Int. J. Oral Maxillofac. Surg. 2014; 43: 1352–1359
http://dx.doi.org/10.1016/j.ijom.2014.06.015, available online at http://www.sciencedirect.com

International Journal of
Oral & Maxillofacial Surgery

Clinical Paper
Orthognathic Surgery

Assessing change in quality of life using the Oral Health Impact Profile (OHIP) in patients with different dentofacial deformities undergoing orthognathic surgery: a before and after comparison

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J. G. Göelzer, O. E. Becker, O. L. Haas Junior, N. Scolari, M. F. Santos Melo, C. Heitz, R. B. de Oliveira: Assessing change in quality of life using the Oral Health Impact Profile (OHIP) in patients with different dentofacial deformities undergoing orthognathic surgery: a before and after comparison. Int. J. Oral Maxillofac. Surg. 2014; 43: 1352–1359.

Abstract. Dentofacial deformities and their treatment have physical and psychological repercussions on quality of life (QOL). Seventy-four patients were evaluated preoperatively (T0) and at 4–6 months postoperatively (T1). Oral health-related QOL was assessed using the short form of the Oral Health Impact Profile (OHIP-14). There was a statistically significant reduction in the average overall OHIP-14 score between T0 (13.23 ± 6.45) and T1 (3.26 ± 4.19). In addition, there were significant decreases in all seven OHIP-14 domains. Class III patients benefited in all domains evaluated, while a significant improvement was seen only in the psychological disability domain for class I patients. Class II patients showed a significant benefit in all domains except the domain of functional limitation. With regard to the total sample ($n = 74$) and class III patients ($n = 58$), correlations

0901-5027/01101352 + 08

between domains were identified for all domains. The same correlation was not identified for class I ($n = 5$) and II ($n = 11$) patients. The entire sample and class III patients showed significant improvements in OHIP-14 scores for all degrees of postoperative sensory disturbance in the upper and lower lips, except for patients with degree 5 (extreme) disturbance of the upper lip. Orthognathic surgical treatment had a positive impact on oral health-related QOL in the patients evaluated.

Key words: orthognathic surgery; questionnaire; quality of life; oral health; dentofacial deformity; OHIP.

Accepted for publication 30 June 2014
Available online 20 July 2014

Orthognathic surgery combined with orthodontic treatment is a well-established treatment modality for the correction of moderate to severe dentofacial deformities, and has been performed routinely for over 100 years.[1–3]

The possible psychological repercussions and effects of dentofacial deformities and their treatment on body image have been approached in several studies,[4,5] which have reported improved self-confidence[6] and quality of life (QOL).[2,3] The World Health Organization (WHO) defines QOL as 'an individual's perception of their position in life in the context of culture and value systems in which they live and about their goals, expectations, standards and concerns'. It is a vast and comprehensive concept, affected in a complex way by the person's physical health, psychological state, social relationships, and environment. It can also be defined as the 'sense of well-being of a person who derives satisfaction or dissatisfaction with areas of life that are important to them'.[7–10]

Health-related QOL is typically measured using disease-specific or generic measures. However, generic measure instruments are not sensitive to changes in oral health and exhibit limited construct validity.[4,8]

An impressive range of questionnaires has been developed to assess the impact of oral conditions and interventions on the well-being of patients, and these are proven tools for the evaluation of a person's perceptions.[9] One of the most used questionnaires is the Oral Health Impact Profile (OHIP), which measures the individual's perception of the social impact of current oral diseases and/or oral conditions on their well-being and QOL.[2–4,8–12]

The OHIP was originally developed by Slade and Spencer to evaluate dysfunction, discomfort, and disability attributed to oral conditions in adults or elderly populations, and presents 49 items grouped into seven domains.[13] A shorter version that includes 14 items (OHIP-14) was also developed (1997), and has well-documented psychometric properties,[5,11,13] covering specific aspects of oral health (domains): functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap.[8,11]

There is growing interest in how orthognathic surgery affects patients' lives, and some studies have shown significant improvements in QOL.[2] Therefore, the goal of this study was to use the OHIP-14 to evaluate the impact of oral health-related problems on QOL in adults with dentofacial deformities of classes I, II, and III assessed preoperatively (T0) and at 4–6 months postoperatively (T1) following orthognathic surgery. Furthermore, the study aimed to identify correlations between the OHIP-14 domains for the different dentofacial patterns and possible improvements in the OHIP-14 score according to the degree of postoperative hypoesthesia/sensory disturbance to the lips.

Materials and methods

The study protocol was reviewed and approved by the regional research ethics committee. Informed consent was obtained from each patient, and they were assured of the confidentiality of the questionnaire. Patients with dentofacial deformities who presented for treatment between 2010 and 2013 were recruited for this study. The sample consisted of consecutive patients, thus it can be considered a convenience sample.

To be included in the sample, patients had to have undergone previous orthodontic treatment and be considered healthy. Patients were excluded from the study if they had cleft lip and palate, syndromes, facial deformities due to trauma or congenital malformation, pre-existing systemic disease, or if they were pregnant women or children younger than 15 years of age. Patients with Angle classes I, II, and III dentofacial deformities were included in the study.

