



# Changes in Oral Health-Related Quality of Life for Patients Undergoing Orthognathic Surgery - A Review

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## Abstract

**Objective:** To identify current knowledge of changes in quality of life including Oral Health-Related Quality of Life (OHRQoL) for patients undergoing orthognathic surgery based on validated questionnaires.

**Material and Methods:** Two databases (PubMed, Cochrane Library), were searched and full-text articles concerning patients with dentofacial deformities undergoing orthodontics and orthognathic surgery were included. Inclusion criteria: articles published in English in referee reviewed journals between January 2003 and December 2017, self-assessed quality of life using validated questionnaires. Exclusion criteria: Articles reporting quality of life of patients with syndromes such as cleft lip palate or severe illness, review articles.

**Results:** Sixteen longitudinal or cross-sectional articles were included, all considered of moderate quality. Oral Health Impact Profile and Orthognathic Quality of Life were the most commonly used questionnaires. Included studies reported a lower OHRQoL for patients with dentofacial deformities compared to patients with normal dentofacial features. There was a tendency towards more positive OHRQoL for patients with dentofacial deformities after orthognathic surgery. This positive effect seems to be evident 6 months after surgery, with further improvements at completion of treatment. Changes in general health related quality of life, predominately measured by the 36-item Short-Form Health Survey, were not coherently evident nor was sex differences.

**Conclusion:** Patients with dentofacial deformities improved moderately after orthognathic surgery, while generic health related quality of life was unchanged.

**Keywords:** Orthognathic surgery; Quality of life; Oral health related quality of life; Review

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## Introduction

Dentofacial deformities can affect a person's Quality of Life (QoL) in many ways. A different appearance can influence social life as well as self-esteem leading to decreased self-confidence [1,2]. Patients with dentofacial deformities are less satisfied with their appearance compared to a control group with normal dentofacial features [3], often experience functional problems such as difficulty chewing, speaking, and have more symptoms from the temporomandibular joint and muscles, as well as headaches [4]. Aesthetic improvement, reduction of oral functional problems and improvements in self-confidence have been the primary motivation for seeking treatment [5-7]. Treatment aims to correct dental and skeletal abnormalities to achieve harmonic dentofacial features and function and consists usually of following phases: planning, pre-surgical orthodontics, orthognathic surgery, post-surgical orthodontics and retention [8].

From a patient perspective, orthognathic surgery is demanding: it is time-consuming (total treatment time: 24-30 months) [9] and expensive for the patient and for society, with costs estimated between 5300 Euros to 6100 Euros [10,11]. The surgical procedure is associated with a wide spectrum of complications, but incidence is low [11,12]. The most common reported complication is nerve injury/sensitivity alteration [13]. These factors motivate for careful analysis of efforts and treatment outcome. Treatment can be evaluated objectively by postoperative dental occlusion measurements, cephalometric parameter changes and changes in temporomandibular disorders or functional issues post-surgery. Patient's satisfaction with treatment correlates to aesthetics, functional issues, and psychosocial factors [14].

According to the World Health Organization (WHO), health is "a state of complete physical,

mental, and social well-being not merely the absence of disease". Thus, measuring health is not just about the occurrence or absence of disease, but also about well-being and Quality of Life (QoL) [15].

A more holistic approach to health and awareness of oral health and its impact on QoL has been of increased interest during the latest decades. To improve quality of health care, considering the patient's perspective is important [16]. There has been a paradigm shift in clinical focus regarding treatment outcome considering the patient's expectations and not only focusing on objective treatment outcomes has become increasingly important [17]. Increased understanding of the patient's perspective, expectations, and views are necessary to achieve a successful treatment outcome [18]. Better understanding of professionals about patient perspective of treatment can improve quality of information of the planned treatment in advance [19].

