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Changes in Oral Health-Related Quality of Life after Orthognathic Surgery and an Accompanying Pre-Post Orthodontic Treatment: A Multidisciplinary Study

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Dr. Jnananjan Chattopadhyay[1], Dr. Vivek Pawar[2], Dr. Madhura Pawar[3], Dr. Manpreet Kaur[4], Dr.Shashank Gaikwad[5], Dr. Vaibhav Khare[6]

1. Assistant Professor, Department of Dentistry, Murshidabad Medical College, Berhampore, Murshidabad, WB, India.
2. Professor, SMBT Institutes of Dental Sciences and Research, Dhamangoan, Nashik, Maharashtra, India
3. Pediatric and Preventive Dentistry, Dr D Y Patil Dental College and Hospital, Dr D Y Patil Vidyapeeth, Pimpri Pune.
4. Professor and HOD, Department of Oral Pathology and Microbiology, Pacific Dental College and Research Centre, Bedla, Udaipur
5. Professor, Department of Orthodontics and Dentofacial Orthopedics, Bharati Vidyapeeth (Deemed to be University) Dental College and Hospital, Navi Mumbai.
6. Professor, Department of Orthodontics,
Triveni Institute of Dental Sciences Hospital and Research Centre, Bilaspur, Chhattisgarh

Corresponding author

Dr. Madhura Pawar, Pediatric and Preventive Dentistry, Dr D Y Patil Dental College and Hospital, Dr D Y Patil Vidyapeeth, Pimpri Pune. drmadhura4@gmail.com

Keywords

Oral health-related quality of life, Orthognathic surgery, Patient-reported outcome measures, Dentofacial deformity, Health-related quality of life

Abstract

The purpose of this study is to evaluate how patients' general and oral HRQoL change after undergoing orthognathic surgery for dentofacial deformity and whether or not these changes differ by the kind of deformity.

Materials and methods

There were 100 people with dentofacial anomalies included in this prospective longitudinal study. The research was carried out at many centers. Before and three and six months after undergoing orthognathic surgery, patients filled out the Orthognathic Quality of Life Questionnaire (OQLQ), Oral Health Impact Profile (OHIP-14), and Short-Form Health Survey version2 (SF-36v2). Dentofacial deformity grades were determined using a paired t-test to assess shifts and an unpaired t-test to differentiate between grades II and III. We were able to examine the rate of transformation by estimating the standard error of the standardized response (SRM).

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Results
Half a year following medical operation, the OQLQ and OHIP-14 revealed really large improvements compared to the pre-careful evaluation; nevertheless, the SF-36v2 showed measurable essential improvements only in the actual portion outline. Most of the OHIP-14 dimensions were unaffected by the SRM, however the OQLQ oral capacity (-1.15) and dentofacial facial feel (-0.71) dimensions were significantly affected.
Conclusions
Patients with Class II and Class III dentofacial abnormalities who had orthognathic surgery reported significant improvements in their oral HRQoL and overall health. As compared to patients in Class II, those in Class III made much more improvement.

1. Introduction

Moderate and severe dentofacial malformations may need a combined orthodontic and surgical approach for correction [1, 2]. This is because it is possible that orthodontic therapy will not be sufficient to fix dentofacial abnormalities by itself. Orthodontic treatment is often administered twice, once before and once after orthognathic surgery, in what is termed as the "three-phase method" [3]. Pre-surgical orthodontics use cephalometric prediction to bring about the desired occlusion before actual surgery is performed. Post-surgical orthodontics involves settling and leveling the arches, maintaining excellent root parallelism, and completing meticulous tooth placement in order to preserve the final occlusion attained and its long-term stability [4]. It is the goal of pre-surgical orthodontics to obtain ideal occlusion using cephalometric analysis. The amount of time needed for orthodontic treatment may range anywhere from 27.9 [5] to 21.9 months, with the median amount of time needed for presurgical treatment being 15.4 months and the median amount of time needed for postsurgical treatment being 5.9 months [6]. To achieve the desired final occlusion in each patient, preoperative orthodontic therapy must first be administered for a period of time that varies, followed by postsurgical orthodontic care that is administered for a period of time that is generally consistent [4].