Patients were asked to complete a questionnaire before surgery (T0) and another at the follow-up, 4–6 months after surgery (T1). OHIP-14 presents 14 questions, divided into seven evaluation domains (two questions per domain): functional limitation (questions 1 and 2), physical pain (questions 3 and 4), psychological distress (questions 5 and 6), physical disability (questions 7 and 8), psychological disability (questions 9 and 10), social disability (questions 11 and 12), and handicap (questions 13 and 14). Each question evaluates a frequency, with five possible answers, ranging from 'never' (score zero) to 'often' (score 4). These scores are multiplied by the weight of each question (weights 0.51, 0.49, 0.34, 0.66, 0.45, 0.55, 0.52, 0.48, 0.60, 0.40, 0.38, 0.62, 0.59, and 0.41 for questions 1–14, respectively); total scores range from 0 to 28, with higher scores indicating a worse impact on oral health. In addition to the questions of the OHIP-14, patients were also questioned on the degree of hypoesthesia of the upper and lower lip postoperatively. The response ranged from 'none' (score 1) to 'extreme' (score 5).

The non-parametric Kolmogorov–Smirnov test was used to assess the normality of data. Fisher's exact test was used to examine the significance of the association (contingency) between gender, age, type of surgery, and type of deformity.

The Wilcoxon matched-pairs test was used to evaluate significant changes in OHIP-14 scores between T0 and T1 for all domains and questions, for all patients and according to the type of deformity. The power of the test and effect sizes of the samples were also recorded. Power is the probability that the test will reject the null hypothesis when it is false. Power can also indicate the sample size required such that an effect of a given size is reasonably likely to be detected. An effect size is a measure that describes the magnitude of the difference between two groups. It is the degree to which randomly selected data can likely be identified with regard to the group that it belongs to based on its value. An effect size is calculated to indicate the impact of a treatment; a larger effect size means the treatment had a greater impact.

The same analysis was used to evaluate significant changes in OHIP-14 score between T0 and T1 for all patients and according to the types of deformity in

relation to the postoperative degree of hypoesthesia/sensory disturbances in the upper and lower lip. Spearman's correlation coefficient was used to assess the existing significant correlation in changes between T0 and T1 between the domains of the OHIP-14. The level of significance was set at 5%; *P*-values of ≤ 0.05 reject the null hypothesis that there is no difference or significant correlation for each measurement analyzed between the preoperative and postoperative periods. IBM SPSS version 22.0 software (IBM Corp., Armonk, NY, USA) was used for the processing and analysis of data.

Results

Seventy-four patients took part in this study and answered the questionnaires before (T0) and 4–6 months after surgery (T1). The demographic characteristics of the patients are presented in Table 1. Fisher's exact test showed that variables such as gender and age had no significant association with the type of deformity or type of surgery performed.

The frequencies of answers obtained before (T0) and 4–6 months after surgery (T1) are presented in Table 2. At T0 there was a variable distribution of answers, showing that the evaluated items quite frequently worried patients ('often', 'several times', 'occasionally', etc.). At T1, most of the evaluated items were no longer a problem for these patients as they 'hardly' or 'never' worried about them.

A statistically significant reduction ($P \leq 0.001$) in the average overall score of the OHIP-14 ($n = 74$) was observed between the preoperative ($T0 = 13.23 \pm 6.45$) and postoperative assessments ($T1 = 3.26 \pm 4.19$) (Table 3). In addition, there were significant decreases in all seven OHIP-14 domains and each question ($P \leq 0.001$). For the overall OHIP-14 score, classes I ($n = 5$), II ($n = 11$), and III ($n = 58$) also presented statistically significant reductions ($P = 0.043$, $P = 0.003$, and $P \leq 0.001$, respectively).

This significant reduction in general and in the individual domain scores after orthognathic surgery was similar for the two sexes, among age groups, and among the types of surgery performed. However, when analyzing the types of deformity in relation to the domains and questions evaluated using OHIP-14 (Table 3), it was observed that patients with dentofacial deformities of class I had significant improvements following orthognathic treatment only for the psychological disability domain and in questions 10 and 13,

Table 1. Demographic characteristics of the study patients.

	n (%)
Gender	
Female	49 (66.2)
Male	25 (33.8)
Age mean ± SD	28.0 ± 9.0
(range)	(range 15–53 years)
≤25 years	39 (52.7)
26–35 years	23 (31.1)
≥36 years	12 (16.2)
Type of deformity	
Class I	5 (6.8)
Class II	11 (14.9)
Class III	58 (78.4)
Type of surgery	
Bimaxillary	65 (87.8)
Single-jaw	9 (12.2)

SD, standard deviation.

Table 2. Percentage distribution of responses to each question of the OHIP-14, preoperative (T0) and postoperative (T1) ($n = 74$).