Previous reviews [13,14,20] show methods to evaluate QoL of patients undergoing orthognathic surgery has developed over time; thus, it is interesting to know current knowledge. Common questionnaires to evaluate Generic Health-Related Quality of Life (GHRQoL) are:

- Short-Form Health Survey (SF-36): 36 statements divided into eight domains: physical functioning, role physical, bodily pain, general health, vitality, social functioning, and role emotional and mental health [21].

- The Sickness Impact Profile (SIP): 136-items self-administrated questionnaire to assess generic health QoL

Common questionnaires to evaluate OHRQoL are:

- Oral Health Impact Profile, short form, with 14 questions (OHIP-14). Measures influence of oral disorders and treatments on OHRQoL in seven subscales: functional limitations, physical pain, psychological discomfort, physical disability, psychological disability, and social disability and handicap. Evaluates frequency from often to never with five possible answers, ranging from zero to four points [22].

- Orthognathic Quality of Life Questionnaire (OQLQ). Condition specific OHRQoL questionnaire for evaluating QoL in patients with dentofacial deformities. Consists of four domains: social, facial aesthetics, oral function, and awareness of facial deformity. It has 22 items on a 4-point scale [23,24].

- The Oral Health Status Questionnaire (OHSQ): condition-specific OHRQoL questionnaire developed for orthognathic surgery patients.

Thus, the objective was to identify the current state of knowledge of changes in QoL and OHRQoL for patients undergoing orthognathic surgery, based on validated questionnaires and answer: is there a change in QoL in patients with dentofacial facial deformities treated with orthognathic surgery?

## Material and Methods

PubMed (National Library of Medicine) and the Cochrane library were searched by one author for articles using following Medical Subject Headings (MeSH-terms): oral health, orthognathic surgery, orthognathic surgical procedures, QoL, dentofacial deformities, surveys and questionnaires. Table 1 presents number of articles obtained per search-string.

Inclusion criteria established prior to the search were: (i) full-

text articles written in English published in referee-reviewed journals between January 2003 to December 2017, (ii) Concerning patients with dentofacial deformities undergoing treatment with orthodontics and orthognathic surgery, (iii) self-assessed OHRQoL using validated questionnaires. Exclusion criteria: articles reporting QoL in patients with syndromes (such as cleft lip palate) or severe illness and review articles.

Titles and abstracts of potentially relevant articles were reviewed. Studies meeting inclusion criteria were read in full-text. Reference lists of included articles were checked for additional studies. Eligible studies were quality-checked. Studies with low quality excluded. Figure 1 describes the process of acquiring studies.

Study quality was classified as high, moderate or low based on following variables: Sample size, follow-up time, drop-out rate, considerations of confounders, ethical considerations, relevant subgrouping. A high-quality article fulfilled following criteria: at least 30 participants, dropout rate <30%, control of confounders and fulfilling ethical concerns such as ethical approval and informed consent [25]. If any variables were missing, the article was evaluated as moderate-quality. Study design limitations led to further downgrading and exclusion.

## Results and Discussion

Sixteen articles with cross-sectional, longitudinal prospective or longitudinal retrospective design were included. Cross-sectional studies made comparisons between patients at different treatment stages [1,26], and/or between control groups. Table 2 presents study-quality. Table 3 shows study design type and questionnaires used.

### GHRQoL changes over the course of treatment

Changes seen with SF-36: No significant differences between patients in two treatment phases: before and after orthognathic treatment [25]. Scores significantly worsened 6 weeks post-surgery. Scores improved at 6 months postoperatively to the same level as baseline. During treatment, mental health component scores increased significantly [19]. Physical component scores significantly decreased from before surgery to the post-surgical phase. Scores returned to pre-treatment levels at 6 months post-surgery and after treatment completion [19]. Figure 2 shows SF-36 scores over time.

Changes seen with SIP: Psychosocial dimension score and overall dimension scores significantly improved compared with before surgery but were non-significant in 2 and 5 years follow up [27].

### OHRQoL changes over the course of treatment

Figure 3 shows OHIP-14 scores and Figure 4 shows OQLQ scores at different treatment stages.

