with a 1-mm increase in overjet away from normal values, resulting in a 1.5 increase in OQLQ score (95% CI = 0.1 to 3.0).

DISCUSSION

This study aimed to investigate associations between clinically measured dentofacial variables for and patient-reported QoL in pretreatment orthognathic patients. The magnitude of overjet was significantly associated with the overall OQLQ score ($P = .032$) and showed further statistical significance in the esthetic ($P = .017$) and functional ($P = .002$) domains. Gender was the other variable significantly associated ($P = .015$) with poorer overall QoL. When explored further, females were found to have statistically significantly poorer QoL in the social impact ($P = .016$) and awareness of deformity domains ($P = .013$) when compared to males. Applying the results of the multivariate regression model to a clinical context, female patients in this cohort tended to score 15.6 OQLQ points (95% CI = 7.4–23.9) more than males. The demographic of this cohort was primarily 21-year-old females, and this may have introduced bias into the analysis. However, robust tests bootstrapping was incorporated, which is a term applied to a family of procedures to estimate statistics that are reliable even when the normal assumptions of variables are not met.[18]

Motivation for patients to seek treatment can be broadly split into three main areas: an exclusively practical problem, an exclusively psychological problem, or, most likely, a combination of both.[3] It has been proposed[20] that patients with increased social QoL concerns are more likely to seek surgical intervention than are those with a purely esthetic concern. Our results show that females are both more aware of their appearance and more likely to complain of an increased social impact. Previous studies[4] that used qualitative interviews also reported that a greater percentage of females suffered a psychosocial disadvantage, when compared to males, as a result of their dental or facial appearance.

Table 2. Results of Multivariate Regression Model for Factors Predicting Overall Orthognathic Quality of Life Questionnaire (OQLQ) Score

	Unstandardized Coefficients			95% Confidence Interval	
Significant Factors	B	Standard Error	Significance	Lower	Upper
Constant	22.0	15.8	.166	−9.3	53.3
Gender	−15.6	4.1	.000	−23.9	−7.4
IOFTN[a]	10.0	4.0	.013	2.1	17.9
Overjet	1.5	0.8	.049	0.1	3.0

[a] IOFTN indicates Index of Functional Treatment Need.

Functional complaints, resulting from a skeletal imbalance, appear to affect both genders more equally. The IOFTN grade showed a statistically significant relationship with patient-reported functional QoL ($P = .006$) and was also a significant predictor of overall OQLQ score when added to the multivariate regression model. The index showed high discriminatory ability, as 99% of patients in this cohort (n = 100) were in the top two of the five severity groups. IOFTN category 5 patients scored 10.0 points (95% CI = 2.1–17.9) more than those in category 4.

Both overjet and overbite were also significantly associated with functional domain of the OQLQ. In modifying the IOTN to create the IOFTN, increasing significance was given to reverse overjet and the presence of an anterior open bite. It is likely that adjusting the threshold of need for these variables has increased the correlation with patient-reported functional symptoms. The IOFTN was easy to apply and showed very good intra- and interoperator reliability, with Kappa values of 0.908 and 0.823, respectively. The IOFTN adequately prioritizes those patients with the greatest functional disadvantage and should be used routinely.

This study reported a poorer QoL for orthognathic patients than did any other previously published work using the OQLQ.[10,12,20–23] The mean total score of 53.5 in this cohort is three points above the previously reported[21] highest score in the literature. Proportionally, the domains in this study that were of most concern to individuals were social impact and esthetics, both 15% higher than mean scores from other authors' studies.[20–23] To put this in context, the sample size in this cohort, at 102 patients, is larger than most previous groups, with only one study[12] having a greater sample at 110 patients. In addition, over half the individuals had Class III malocclusions (51% of the sample). When compared to other studies[12,13,15] in white populations, a similar mix of malocclusion types is observed. Therefore, the cohort can be considered representative of the type of patient who seeks orthognathic surgery. Despite this, patient-reported results are prone to responder bias. All patients were aware of their malocclusion prior to referral and will have increased awareness of facial deformity. In addition, patients referred for a specialized service, with a high demand and significant waiting list, are cognizant of the fact that they should demonstrate a "need" for treatment to be offered to them.

Quantification of psychosocial disadvantage is subjective, but as recommended by other authors,[10,12,20,22,23] the use of a patient-reported outcome measure should be introduced universally to complement the clinician's assessment of need. The OQLQ is valid, responsive, and acceptable to patients.[24] Using a similar methodology to this study, it would be desirable to combine the results obtained from multiple centers to provide predicted values and to offer guidance on a threshold for treatment need.

CONCLUSIONS

- This study has shown that there are correlations between clinically measured variables and patient-reported QoL in orthognathic patients.
- Specifically, gender and the magnitude of overjet are significantly associated with poorer patient-reported QoL when measured with the condition-specific OQLQ.
- Females are more aware of their facial deformity and report a greater social detriment when compared to males.
- Poorer esthetics and functional complaints are associated with patients who present with large increased or reverse overjets.
- The IOFTN is significantly associated with the functional domain of OQLQ.
- Patients with a higher treatment need report poorer functional QoL.

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