Statement	0		1		2		3		4	
	T0	T1	T0	T1	T0	T1	T0	T1	T0	T1
1. Have you had trouble pronouncing any words because of problems with your mouth or joint?	20.3	43.2	23.0	37.8	29.6	12.2	20.3	6.8	6.8	0.0
2. Have you felt that your sense of taste has worsened because of problems with your mouth or joint?	37.8	73.0	24.3	20.3	13.5	6.7	17.6	0.0	6.8	0.0
3. Have you had painful aching in your mouth or joint?	25.7	58.1	28.4	21.6	16.1	17.6	17.6	2.7	12.2	0.0
4. Have you found it uncomfortable to eat any foods because of problems with your mouth or joint?	9.5	51.4	16.2	24.3	29.7	21.5	18.9	1.4	25.7	1.4
5. Have you been self-conscious because of your mouth or joint?	4.1	68.9	9.5	21.6	21.5	8.1	28.4	1.4	36.5	0.0
6. Have you felt tense because of problems with your mouth or joint?	5.4	68.9	16.2	20.3	24.3	6.7	24.3	2.7	29.7	1.4
7. Has your diet been unsatisfactory because of problems with your mouth or joint?	28.4	63.5	24.3	21.6	22.9	6.7	9.5	5.4	14.9	2.7
8. Have you had to interrupt meals because of problems with your mouth or joint?	33.8	73.0	21.6	17.6	18.9	5.3	16.2	1.4	9.5	2.7
9. Have you found it difficult to relax because of problems with your mouth or joint?	25.7	67.6	20.3	24.3	18.9	5.3	24.3	1.4	10.8	1.4
10. Have you been a bit embarrassed because of problems with your mouth or joint?	1.4	79.7	10.8	9.5	24.3	8.1	40.5	0.0	23.0	2.7
11. Have you been a bit irritable with other people because of problems with your mouth or joint?	33.8	85.1	21.6	10.8	21.6	1.4	20.3	2.7	2.7	0.0
12. Have you had difficulty doing your usual jobs because of problems with your mouth or joint?	20.3	82.4	27.0	10.8	27.0	4.1	16.2	2.7	9.5	0.0
13. Have you felt that life in general was less satisfying because of problems with your mouth or joint?	17.6	77.0	21.6	14.9	20.3	4.0	21.6	1.4	18.9	2.7
14. Have you been totally unable to function because of problems with your mouth or joint?	36.5	85.1	23.0	10.8	24.3	2.7	10.8	1.4	5.4	0.0

0 = never/I don't know; 1 = hardly ever or nearly never; 2 = occasionally; 3 = fairly often or many times; 4 = very often.

Table 3. Comparison of the OHIP-14, preoperative (T0) and postoperative (T1), by domains and individual questions for all patients and patients by type of deformity.