OHIP-14: Pre-treatment phase: patients had worst QoL, compared to patients in other phases [28]. Pre-surgical phase: QoL decline [21] in class II patients [29]. Class III patients had improvement [29]. Overall QoL improvement [28]. Postsurgical orthodontic phase: Statistically significant decreases in overall scores [19,29-32]. Reduction was similar for sex, age, and among the types of orthognathic surgery performed [33]. One study indicated deterioration compared to pre-surgery and retention phase [28]. Six weeks post-surgery: No statistically significant decrease [2,19,34]. Six months post-surgery: Statistically significant decrease [2,19,32-34]. After active treatment completion: Almost null scores [28]. Twelve months after treatment: Highly significant improvement compared to pre-treatment in class II and III patients [29]. Scores at same level

**Table 1:** Search strings, and number of items of each search.

Number	Search terms	Items
1	((Surveys and Questionnaires[MeSH Terms])) AND ((quality of life[MeSH Terms]) AND ((orthognathic surgery[MeSH Terms]) OR orthognathic surgical procedures))	41
2	(quality of life[MeSH Terms]) AND dentofacial deformities[MeSH Terms]	17
3	orthognathic surgery[MeSH Terms] AND quality of life[MeSH Terms]	2
4	orthognathic surgery[MeSH Terms] OR orthognathic surgical procedures)) AND quality of life[MeSH Terms]	86
5	(orthognathic surgery[MeSH Terms] OR dentofacial deformity[MeSH Terms])) AND quality of life[MeSH Terms]	18

The number refers to the order in which the search was performed. The search terms describe which MeSH Terms were used and combined, and the items describe number of articles found through each search

**Table 2:** Quality of included studies and the reasons for level of quality.

Author, year of publication	Study sample	Drop-out rate	Confounders, age sex	Ethical	Study design
Al-Ahmad [26]	+	-	+	-	+
Baherimoghaddam [29]	+	+	-	-	+
Choi [19]	+	+	+	+	-
Göelzer [33]	+	-	+	+	-
Jung [18]	+	+	+	+	-
Khadka [35]	+	+	+	+	-
Lee [38]	+	+	+	+	-
Lee [34]	+	-	-	+	-
Motegi [27]	+	+	+	-	-
Murphy [36]	+	+	+	+	-
Palomares [28]	+	-	+	+	+
Rustemeyer [30]	+	-	+	+	-
Silva [2]	+	+	+	+	-
Silvola [31]	+	-	+	+	-
Stagles [37]	+	+	+	+	-
Wang [32]	+	+	+	+	-

Classification of study quality according to the following criteria: Sample size: at least 30 participants. Drop-out rate: drop-out rate presented and with no more than 30%. Confounders: age and sex considered in the analysis. Ethical: ethical approval performed. Study design: sufficient study design. A weighting of limiting factors in study design such as no power analysis performed, no report of subgrouping according to type of malocclusion, or unclearly reported data could. "+"/"-": criteria have been met/ not met.

as reported in the general population [31]. Significant decreases in psychological discomfort, social disability and unsatisfactory aesthetics domains. Items concerning physical limitations, pain and chewing function did not decrease significantly [30]. After 2.8 years, treatment statistically significant improvements, compared to pre-treatment [31].

OQLQ: Worst impact on QoL in pre-treatment group [28]. Relatively high overall scores compared to other studies. Esthetics scored highest. Functional domain had lowest mean score. Sex and increased overjet correlated with higher overall scores. Pre-surgical orthodontic phase: Overall QoL improved. Six weeks post-surgery: significant improvement. Psychological distress and psychological disability improved most [2]. One study reported no significant differences [34]. Six months post-surgery: Statistically significant decrease [2,19,34-36]. After active treatment completion: Almost null scores [1].

OHSQ: Significant improvement 2 and 5 years postoperatively. Improvements remained stable between follow-ups, except general oral health which slightly but significantly deteriorated [14].