When evaluating the efficacy of therapeutic interventions, the Health-Related Quality of Life (HRQoL) is a crucial patient-reported outcome [7]. Patient-reported outcomes are increasingly being used as a technique of acquiring additional and supplementary insight into patients' health [8]. Disease-specific patient-reported outcomes have the potential to be more indicative of intervention-related changes than broad, population-based measures [9]. When it comes to individuals with dentofacial abnormalities, the Orthognathic Quality of Life Questionnaire (OQLQ) is the sole instrument available for measuring Oral Health-Related Quality of Life (OHRQoL) [10, 11]. The study's goal is to assess the value of orthognathic surgery from the viewpoint of individuals who have already had the treatment. The OQLQ was validated in Chilean Spanish and shown to have good levels of validity, reliability, and responsiveness [12].

Patients who have had an orthodontic and surgical treatment plan for dentofacial anomalies have reported considerable benefits [11-17]. Cost-effectiveness study

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has also shown that orthognathic surgery is beneficial [18]. With the exception of the research by Khadka et al. [15], which included n = 110 participants, the sample sizes of the studies measuring both general and oral HRQoL [11, 15-17] were modest (14 to 60 patients). While considerable differences have been documented between Class II and Class III dentofacial abnormalities in terms of preoperative psychologic profiles and postoperative dynamics of patients [22], there are not many research that analyse the two classes separately [13, 19–21]. The need for decompensation in patients with Class III malocclusion may have a significant influence on skeletal disharmony, suggesting that presurgical orthodontic treatment may have further effects on OHRQoL. [23]

The study's goals were to determine whether or not different types of dentofacial deformities result in different changes in patients' general and oral HRQoL after undergoing orthognathic surgery, and to determine whether or not these changes are associated with the severity of the deformity.

2. Methods

Study design

This is a prospective, longitudinal study of people with dentofacial anomalies being carried out in many locations. Regardless of the severity of their dysgnathia, individuals aged 18 and over with Class II or III dentofacial deformity who were candidates for orthodontic treatment and orthognathic surgery were included. Those who experienced maxillofacial trauma or were born with a congenital defect such as cleft lip or palate were also excluded from the research.

People were classified as Class II or Class III based on the severity of their dentofacial deformity, as determined by clinical and cephalometric examinations. For his Classification of Orthodontic Malocclusion, Edward Angle (1899) used the mesio-distal relationship of the first permanent molars, also called the key ridge teeth [24]. The following may or may not be relevant depending on the position of the upper first molar in relation to the lower first molar: Class I malocclusion is characterized by an anterior (or mesial) position of the upper first molar's mesiobuccal cusp in relation to the buccal groove of the lower first molar; Class II malocclusion is characterized by a posterior (or distal) position of the upper first molar's mesiobuccal cusp in relation to the buccal groove of the lower first molar; and Class III malocclusion is Class II skeletal malocclusion is characterized by a convex facial profile due to insufficient growth of the mandible and/or excess of the maxilla, while Class III skeletal malocclusion is characterized by retrognathia of the maxilla and/or protrusion of the mandible, resulting in a concave facial profile [27]. There may be a connection between skeletal irregularities and malocclusion [26].

The orthodontic treatment followed the typical three-stage protocol, which included pre-surgical orthodontics, surgery, and post-surgical orthodontics. In order to proceed with the treatment, the doctors made sure to have the patients' signed consent forms during the preoperative

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evaluation session. The Valparaiso-San Antonio Health Service's ethical committee approved the study.