Domain	Number	T0, mean (SD)	T1, mean (SD)	*P*-value[a]	Power	*r*[b]
All; OHIP-14	74	13.23 (6.45)	3.26 (4.19)	≤0.001**	1.000	0.85 (L)
Class I	5	13.56 (4.62)	5.96 (5.58)	0.043*	1.000	0.90 (L)
Class II	11	11.26 (4.68)	3.44 (3.93)	0.003*	0.999	0.88 (L)
Class III	58	13.57 (6.85)	2.99 (4.11)	≤0.001**	1.000	0.85 (L)
1. Functional limitation	74	1.51 (1.13)	0.58 (0.63)	≤0.001**	1.000	0.65 (M)
Class I	5	1.30 (0.97)	0.80 (0.76)	0.223 (NS)	0.115	0.54 (M)
Class II	11	0.87 (1.08)	0.55 (0.65)	0.439 (NS)	0.184	0.23 (S)
Class III	58	1.65 (1.13)	0.57 (0.64)	≤0.001**	1.000	0.73 (M)
Question 1	74	0.86 (0.61)	0.42 (0.45)	≤0.001**	1.000	0.56 (M)
Class I	5	0.71 (0.45)	0.51 (0.36)	0.276 (NS)	0.082	0.31 (S)
Class II	11	0.51 (0.60)	0.37 (0.40)	0.429 (NS)	0.115	0.23 (S)
Class III	58	0.94 (0.60)	0.42 (0.47)	≤0.001**	1.000	0.62 (M)
Question 2	74	0.64 (0.64)	0.16 (0.29)	≤0.001**	1.000	0.62 (M)
Class I	5	0.58 (0.63)	0.29 (0.43)	0.276 (NS)	0.122	0.48 (S)
Class II	11	0.35 (0.49)	0.17 (0.33)	0.157 (NS)	0.271	0.42 (S)
Class III	58	0.70 (0.66)	0.15 (0.27)	≤0.001**	1.000	0.66 (M)
2. Physical pain	74	2.10 (2.19)	0.72 (0.83)	≤0.001**	1.000	0.74 (M)
Class I	5	2.46 (1.39)	1.40 (1.38)	0.109 (NS)	0.361	0.71 (M)
Class II	11	2.06 (0.94)	0.57 (0.70)	0.007*	0.994	0.80 (L)
Class III	58	2.08 (1.24)	0.70 (0.80)	≤0.001**	1.000	0.73 (M)
Question 3	74	0.55 (0.46)	0.22 (0.29)	≤0.001**	1.000	0.54 (M)
Class I	5	0.61 (0.55)	0.34 (0.48)	0.102 (NS)	0.374	0.73 (M)
Class II	11	0.68 (0.37)	0.15 (0.17)	0.015*	0.945	0.73 (M)
Class III	58	0.52 (0.47)	0.22 (0.29)	≤0.001**	0.990	0.48 (S)
Question 4	74	1.55 (0.84)	0.50 (0.61)	≤0.001**	1.000	0.75 (M)
Class I	5	1.84 (0.86)	1.05 (1.00)	0.109 (NS)	0.352	0.71 (M)
Class II	11	1.38 (0.62)	0.42 (0.61)	0.011*	0.970	0.77 (M)
Class III	58	1.55 (0.88)	0.47 (0.56)	≤0.001**	1.000	0.76 (M)
3. Psychological discomfort	74	2.68 (1.11)	0.44 (0.73)	≤0.001**	1.000	0.84 (L)
Class I	5	3.11 (0.56)	1.02 (1.27)	0.059 (NS)	0.738	0.84 (L)
Class II	11	2.45 (1.07)	0.50 (0.59)	0.006*	0.989	0.83 (L)
Class III	58	2.70 (1.16)	0.39 (0.69)	≤0.001**	1.000	0.85 (L)
Question 5	74	1.27 (0.51)	0.18 (0.31)	≤0.001**	1.000	0.83 (L)
Class I	5	1.35 (0.31)	0.36 (0.37)	0.059 (NS)	0.802	0.84 (L)
Class II	11	1.14 (0.46)	0.20 (0.30)	0.004*	0.009	0.85 (L)
Class III	58	1.29 (0.54)	0.17 (0.31)	≤0.001**	1.000	0.83 (L)
Question 6	74	1.41 (0.67)	0.26 (0.46)	≤0.001**	1.000	0.80 (L)
Class I	5	1.76 (0.46)	0.66 (0.90)	0.059 (NS)	0.663	0.84 (L)
Class II	11	1.30 (0.66)	0.30 (0.37)	0.015*	0.904	0.73 (M)
Class III	58	1.40 (0.69)	0.21 (0.42)	≤0.001**	1.000	0.81 (L)
4. Physical disability	74	1.52 (1.26)	0.53 (0.89)	≤0.001***	1.000	0.64 (M)
Class I	5	1.50 (1.32)	1.10 (1.13)	0.285 (NS)	0.231	0.47 (S)
Class II	11	1.40 (0.97)	0.55 (1.05)	0.050*	0.604	0.59 (M)
Class III	58	1.55 (1.32)	0.48 (0.84)	≤0.001***	1.000	0.66 (M)
Question 7	74	0.82 (0.72)	0.32 (0.52)	≤0.001**	1.000	0.57 (M)
Class I	5	0.72 (0.59)	0.52 (0.63)	0.414 (NS)	0.094	0.36 (S)
Class II	11	0.61 (0.51)	0.33 (0.66)	0.150 (NS)	0.224	0.43 (S)
Class III	58	0.86 (0.76)	0.30 (0.49)	≤0.001**	1.000	0.61 (M)
Question 8	74	0.70 (0.65)	0.20 (0.42)	≤0.001**	1.000	0.62 (M)
Class I	5	0.76 (0.72)	0.57 (0.78)	0.157 (NS)	0.243	0.63 (M)
Class II	11	0.78 (0.57)	0.21 (0.39)	0.015*	0.806	0.73 (M)
Class III	58	0.67 (0.66)	0.17 (0.37)	≤0.001**	1.000	0.62 (M)
5. Psychological disability	74	2.13 (1.02)	0.41 (0.72)	≤0.001**	1.000	0.83 (L)
Class I	5	2.48 (0.99)	0.56 (0.82)	0.042*	0.997	0.90 (L)
Class II	11	1.96 (0.96)	0.53 (0.73)	0.007*	0.981	0.80 (L)
Class III	58	2.14 (1.05)	0.38 (0.73)	≤0.001**	1.000	0.82 (L)
Question 9	74	1.04 (0.81)	0.26 (0.46)	≤0.001**	1.000	0.69 (M)
Class I	5	1.44 (1.08)	0.48 (0.78)	0.063 (NS)	0.525	0.83 (L)
Class II	11	1.09 (0.75)	0.27 (0.41)	0.020*	0.775	0.69 (M)
Class III	58	1.00 (0.81)	0.24 (0.45)	≤0.001**	1.000	0.68 (M)
Question 10	74	1.09 (0.39)	0.14 (0.34)	≤0.001**	1.000	0.83 (L)
Class I	5	1.04 (0.21)	0.08 (0.17)	0.038*	1.000	0.92 (L)
Class II	11	0.87 (0.39)	0.25 (0.36)	0.004*	0.993	0.86 (L)
Class III	58	1.13 (0.39)	0.13 (0.34)	≤0.001**	1.000	0.83 (L)
6. Social disability	74	1.55 (1.10)	0.24 (0.60)	≤0.001**	1.000	0.77 (M)
Class I	5	1.40 (0.93)	0.65 (0.99)	0.068 (NS)	0.697	0.81 (L)

Table 3 (*Continued*)