### Differences between sexes

Some results indicated female patients have greater negative impact on QoL than male patients: female patients had significantly

higher pre-treatment OQLQ scores [2,37] and worse OHRQoL [1] according to OHIP-14 and OQLQ. Mainly in social and functional aspects, measurements post-op revealed no differences between sexes [2].

Using OHIP-14, no correlation between sex and QoL in any treatment phase [2,30,33]. No significant differences in self-reported QoL between sexes using SF-36, OHIP-14 and OQLQ [19].

### Comparing patients at different treatment stages and control groups regarding GHRQoL and OHRQoL

No significant differences in SF-36 scores between pre-surgery patients and control group (similar age, sex and educational attainment level attending for consultation on asymptomatic wisdom teeth). Significant differences in overall OHIP-14 and OQLQ scores. Thus, patients with dentofacial deformity have poorer OHRQoL than those without [38].

Significant differences in the SF-36 role physical and bodily pain components compared to patients having square faces and prominent zygoma, going through plastic surgery. Non-significant differences in other components. Significant differences in OQLQ oral function and aesthetics scores. Postoperatively, non-significant differences in all overall SF-36 and OQLQ components except for the oral function domain [35].

**Table 3:** Table describing study design, questionnaires used in each study and when the scores were obtained.

Study	Questionnaire used	Times for measurement	Patients
<b>Cross-sectional studies</b>			
Jung [18]	OQLQ	pre-treatment	Pre-treatment female patients with dentofacial deformities control group: with class I molar relationship and minor malocclusion
Palomares [28]	OHIP-14, OQLQ	1. Before any treatment started, 2. Pre-surgically, prior to the operation, 3. Postsurgical at least 3 months after surgery and still going through orthodontic treatment 4. retention phase (completed orthodontics at least 6 months before the study),	patients at different stages of orthognathic treatment
Al-Ahmad [26]	OQLQ, SF-36	1. before orthognathic surgery 2. after orthognathic surgery	Patients with dentofacial deformities control groups: i) patients who had declined treatment with orthognathic surgery, and ii) subjects with normal occlusion and normal skeletal relationships;
Lee [38]	OHIP-14, OQLQ, SF-36	before orthognathic surgery	patients with dentofacial deformities control group (similar age, sex and educational attainment level) consisting of patients attending for consultation on asymptomatic wisdom teeth
Stagles [37]	OQLQ	Pre treatment orthognathic patients	102 pre treatment orthognathic patients
<b>Prospective longitudinal studies</b>			
Choi [19]	OHIP-14, OQLQ, SF-36	1. Recruitment at the clinic (Baseline), 2. Postoperative 6 weeks, 3. Postoperative 6 months, 4. after orthodontic treatment (Final registration)	36 consecutive patients scheduled to undergo orthognathic surgery
Khadka [35]	OQLQ, SF-36	1. Preoperatively, prior to surgery, 2. 6-8 months after surgery	patients with dentofacial deformities going through conventional treatment with orthognathic surgery patients having square faces and prominent zygoma going through plastic surgery procedure
Göelzer [33]	OHIP-14	1. prior to surgery 2. 4-6 months postoperatively	74 patients with dentofacial deformities undergoing orthognathic surgery
Silva [2]	OHIP-14, OQLQ	1. prior to surgery (Baseline), 3. 6 months after surgery (Final registration) 2. 6 weeks after surgery	50 patients with dentofacial deformities
Baherimoghaddam [29]	OHIP-14	1. before any active treatment, 2. prior to surgery, 3. 6 months after surgery, 4. 12 months after active postsurgical orthodontic treatment was completed	30 patients with class II and 28 patients with class III dentofacial deformities undergoing orthognathic surgery
Lee [34]	OHIP-14, OQLQ, SF-36	1. pre-surgical phase prior to surgery (Baseline registration), 2. 6 weeks postoperatively, 3. 6 months postoperatively	36 patients with dentofacial deformities
Murphy [36]	OQLQ	1. prior to surgery (Baseline), 2. 6 months after surgery (Final registration)	52 patients with dentofacial deformities undergoing orthognathic surgery
Rustemeyer [30]	OHIP-14	1. before any active treatment, 2. 12 months after surgery	50 patients with dentofacial deformities
Silvola [31]	OHIP-14	Data were collected in average 2.8 years after treatment.	51 patients with severe malocclusions 36 went through orthognathic surgery and 15 orthodontic treatment only
Wang [32]	OHIP-14		patients who had undergone conventional orthognathic surgery with patients who had undergone treatment with orthognathic surgery first
<b>Longitudinal retrospective design</b>			
Motegi [27]	SIP, OHSQ	5 years post-surgery the 2- and 5 years of follow-up	93 patients treated with mandibular advancement for class II dentofacial relationships