3. Collecting information and using various equipment

Three sets of data were collected for each patient: at the beginning of orthodontic treatment 1 (T1), 14 days before to the medical procedure (T2), after 90 days (T2), and again after 6 months (T3) after the orthognathic medical operation (T3). The T2 and T3 patients were all receiving orthodontic treatment using a respectable device after their examinations. Patients were instructed to self-complete three surveys: the Orthognathic Personal Satisfaction Poll (OQLQ) [10, 11], the Short-Structure Oral Wellbeing Effect Profile (OHIP-14) [28], and the Short-Structure Oral Wellbeing Study Variant 2 (SF-36v2) [29]. In addition, patients were asked for their personal stories about what prompted them to seek care.

Twenty-two items make up the OQLQ, and responses are given on a five-point Likert scale ranging from "does not bother me by any stretch of the imagination" (zero) to "annoys me a ton" (four) (five). [10, 11]. (4). Effect on dentofacial feel (items 1, 7, 10, 11, and 14; score range: 0 to 20), Effect on oral capability (items 2 to 6; score range: 0 to 20), Effect on mindfulness (items 8, 9, 12, and 13; score range: 0 to 16), and Effect on public activity (items 8, 9, 12, and 13; score range: 0 to 16) are all included in this survey of oral HRQoL. (things 15 to 22; score range 0 to 32) [7, 8, 30, 31]. The results of Cunningham and colleagues' research show that the scores are not predetermined by adding together the weights given to each item or query. [10] In addition, a maximum possible score is calculated, with a range that goes from 0 (22 + 0) to 88 (22 + 8) points (22 duplicated by 4). A lower score indicates an improved patient's oral HRQoL. The missing data were approximated using a straightforward allocation approach, with the mean of the accessible items in each dimension of the questionnaire serving as the point of departure [32].

To measure orofacial HRQoL, the OHIP-14 includes 14 distinct metrics. Functional impairment, physical pain, mental distress, physical disability, mental illness, social impairment, and handicap are some of the areas affected [28]. Responses are collected using a Likert scale with possible values ranging from 0 (never) to 4 (almost never; seldom; often; and very often). If you take the OHIP-14 summary version, your score might range from 0 to 56, with higher numbers indicating a worse HRQoL [33].

In all, the SF-36v2 consists of 36 questions meant to gauge 8 distinct dimensions of HRQoL. There are several facets to health, including physical functioning, role-physical functioning, physiological discomfort, general health, vitality, social functioning, role-emotional functioning, and mental health [34, 35]. All of the dimension scores, as well as the summaries of the physical and mental components, were calculated using the approved scoring procedures [35]. (PCS and MCS). It was determined that the mean SF-36v2 score for the US population as a whole should be 50, with a standard deviation of 10. The HRQoL [29] improves with greater scores.

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Patients were given the Global Transition Scale at both the 2- and 3-month post-op checkups and asked to evaluate the state of their oral health in comparison to pre-op levels. Patients were given the choice between "better," "about the same," and "worse." Patients who felt they were improving were asked to assign a number between one and six to their improvement by the study's researchers [36]. Patients who reported that they had become worse also indicated by how much they had declined using a scale with six possible responses. Patients who reported that they were about the same were given three answer alternatives to choose from in order to identify whether there had been any minor changes. As a result, we made use of a worldwide evaluation system with 15 points that ranged from -7 (a huge great deal worse) to +7 (a pretty significant improvement) (a very great deal better).

4. Sample size

If there are two potential results and one accepts an alpha risk of 0.05 and the other accepts a beta risk of 0.2, then 33 people must agree that a paired difference of 0.5 SRM or more is statistically significant. In order to do class stratified analysis, we need 80 people to take part in the study. Using a 20% attrition rate and an even split between Class II and Class III, we arrive at this estimate.

5. Data analysis

The example's sociodemographic characteristics were analysed for their repeatability and transferability, and clear insights were used to do so. Patients' characteristics were analyzed using the Chi-squared test and Fisher's exact test to see how they varied with respect to the kind of dentofacial deformity they presented with.