Domain	Number	T0, mean (SD)	T1, mean (SD)	*P*-value[a]	Power	*r*[b]
Class II	11	1.08 (0.91)	0.27 (0.61)	0.007*	0.853	0.80 (L)
Class III	58	1.66 (1.14)	0.21 (0.57)	≤0.001**	1.000	0.77 (M)
Question 11	74	0.51 (0.46)	0.08 (0.22)	≤0.001**	1.000	0.64 (M)
Class I	5	0.53 (0.43)	0.15 (0.20)	0.102 (NS)	0.401	0.73 (M)
Class II	11	0.51 (0.39)	0.10 (0.24)	0.016*	0.876	0.72 (M)
Class III	58	0.51 (0.48)	0.07 (0.23)	≤0.001**	1.000	0.63 (M)
Question 12	74	1.03 (0.76)	0.16 (0.41)	≤0.001**	1.000	0.74 (M)
Class I	5	0.86 (0.55)	0.49 (0.80)	0.083 (NS)	0.463	0.77 (M)
Class II	11	0.56 (0.64)	0.16 (0.40)	0.034*	0.541	0.63 (M)
Class III	58	1.14 (0.77)	0.13 (0.36)	≤0.001**	1.000	0.77 (M)
7. Handicap	74	1.71 (1.23)	0.30 (0.69)	≤0.001**	1.000	0.74 (M)
Class I	5	1.32 (0.62)	0.44 (0.43)	0.066 (NS)	0.690	0.82 (L)
Class II	11	1.45 (0.83)	0.47 (0.71)	0.016*	0.498	0.72 (M)
Class III	58	1.80 (1.33)	0.26 (0.71)	≤0.001**	1.000	0.74 (M)
Question 13	74	1.19 (0.81)	0.22 (0.50)	≤0.001**	1.000	0.72 (M)
Class I	5	0.82 (0.32)	0.35 (0.32)	0.046*	0.843	0.89 (L)
Class II	11	1.07 (0.57)	0.42 (0.65)	0.028*	0.709	0.66 (M)
Class III	58	1.25 (0.87)	0.17 (0.48)	≤0.001**	1.000	0.72 (M)
Question 14	74	0.51 (0.49)	0.08 (0.22)	≤0.001**	1.000	0.63 (M)
Class I	5	0.49 (0.44)	0.08 (0.18)	0.102 (NS)	0.290	0.73 (M)
Class II	11	0.37 (0.34)	0.03 (0.12)	0.024*	0.799	0.67 (M)
Class III	58	0.54 (0.52)	0.09 (0.24)	≤0.001**	1.000	0.63 (M)

SD, standard deviation.
[a] *P*-value: level of significance; NS, not significant; *significant at $P \leq 0.05$; **significant at $P \leq 0.001$.
[b] *r*: the effect size; L, large effect ($r \geq 0.80$); M, medium effect ($0.5 \leq r < 0.8$); S, small effect ($0.2 \leq r < 0.5$).

Table 4. Correlation of the difference in OHIP-14 between the preoperative (T0) and postoperative (T1) assessments by domains for class III patients (lower left) and all patients (upper right).

Domain		1	2	3	4	5	6	7	All
1	Corr. Coeff.	_	0.479*	0.393*	0.505*	0.440*	0.402*	0.346*	0.645*
	Sig.	_	≤0.001	0.001	≤0.001	≤0.001	≤0.001	0.003	≤0.001
2	Corr. Coeff.	0.525*	_	0.390*	0.604*	0.501*	0.269*	0.436*	0.694*
	Sig.	≤0.001	_	0.001	≤0.001	≤0.001	0.021	≤0.001	≤0.001
3	Corr. Coeff.	0.378*	0.482*	_	0.387*	0.680*	0.547*	0.603*	0.772*
	Sig.	0.003	≤0.001	_	0.001	≤0.001	≤0.001	≤0.001	≤0.001
4	Corr. Coeff.	0.594*	0.681*	0.520*	_	0.511*	0.412*	0.514*	0.713*
	Sig.	≤0.001	≤0.001	≤0.001	_	≤0.001	≤0.001	≤0.001	≤0.001
5	Corr. Coeff.	0.397*	0.606*	0.748*	0.579*	_	0.570*	0.740*	0.856*
	Sig.	0.002	≤0.001	≤0.001	≤0.001	_	≤0.001	≤0.001	≤0.001
6	Corr. Coeff.	0.397*	0.327*	0.619*	0.379*	0.603*	_	0.768*	0.721*
	Sig.	0.002	0.012	≤0.001	0.003	≤0.001	_	≤0.001	≤0.001
7	Corr. Coeff.	0.344*	0.529*	0.680*	0.504*	0.804*	0.779*	_	0.838*
	Sig.	0.008	≤0.001	≤0.001	≤0.001	≤0.001	≤0.001	_	≤0.001
All	Corr. Coeff.	0.624*	0.763*	0.816*	0.763*	0.872*	0.735*	0.859*	_
	Sig.	≤0.001	≤0.001	≤0.001	≤0.001	≤0.001	≤0.001	≤0.001	_

Corr. Coeff., correlation coefficient.
* Correlation is significant at the 0.05 level.

while class III patients had significant changes in all domains and questions evaluated. Class II patients showed significant changes for all domains and questions except the domain of functional limitation and questions 1, 2, and 7.