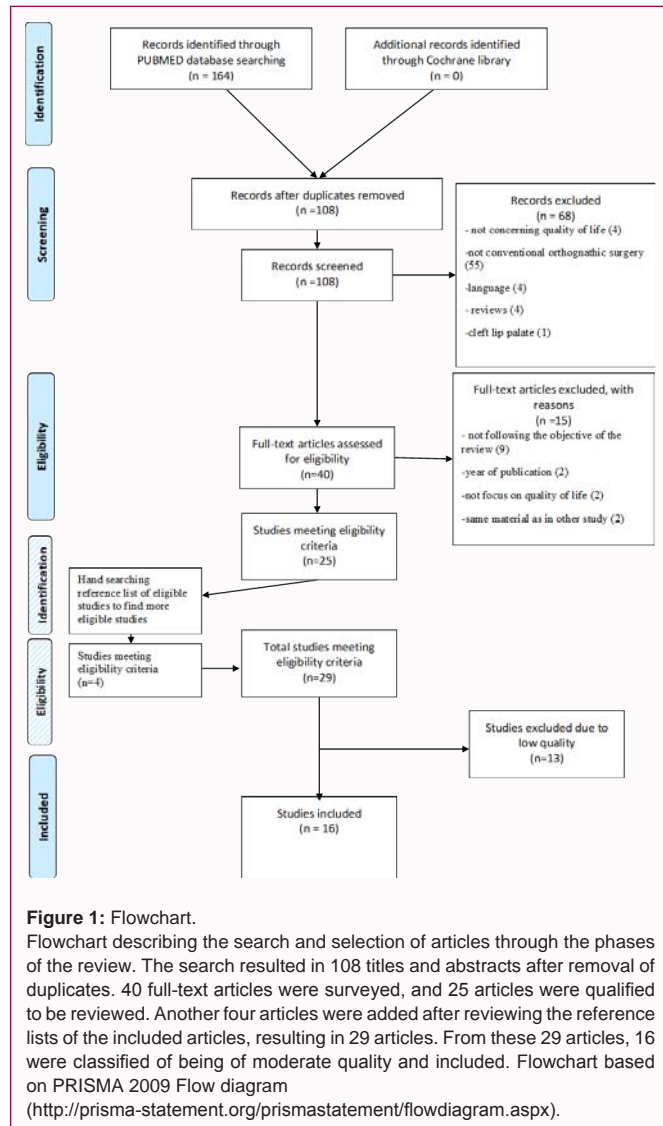
Table describing the study design and questionnaires used. The questionnaire types were: Oral Health Impact Profile, short form, with 14 questions (OHIP-14), Oral health-related quality of life condition-specific questionnaire Orthognathic Quality of Life Questionnaire (OQLQ), Sickness Impact Profile (SIP) and Oral Health Status Questionnaire (OHSQ).

Significant differences only in 3/8 SF-36 sub-scores between: (i) patients pre-surgery (ii) patients post-surgery, (iii) patients who had declined treatment with orthognathic surgery, and (iv) subjects with normal occlusion and normal skeletal relationships; indicating this form did not discriminate between the groups. Worst QoL in pre-surgery group. Pre-treatment patients had significantly higher OQLQ scores compared to group with normal occlusion. Largest differences were in social and facial esthetics domains. No significant differences in overall OQLQ scores when comparing post-surgery group with

control groups. When pre-surgery and post-surgery groups were compared, significant improvements in overall scores after treatment [26].