6. Results

100 patients were included in the study while they were getting orthodontic treatment before to surgery; 75 of these patients completed the two follow-ups conducted 3 and 6 months following surgery (81.5 percent response rate). At the height of the SARS-CoV-2 epidemic, patients postponed their clinical appointments for elective controls, which is the primary reason why they dropped out of the follow-up study.

Table 1 presents a list of patient features, including: The participants' mean age was 25.05 years old with a standard deviation of 5.5 years, the majority of participants were female (55), and 52 of individuals reported having begun or finished their education at a university. The percentage of patients who were classified as having a Class III diagnosis was 53.4%, and researchers discovered that there were statistically significant variations in treatment motivation between patients in Classes II and III ($p = 0.045$). In Class II, only half of the patients were motivated by functional concerns, but in Class III, the majority of patients were motivated by a mix of aesthetic and functional concerns .

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Table 1
Characteristics of patients according to type of deformity and follow-up completion

Patient characteristics	**Patients with follow-up completed**	**Class II patients**	**Class III patients**	***p* value***	**Patients not completing follow-up**
Number of patients	75	35	40		25
Age, year mean (SD)	25.05 (5.5)	24.52 (5.0)	23.15 (4.7)		24.05 (4.5)
range, n					
18 – 20	37	19	17	0.565[a]	
21 – 42	38	16	23		
Gender, (n)					
Female	55	25	29	0.920[a]	20
Male	20	10	11		5
Education, (n)					
Secondary	10	7	7	0.865[b]	5
Technic	8	5	6		1
University	52	20	25		15
Postgraduate	5	3	2		4
Type of deformity, (n)					
Class II	35				
Class III	40				
Motivation for treatment, (n)					
aesthetics	2	0	2 (5.1)	0.045[b]	0
functional	28	15	10		5
Both	45	20	30		20

*[a]Chi-squared, [b]Fisher's exact tests differences between class II and III

Table 2 displays the average global and subtotal scores of nonexclusive and oral HRQL instruments at gauge (before medical procedure), 3 and a half years after medical procedure during follow-up, and the average changes that occurred between pre- and post-medical operation. Changes for the better might be seen as negative. After 3.5 years, patients who scored higher on the OQLQ and OHIP-14 than they did before treatment demonstrated considerable improvements. Half a year after surgery, patients who took part in the SF-36v2's single-item summary saw significant gains. The breakdown of components really looked like this. The OQLQ was judged to have the strongest standardized reaction means (SRMs), whereas the SF-36v2 was judged to have the weakest. Six months after

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surgery, the most noticeable adverse effects were seen in the areas of oral capacity and dentofacial facial feel on the OQLQ.

Table 2

Mean scores at three times: before surgery (T1), 3 months (T2) and 6 months after orthognathic surgery (T3); and mean changes between pre and post-surgery