Correlations between domains and overall OHIP-14 scores were identified between all of them for the total sample ($n = 74$) and class III patients ($n = 58$) (Table 4). The same correlation for class I patients ($n = 5$) was identified only between domains 2 and 4, domain 2 and overall OHIP-14 score, and domain 4 and overall score (Table 5). For class II patients ($n = 11$), correlations were found between domains 1 and 5, domains 2 and 4, domains 5 and 6, and domains 6 and 7, and also for the overall OHIP-14 score and domains 1, 4, 5, 6, and 7 (Table 5).

For the whole sample, there were statistically significant differences in the OHIP-14 score between T0 and T1 for all degrees of postoperative hypoesthesia/sensory disturbance to the upper and lower lip, except for patients with degree 5 (extreme) disturbance to the upper lip (Table 6). The same results were observed for class III patients. For class I patients, there were no statistically significant differences for any degree of hypoesthesia/sensory disturbance. For class II patients, there were statistically significant differences only for degree 4 hypoesthesia/sensory disturbances to both the upper and lower lip.

Discussion

The impact of oral diseases and interventions on the patient's perception of their oral health and QOL is increasingly recognized as an important component of health.[14] The aim of this study was to evaluate the impact of orthognathic

Table 5. Correlation of the difference in OHIP-14 between the preoperative (T0) and postoperative (T1) assessments by domains for class I patients (lower left) and class II patients (upper right).

Domain		1	2	3	4	5	6	7	All
1	Corr. Coeff.	_	0.238	0.045	0.516	0.668*	0.367	0.364	0.756*
	Sig.	_	0.482	0.896	0.105	0.025	0.267	0.271	0.007
2	Corr. Coeff.	0.789	_	−0.190	0.637*	−0.026	0.035	0.125	0.455
	Sig.	0.112	_	0.576	0.035	0.940	0.919	0.714	0.159
3	Corr. Coeff.	0.000	0.516	_	−0.320	0.295	0.218	0.302	0.275
	Sig.	1.000	0.373	_	0.337	0.378	0.519	0.367	0.414
4	Corr. Coeff.	−0.816	−0.947*	−0.574	_	0.358	0.557	0.475	0.664*
	Sig.	0.092	0.014	0.312	_	0.279	0.075	0.14	0.026
5	Corr. Coeff.	0.579	0.263	0.000	−0.500	_	0.646*	0.579	0.813*
	Sig.	0.306	0.669	1.000	0.391	_	0.032	0.062	0.002
6	Corr. Coeff.	−0.667	−0.359	0.224	0.462	−0.872	_	0.768*	0.654*
	Sig.	0.219	0.553	0.718	0.434	0.054	_	0.006	0.029
7	Corr. Coeff.	0.263	−0.026	−0.688	0.132	0.263	−0.667	_	0.737*
	Sig.	0.669	0.966	0.199	0.833	0.669	0.219	_	0.010
All	Corr. Coeff.	0.718	0.975*	0.671	−0.975*	0.308	−0.300	−0.205	_
	Sig.	0.172	0.005	0.215	0.005	0.614	0.624	0.741	_

Corr. Coeff., correlation coefficient. *Correlation is significant at the 0.05 level.

Table 6. Comparison of the OHIP-14 at the preoperative (T0) and postoperative (T1) assessments by domains for all patients and patients by type of deformity in relation to the degree of hypoesthesia/sensory disturbance of the upper and lower lip at T1.