Significant improvements in QoL using OHIP-14 after treatment in both patients who had undergone conventional orthognathic surgery and patients who had undergone treatment with orthognathic surgery first [21].

Pretreatment female patients with class II and class III relationships



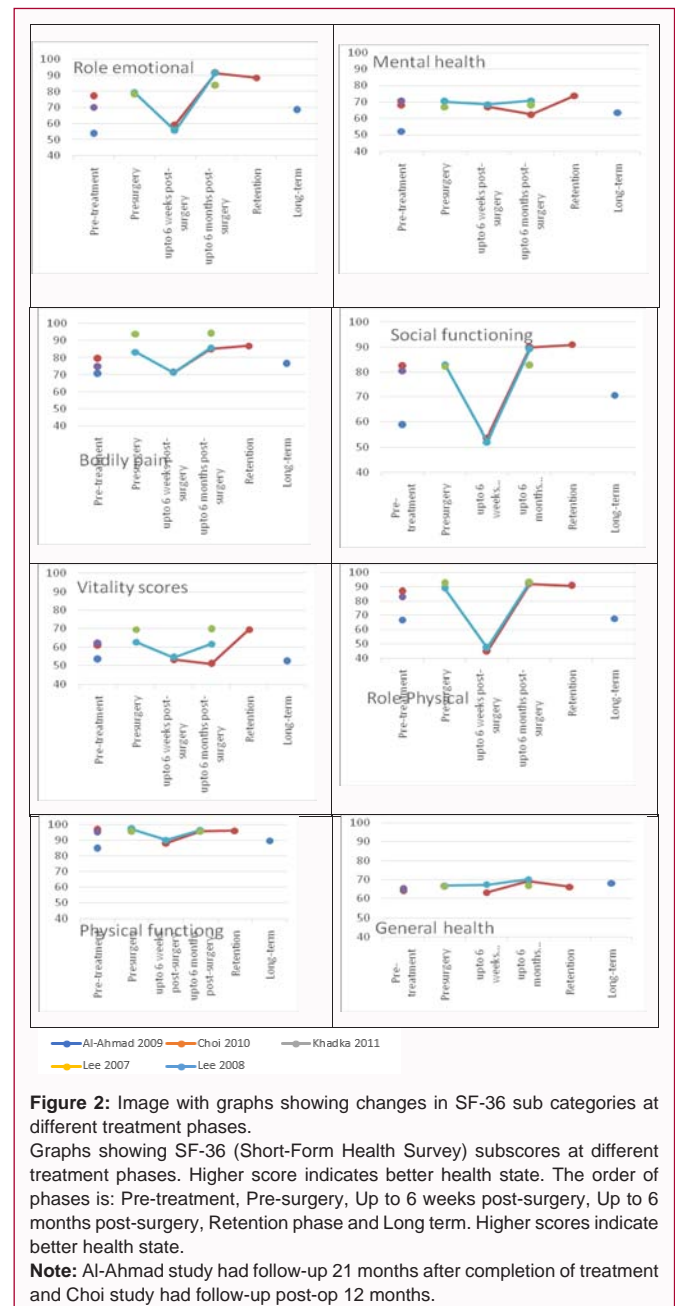
had significantly higher scores in QOLQ domains of social aspects, aesthetics and oral function scores compared to a control group with normal occlusion or minor malocclusion. Orthognathic patients showed significant impairments in QOL compared with patients with mild malocclusion [35].

An average 2.8 years after treatment, patients that underwent orthognathic surgery showed no statistically significant difference regarding relation between occlusal characteristics and OHIP-14 changes compared to patients that received orthodontic treatment only [22].