Instruments	**T1**	**T2**	**T3**	**CHANGE (T2-T1)**			**CHANGE (T3-T1)**		
	Mean (SD)	**Mean (SD)**	**Mean (SD)**	**Mean change (SD)**	***p****	**SRM**	**Mean change (SD)**	***p****	**SRM**
OQLQ Global Score	40.05	25.45	24.80	−14.6	<0.001	-0.55	−15.25	<0.001	-0.75
Social aspects of deformity	10.57	8.45	6.65	−2.12	0.0054	-0.35	−3.92	<0.001	-0.53
Dentofacial aesthetics	10.56	7.55	6.80	−3.01	<0.001	-0.65	−3.76	<0.001	-0.71
Oral function	11.04	6.45	5.01	−4.59	<0.001	-0.69	−6.03	<0.001	-1.15
Awareness of facial deformity	6.55	5.95	5.80	−0.6	0.1640	-0.18	−0.75	0.1215	-0.19
OHIP-14 Global Score	15.30	10.10	8.85	−5.2	<0.001	-0.60	−6.45	<0.001	-0.65
Functional limitation	1.8	1.05	0.97	−0.75	0.0155	-0.30	−0.83	0.0130	-0.30
Physical pain	3.40	3.05	2.35	−0.35	0.0792	-0.20	−1.05	<0.001	-0.55
Psychological discomfort	3.05	1.58	1.65	−1.47	<0.001	-0.61	−1.4	<0.001	-0.56
Physical disability	2.85	1.45	1.40	−1.4	<0.001	-0.67	−1.45	<0.001	-0.58
Psychological disability	2.75	1.40	1.25	−1.35	<0.001	-0.72	−1.5	<0.001	-0.56
Social disability	1.80	1.04	0.85	−0.76	<0.001	-0.40	−0.12	<0.001	-0.45
Handicap	0.97	0.55	0.44	−0.42	0.0445	-0.25	−0.53	0.0121	-0.30
Short-Form 36v2 Global Score									
Physical Functioning	92.41	93.45	95.70	1.04	0.4765	0.07	3.29	0.0015	0.38

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Role-Physical	87.85	86.75	91.75	−1.1	0.9547	-0.01	3.9	0.0085	0.31
Bodily Pain	77.25	78.81	83.95	1.56	0.5995	0.06	6.7	0.0185	0.30
General Health	76.50	80.41	80.78	3.91	0.0146	0.30	4.28	0.0190	0.29
Vitality	64.28	64.38	66.15	0.1	0.9711	0.00	1.87	0.2781	0.14
Social Functioning	81.17	82.15	83.45	0.98	1	0.00	2.28	0.4160	0.10
Role Emotional	85.16	88.05	86.15	2.89	0.2155	0.15	0.99	0.6967	0.05
Mental Health	73.64	74.45	74.15	0.81	0.9274	-0.01	0.51	0.8249	-0.02
SF-36v2 Physical Health Component Summary	54.25	54.95	55.87	0.7	0.3675	0.11	1.62	<0.001	0.47
SF-36v2 Mental Health Component Summary	48.35	48.65	49.15	0.3	0.8045	0.03	0.8	0.8781	-0.02

SRM standardized response mean
*paired *t*-test

Three and six months after surgery, there was a statistically significant mean change in OQLQ and OHIP-14 for both deformity types. The mean change in SF-36v2 PCS was likewise statistically significant at 6 months post-op. On the OQLQ, there was a statistically significant difference between the mean changes in Class II and III.

Table 4
Responses to the Global Transition Scale by type of deformity and follow-up time

Global rating	**T2**		**T3**	
	Class II (*n* = 30)	**Class III (*n* = 32)**	**Class II (*n* = 30)**	**Class III (*n* = 35)**
Has improved	15	25	26	30
A very great deal better	10	11	10	14
A great deal better	5	5	5	5

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A good deal better	0	5	8	7
Moderately better	0	5	1	4
Somewhat better	0	0	3	1
A little better	2	1	0	1
Practically the same	2	3	1	3
Almost the same, hardly any better at all	0	0	0	2
No change	2	3	1	1
Almost the same, hardly any worse at all	0	0	0	0
It has worsened	10	0	0	0
A very great deal worse	0	0	0	0
A great deal worse	0	0	0	0
A good deal worse	5	0	0	0
Moderately worse	1	0	0	0
Somewhat worse	2	0	0	0
A little worse	1	0	0	0
P value*	0.001		0.615	

7. Discussion

Patients with dentofacial abnormalities reported greater happiness and health 3 and a half years after undergoing orthognathic surgery. Big shifts occurred between Grades 2 and 3. Patients in Class III improved much more than those in Class II, particularly in the first postoperative three months.