Degree	Lip	Number	T0, mean (SD)	T1, mean (SD)	*P*-value[a]	Power	*r*[b]
1	Upper	28	12.99 (7.51)	2.40 (3.63)	≤0.001**	1.000	0.86 (L)
	Class I	1	9.26 (–)	0.00 (–)	–	–	–
	Class II	2	8.04 (5.07)	4.01 (5.67)	0.180 (NS)	0.543	0.94 (L)
	Class III	25	13.54 (7.71)	2.37 (3.61)	≤0.001**	1.000	0.86 (L)
2	Upper	13	15.22 (5.49)	4.33 (3.44)	0.002*	1.000	0.86 (L)
	Class I	1	18.85 (–)	14.34 (–)	–	–	–
	Class II	1	5.19 (–)	1.00 (–)	–	–	–
	Class III	11	15.81 (4.94)	3.72 (1.65)	0.004*	1.000	0.85 (L)
3	Upper	9	11.26 (5.43)	2.32 (2.80)	0.008*	0.978	0.88 (L)
	Class I	0	– (–)	– (–)	–	–	-
	Class II	2	14.55 (3.69)	1.50 (2.12)	0.180 (NS)	0.642	0.94 (L)
	Class III	7	10.33 (5.70)	2.55 (3.08)	0.018*	0.790	0.89 (L)
4	Upper	18	14.32 (5.53)	4.17 (5.42)	≤0.001**	1.000	0.87 (L)
	Class I	3	13.24 (4.41)	5.15 (2.92)	0.109 (NS)	0.988	0.92 (L)
	Class II	6	12.25 (4.35)	4.30 (4.45)	0.028*	0.890	0.89 (L)
	Class III	9	16.07 (6.42)	3.75 (6.88)	0.008*	1.000	0.88 (L)
5	Upper	6	9.66 (6.42)	3.65 (5.69)	0.080 (NS)	0.454	0.71 (M)
	Class I	0	– (–)	– (–)	–	–	–
	Class II	0	– (–)	– (–)	–	–	–
	Class III	6	9.66 (6.42)	3.65 (5.69)	0.080 (NS)	0.454	0.71 (M)
1	Lower	7	9.32 (3.61)	0.83 (1.43)	0.018*	1.000	0.89 (L)
	Class I	1	9.26 (–)	0 (–)	–	–	–
	Class II	0	– (–)	– (–)	–	–	–
	Class III	6	9.33 (3.96)	0.97 (1.51)	0.028*	0.993	0.89 (L)
2	Lower	8	15.09 (7.50)	3.15 (3.13)	0.017*	0.969	0.84 (L)
	Class I	0	– (–)	– (–)	–	–	–
	Class II	1	4.45 (–)	0.00 (–)	–	–	—
	Class III	7	16.61 (6.64)	3.60 (3.09)	0.028*	0.969	0.83 (L)
3	Lower	14	10.82 (6.38)	1.26 (2.05)	≤0.001**	0.999	0.84 (L)
	Class I	0	– (–)	– (–)	–	–	–
	Class II	1	16.72 (–)	0.51 (–)	–	–	–
	Class III	13	10.37 (6.40)	1.32 (2.12)	0.002*	0.994	0.84 (L)
4	Lower	27	15.57 (6.54)	3.97 (4.65)	≤0.001**	1.000	0.87 (L)
	Class I	3	13.24 (4.41)	5.15 (2.92)	0.109 (NS)	0.988	0.92 (L)
	Class II	5	10.96 (4.91)	4.16 (2.62)	0.043*	0.792	0.90 (L)
	Class III	19	17.16 (6.69)	3.71 (4.89)	≤0.001**	1.000	0.87 (L)
5	Lower	18	12.27 (5.64)	4.77 (5.05)	≤0.001**	1.000	0.84 (L)
	Class I	1	18.85 (–)	14.34 (–)	–	–	–
	Class II	4	11.97 (3.84)	4.13 (2.62)	0.068 (NS)	0.633	0.91 (L)
	Class III	13	11.86 (6.13)	4.23 (5.13)	0.003*	0.979	0.82 (L)

SD, standard deviation.

[a] *P*-value: level of significance; NS, not significant; *significant at $P \leq 0.05$; **significant at $P \leq 0.001$.

[b] *r*: the effect size; L, large effect ($r \geq 0.80$); M, medium effect ($0.5 \leq r < 0.8$); S, small effect ($0.2 \leq r < 0.5$).

surgery on QOL related to oral health using questionnaires completed by patients before surgery and 4–6 months after surgery for dentofacial deformities. OHIP-14 questionnaires were used and were conclusive and valid for the specific evaluation of changes in QOL in orthognathic surgery patients.

Considerable evidence has indicated that the face is a key feature in determining human physical attractiveness, and people with dentofacial deformities experience a negative impact on QOL in many aspects.[4,15] Patients have reported high satisfaction, increased self-confidence and greater social skills, improved appearance, and psychosocial benefits after orthognathic surgery.[1] In general, improvements in appearance caused by orthognathic surgery are associated with an improvement in psychosocial adjustment, and psychological factors and aesthetics have a strong influence on QOL.[8]

A significant reduction in overall OHIP and the individual domain scores was noted after orthognathic surgery; this reduction is usually similar for the two genders, across age groups, and between the types of surgery performed.[8] However, women have been found to be twice as likely to report negative impacts of their malocclusion on QOL related to oral health than men.[5] A higher level of aesthetic standards in women and the greater importance they place on appearance might explain this finding.

When analyzing the distribution of answers to each question (Table 2), a few patients still gave scores of 3 or 4 after surgical treatment. However, these higher scores were related to characteristics of feeding and chewing, which are affected because the patient is still in recovery and adapting to the new occlusion. Research has shown that in the initial postoperative period, from 6 weeks to 6 months, there may be a transient and significant deterioration in OHIP scores, especially in the fields of appearance and functional limitation; this is linked to postoperative morbidity, when the presence of pain, oedema, neurosensory disorders, limited mouth opening, and decreased masticatory efficiency are common.[2,3] However, after 6 months, there is a continuous improvement in QOL, with scores decreasing over time, indicating health gains and supporting the hypothesis that orthognathic surgery improves oral health. Our study evaluated the postoperative period of 4–6 months, i.e. a time at which most of the post-surgical symptoms have ceased, indicating that this treatment reduces the frequency and the severity of the impact of oral health on QOL.

When analyzing the types of deformity in relation to the domains evaluated by the OHIP-14 (Table 3), this study found that patients with class I dentofacial deformities who underwent orthognathic surgery for the correction of vertical or transversal (asymmetry) discrepancies obtained significant improvements from the treatment only for the psychological disability domain and questions 10 and 13, while class III patients benefited in all domains evaluated; this confirms the findings of Pahkala and Kellokoski[16] who reported that patients with mandibular setback were more pleased with the outcome than those with mandibular advancement. Class II patients showed no significant benefits regarding the functional limitation domain and questions 1, 2, and 7.