### Discussion

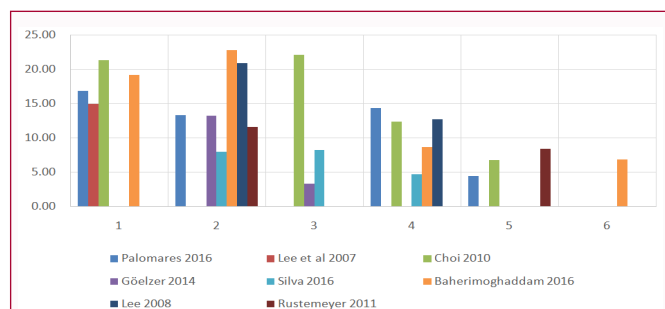
Results indicate orthognathic surgery positively affects OHRQoL for patients with dentofacial deformities and improves over the course of treatment. Worst scores were during the pre-treatment, pre-surgery phases. Best scores were at the end of treatment. Cross-sectional studies showed control groups had better QoL than pretreatment phase patients [35,38].

These findings agree with previous reviews: Orthognathic surgery has positive effects [13,14,20,37]. Results indicate benefits on psychosocial well-being and OHRQoL. Patients treated with



orthognathic surgery were satisfied. Satisfaction with postoperative appearance correlated highest with overall patient satisfaction [12]. Post-surgery, patients had higher self-confidence than before treatment and were pleased with treatment-outcome. QoL improvements were evident 6 months post-surgery [20].

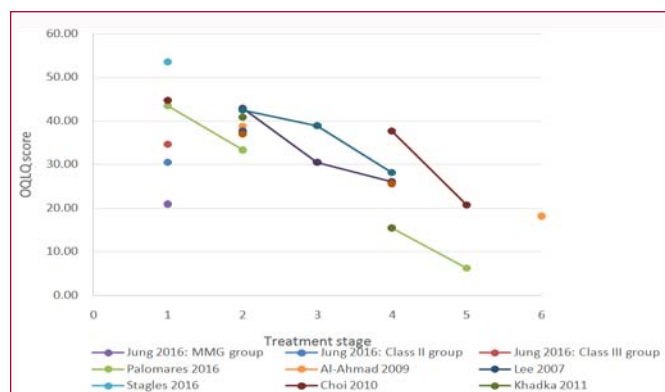
Whether orthognathic surgery has a clinically relevant effect on GHRQoL is uncertain. Some results indicated GHRQoL changes during treatment, or when compared to patients without dentofacial deformities [19,35,27]. Some showed no difference [26,34,38]. Studies reporting positive impacts, reported improvements in “bodily pain”, “role physical” [35], “mental health” [19], and psychosocial dimensions after treatment compared to pre-treatment [27]. The trend seen was: all SF-36 categories’ scores decrease during treatment. Scores increase to or more than pre-treatment level at treatment completion. Worst impact at 6 weeks post-surgery, with greatest



**Figure 3:** Graph showing OHIP-14 at the different treatment stages.

Graph showing mean OHIP-14 (Oral Health Impact Profile, short form) score for the different studies at different treatment phases. The numbers on the horizontal axis indicate stage of treatment: 1: Pre-treatment, 2: Pre-surgery, 3: Up to 6 weeks post-surgery, 4: Up to 6 months post-surgery, 5: Retention phase and 6: Long term.

**Note:** Baherimoghaddam study had follow-up evaluation 12 months after removal of orthodontic appliances and Rustemeyer study had post-surgical evaluation 12 months post-op. Higher scores indicate worse impact on Oral Health Related Quality of Life (OHRQoL). Score (range): 0 - 56.



**Figure 4:** Graph showing OQLQ score at different treatment phases.

Graph showing means Orthognathic Quality of Life Questionnaire (OQLQ) score through different treatment phases. Higher scores indicate worse impact on Oral Health Related Quality of Life (OHRQoL). Score (range): 0 - 88. The numbers on the horizontal axis indicate treatment phase: 1: Pre-treatment, 2: Pre-surgery, 3: Up to 6 weeks post-surgery, 4: Up to 6 months post-surgery 5: Retention phase and 6: Long term.