Mean pre-medical procedure OQLQ change was greater at 6 months for our group than at 3 months. The OQLQ dimensions of dentofacial feel and oral competence improved considerably at 90 days post-surgery and completely at half a year, as measured by the SRM. Three to six months after medical treatment resulted in moderate to considerable improvement, according to studies by Choi et al. (2010) [16] and Eslamipour et al. (2017) [13]. These morphing states are expected postoperatively in a therapeutic setting. With the exception of genuine distress, which increased in severity from 90 days to 6 months, the OHIP-14 did not demonstrate this consistent change.

Patient preference for capacity over feel [31, 38] is reported by Baherimoghaddam et al. Both the most inhibited OQLQ characteristics at gauge (dentofacial feel and oral competence) and the most beneficial treatment outcomes (large upgrades, SRM = - 0.71 and - 1.15, respectively) were consistent with the patients' sophisticated and practical perspectives on orthognathic surgery. Comparable to our own findings, studies conducted before and half a year after surgery shown significant improvements in dentofacial sensation and oral capacity [13, 16, 31, 39]. Half a year following medical treatment, our group mirrored the

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results of the majority of these studies, which found moderate social improvement [13, 16, 39] and minimal mindfulness improvement [16, 31, 39]

Patients with Point's Group III malocclusion who had a combination of orthognathic operations had greater improvements in their physical and social SF-36v1 domains [40]. Nevertheless, other two studies reported a substantial but transient deterioration in the SF-36v1 Physical and Mental component summaries at a month and a half after a medical surgery [16] [39], which restored to normal levels at half a year or near the end of orthodontic therapy [16]. Nevertheless, we were unable to confirm this reduction in the underlying evaluation at 3 months post-medical operation due to the lack of a 6-week assessment.

Using the OQLQ and OHIP-14 global scores, patients in Class III improved more than those in Class II in terms of satisfaction with their oral health. Our findings are in line with those of the two studies that broke down the improvement by symptomatic group, both of which found that patients in Class III improved more than those in Class II when measuring their oral health-related satisfaction with the OQLQ [13, 19] and the OHIP-14 [19, 21].

Patients in Class III reported lower levels of attractiveness, more attention, and greater insecurity about their appearance prior to surgery [22]. In contrast to Class II, Class 3 exhibited significantly higher levels of depression in a recent investigation of the Minnesota Multiphasic Character Stock [41]. Class III patients who had orthognathic surgery reported increased productivity following the treatment because their improved bite gave them a more solid footing.

The biggest drawback of the evaluation is the need for preliminary gauge assessment prior to a medical operation. It would have been ideal to measure the trend before the introduction of orthodontic devices and to finish the next after the elimination of post-careful orthodontics, a process that would have taken 2-3 years. This is because the standard three-stage treatment for dentofacial distortions consists of pre-careful orthodontics, medical procedures, and post-careful orthodontics. As a result of constraints on time and money, we were unable to use this ideal, prolonged follow-up in our investigation. However, most of the studies employing this optimal plan also demonstrated substantial enhancements for dentofacial feel [11, 16], oral capability [16, 42], and social [11, 42], with more pronounced variation on mindfulness, which showed moderate improvement in some [16, 42], yet irrelevant in another [11].

Second, our gender and social class conclusions are questionable since our research comprised mostly young university-educated women. Women with dentofacial abnormalities have a worse quality of life than males and a higher incentive for surgery [43]. Studies reveal a "2 to 1 ratio" in favour of women [43, 44]. When growth is complete, young people are recommended this operation, but the Chilean public health system covers it relatively seldom. Our sample's high

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number of university graduates indicates private treatment's socioeconomic bias.

8. Conclusion

Patients with Class II and Class III dentofacial anomalies who had orthognathic surgery reported significant improvements in their oral health-related quality of life and overall health at 3 and 6 months. Overall, Class III made greater progress than Class II. These results improve patient-centered, team-based clinical decision-making and benefit patients, oral health professionals, and health care planners.

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