Although class I patients showed non-significant changes in the psychological discomfort, social disability, and handicap domains and in questions 5, 6, and 9, the power of the test in these aspects ranged from 0.525 to 0.802 (medium power) and effect sizes were large, demonstrating that there was a large magnitude of difference between these groups and that clinically the treatment had a great impact, but due to the small sample size there was a lack of statistical power to identify changes.

In other domains and questions with non-statistically significant changes for class I and II patients, the power and effect size were even smaller. However, taking into account the small and medium effect sizes for these groups, it is possible that the benefits of this treatment in oral health related to QOL could be identified clinically. For question 3 in class III patients, although statistically significant changes were identified, the magnitude of the difference between scores at T0 and T1 was small ($r = 0.48$).

Patients who have a class III dentofacial deformity begin to show signs of developmental disorders during childhood and become physically and psychosocially affected by this deformity. These patients benefit from surgical treatment in all aspects involved and all domains evaluated, from oral function and facial aesthetics to interpersonal and psychological factors, such as self-esteem and self-confidence. However, in order to correct the large dentofacial discrepancy, the mandibular setback and maxillary advancement performed on class III patients can lead to an extreme change in appearance and a radical change in facial profile, with decreased facial convexity. This may contribute to a significant delay in becoming used to the new appearance,[9] however this factor was not observed in our study.

For the total sample and class III patients, all domains and overall OHIP-14 scores were correlated to each other, meaning that each benefit acquired after the orthognathic treatment interacted with the others. For class I patients, a benefit in physical pain was related to a benefit in physical disability, and a benefit in these two domains was related to a benefit in overall oral health. As for class I patients, a benefit in physical pain was also related to a benefit in physical disability for class II patients. For class II patients, a benefit in functional limitation was related to a benefit in psychological disability, and a benefit in handicap was related to a benefit in psychological and social disability. Overall oral health in class II patients was related to functional limitation, physical, psychological and social disability, and handicap. The only two correlations found in every group were those between physical pain and physical disability, and between physical disability and overall oral health. It could be that the smaller sample sizes of class I and II patients (Table 5) resulted in the lack of correlation between all domains and the overall OHIP-14 score and each other, which was identified in class III patients and the whole sample (Table 4).

When comparing the types of deformity in relation to the degree of hypoesthesia/sensory disturbance in the upper and lower lip (Table 6), the whole sample and class III patients presented a non-significant difference only for the degree of disturbance with the smaller sample size ($n = 6$), with a low power of the sample and medium effect size, indicating a lack of power to identify a statistically significant difference; there may have been a difference between scores at T0 and T1 that was possible to identify clinically. For class I patients, there was a sample size of more than two only for degree 4 disturbance to the upper and lower lip, allowing a statistical analysis only in these two groups; however the sample comprised only three patients, which hinders analysis of the results. The sample size for class II patients was two or more only for degrees 1, 3, and 4 disturbance to the upper lip and degrees 4 and 5 for the lower lip. Statistically significant differences were identified in the groups with larger samples, degree 4 of the upper lip ($n = 6$) and lower lip ($n = 5$). The samples for degrees 1 and 3 of the upper lip and degree 5 of the lower lip lacked power to identify statistically significant differences, but the large effect sizes indicate that the OHIP-14 scores were different at T0 and at T1 for these groups. Clearly, for classes I and II the

small sample sizes hinder the analysis of the results.

The use of standardized instruments for measuring the impact of oral problems and their treatments on QOL is essential because it allows the evaluation of the real benefit of a clinical procedure to people's lives.[5] The instrument of choice for assessing QOL in orthodontic–surgical patients is the OHIP-14, and this supported the notion that orthognathic surgery can improve oral health.

Regarding the evaluation instrument, the OHIP is a valid and reliable instrument when used as a self-completion questionnaire, because it is sufficiently structured to evaluate psychometric properties and is suitable for cross-sectional and longitudinal studies and multinational investigations due to the lack of substantial differences in the concepts of cross-cultural QOL related to oral health.[13] However, we believe that the OHIP answers format, based on frequency, often leads the patient to a subjective evaluation, because we do not know whether they think in terms of absolute numbers or an average of the frequencies in a given period. There may also be deviations in answers, where the respondents have forgotten the experienced impacts, which may lead them to underestimate the true levels. We must also be careful in interpreting findings as health states, because they tend to be slightly overestimated.[12] Nonetheless, based on the widespread use of the international OHIP, and in a situation where there is no unanimity on the agreed definition of QOL, this instrument is widely accepted in clinical trials and health research.

Using the OHIP-14, this study identified significant statistical and clinical changes and correlations in QOL related to oral health after orthognathic surgery for class I, II, and III patients. Orthognathic surgery has many favourable effects, and patients who have undergone orthognathic surgery have experienced functional and psychosocial benefits following this treatment. These benefits can be emphasized when discussing possible treatments with patients.

Funding

None.

Competing interests

The authors declare that they have no competing interests.

Ethical approval

This study was approved by the Ethics Committee in Research of the Pontifical Catholic University of Rio Grande do Sul, Brazil, 05/02890.

Patient consent

Not required.

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