**Note:** Al-Ahmad study had follow-up 21 months after completion of treatment and Choi study had follow-up post-op 12 months.

impact on “role physical” and “social functioning” domains. This may be due to post-operative inconveniences such as pain, swelling and difficulties to adapt to the new occlusion and appearance. This worsening was not evident after treatment completion [19,34]. According to another review: patients with dentofacial deformities did not differ from others regarding GHRQoL. No significant improvements detected after orthognathic treatment [20].

It can be discussed if GHRQoL questionnaires such as SF-36 are too imprecise to detect clinically important effects of orthognathic treatment or if OHRQoL is not that important to overall QoL. Cunningham et al. highlighted the weakness of generic questionnaires such as SF-36 for evaluating QoL of patients with dentofacial deformities undergoing orthognathic treatment; and presented OQLQ to be the most precise tool to detect changes in impact on QoL which could be undiscovered by SF-36 and OHIP-14 [23,24]. SF-36, assesses other areas compared to OHIP-14 and OQLQ [38] and is not as sensitive to detect QoL changes between patients with and without facial deformities [28,38] and patients in different treatment phases [26].

Only studies using quantitative methods to measure QoL were included. Based on findings of this review it seems GHRQoL questionnaires were not sensitive to detect impacts of orthognathic treatment on QoL. It is reasonable to think there are subjective variations the treatment entails for the individual patient that cannot fully be expressed and measured by analyzing quantitative questionnaires. Individual differences in patients, for example, motivations and perceptions, are important when evaluating the treatment [17]. To gain a more comprehensive understanding of how QoL changes in patients, questionnaires could, as a suggestion, be supplemented with qualitative methods such as deep interviews. Included articles did not have deep interviews.

Included studies originated from several countries. Since QoL depends on both psychological and physiological factors, cultural differences between countries can eventually influence perception of QoL. The conclusion orthognathic surgery positively affects QoL was drawn regardless of the country studies had been conducted; in this review’s results can be considered representative for countries around the world. No RCT investigating differences in QoL of patients with dentofacial deformities receiving/not receiving treatment were found, probably because of the ethical issue associated with randomizing patients to receive treatment or not.

Self-assessed questionnaires to measure health-related and OHRQoL are more popular, compared to a previous review [39]. This trend towards standardized questionnaires has been reported earlier [17] with changes in well-being most often valued by questionnaires designed to measure impact of oral health on QoL, such as OQLQ and OHIP-14 [40]. Previously, SF-36 was the most commonly used questionnaire, whereas now OQLQ and OHIP-14 are more common.

No study was classified as high-quality; mostly based on shortcomings in study design, follow up timings, and unclear reporting of study results. It can be assumed QoL depends on many factors and can differ during different phases of life. Treatment is usually performed on adolescents or young adults in a phase of major life changes [41,42]. It would have been desirable to find prospective longitudinal studies with age, sex and socioeconomically matched controls with normal dentofacial features for better comparison with patients undergoing orthognathic treatment. Such prospective longitudinal studies with matched controls were not found.

A weakness of many included studies was the timing of measuring QoL. Orthognathic treatment often proceeds for a long time with different phases. To adequately estimate the entire treatment’s effect on QoL, it would be advantageous to start measurement before commencing any active treatment and conducting the earliest final measurement, after treatment completion.

Tendency towards a positive change in OHRQoL for patients with dentofacial deformities undergoing orthognathic surgery and appears to be evident 6 months post-surgery. Further improvements seem to occur after treatment completion.

## Conclusion

Current knowledge in this area seems to be: OHRQoL in patients with dentofacial deformities is worse than for those without. Orthognathic surgery positively affects OHRQoL. Although these results should be interpreted with caution since no high-quality study was included. Unclear effect on GHRQoL (measured with self-assessed questionnaires). Lack of longitudinal prospective studies

with matched controls measuring QoL during all treatment phases, and studies with long-term follow-up measurements.

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