

ORIGINAL ARTICLE



Quality of life several years after orthodontic-surgical treatment with bilateral sagittal split osteotomy

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ABSTRACT

Objective: To analyse oral health related quality of life (OHRQoL) several years after orthognathic treatment in patients who had Class II malocclusion with retrognathic mandible.

Material and methods: The initial study cohort comprised 151 patients with orthognathic treatment in 2007–2011. Of them, 77 patients (Group 1, mean age 41 years, range 19–71 years, 71% women) were clinically examined 6 years (range 4–8 years) after bilateral sagittal split osteotomy (BSSO). Group 2 included 24 former patients (mean 48 years, range 25–79 years, 50% women) who were willing to participate in a structured telephone interview. Group 3 consisted of 22 prospective patients (mean 35 years, range 18–56 years, 86% women) with a recent orthognathic treatment plan and awaiting treatment. QoL was assessed using two questionnaires, OHIP-14 and OQLQ.

Results: Based on responses, patients who had received orthognathic treatment (Groups 1 and 2) had better QoL than those awaiting treatment (Group 3).

Conclusion: Conventional orthognathic treatment, including mandibular advancement with BSSO, seems to have a positive long-term effect on patients' QoL. More long-term follow-up studies are needed to assess the real impact of treatment on patients' lives in the long run.

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Introduction

In adults, severe dentofacial deformities are corrected with orthognathic treatment, including both orthodontics and surgery. Because this treatment is not mandatory, the decision of whether to start treatment always depends on the patient's own opinion. Patients should therefore be aware of all that treatment entails, including agreed goals, risks of complications, realistically achievable outcomes and treatment duration. Cunningham and Shute stated that following orthognathic treatment, patients' quality of life (QoL) depends on technically good results, internal patient-related factors, interaction and communication, and external factors connected to the patient and clinical team. Communication between patients and orthodontists/surgeons is the most vital factor in posttreatment satisfaction. If pre-treatment communication is not sufficient, it may not be possible to achieve a good level of satisfaction even with technically good results [1].

The World Health Organisation (WHO) defines the concept of 'quality of life' as 'an individual's perception of their position in life in the context of the culture and value systems in which they live, and in relation to their goals, expectations, standards and concerns' [2]. In recent years, several studies have focussed on patients' QoL following

orthognathic treatment. Despite findings of worsened oral health-related quality of life in the beginning of the orthodontic treatment phase [3], significant improvements in QoL have been registered post-treatment [3,4]. According to several studies, orthognathic treatment can improve patients' self-esteem, self-confidence, body image as well as their QoL [5–10].

In a recent study, Lee et al. [11] reported that before treatment, patients' concerns most commonly focus on treatment duration. The main factors suggested to affect treatment duration are the patient's age, gender, co-operation, severity/type of malocclusion, treatment method (extraction/non-extraction, type of surgery), and practice setting (university/hospital, private, experience of orthodontist) [12–15]. Long-term satisfaction with the outcome does not, however, seem to be affected by treatment duration [16].

The aim of this study was to analyse QoL several years following conventional orthognathic treatment in patients with Class II malocclusion and retrognathic mandible advanced with bilateral sagittal split osteotomy (BSSO).

Material and methods

The initial study cohort comprised 151 patients who had received orthognathic treatment at the Oral and Maxillofacial

Unit of Tampere University Hospital, Tampere, Finland, in 2007–2011. Inclusion criteria were mandibular retrognathia, Class II dental relationship with increased overjet, conventional orthognathic treatment with pre- and postoperative orthodontic phases (straight-wire orthodontic technique with Roth's bracket prescription), and mandibular advancement (BSSO with rigid fixation). Patients with temporomandibular joint arthritis, trauma history, cleft lip and/or palate, or craniofacial anomalies were excluded.

To ensure optimal occlusal stability, all patients were examined by the clinical team (orthodontist and maxillofacial surgeon) approximately three months before the operation. In patients with short anterior face height and deep bite, the steep curve of Spee was not levelled presurgically, but the mandible was rotated backwards with mandibular BSSO advancement to reduce overbite and increase lower face height. Postoperatively, these patients had a lateral open bite with tooth contacts in the front teeth and second molars. According to the treatment plan, lateral open bites were postsurgically closed as part of orthodontic finalising. To obtain the planned occlusion, a splint was used in all cases during the operation. The splint was removed in all cases once osteosynthesis had been attained. In all cases rigid fixation with bicortical screws or miniplates was used; no maxillomandibular fixation was needed. Orthodontic treatments were carried out by four senior orthodontists and the operations by three senior surgeons, with or without residents.

Participants quality of life was assessed using two questionnaires, the condition-specific Orthognathic Quality of Life Questionnaire (OQLQ) and the short form of the oral health-related quality of life questionnaire Oral Health Impact Profile (OHIP-14). The OQLQ includes four dimensions: (1) oral function, (2) facial aesthetics, (3) awareness of dentofacial aesthetics, and (4) social aspects of dentofacial deformity. The lower the OQLQ scores, the better the QoL [17,18]. The OHIP-14 includes seven dimensions: (1) functional limitation, (2) physical pain, (3) psychological discomfort, (4) physical disability, (5) psychological disability, (6) social disability, and (7) handicap. In the OHIP-14, lower scores indicate lower QoL [19].

A total of 77 patients (51%) from the initial patient group of 151 individuals agreed to participate in the present study, which took place an average of six years (range 4–8 years) after the operation. Seventy-four patients of the initial group did not respond to the invitation. Of them, every third ($n=25$) were reached by phone, and 24 (Group 2, 16% of the initial patient group) were willing to participate in a structured telephone interview based on the two QoL questionnaires. In Group 2 (the first control group), the mean age was 48 years, (range 25–79 years, SD 9.5), and 50% of participants were women. Group 3 (the second control group) consisted of 22 prospective patients (mean age 35 years, range 18–56 years, SD 13, 86% women) with Class II malocclusion with a recent orthognathic treatment plan and awaiting treatment.

All patients signed an informed consent form and responded to both the OQLQ and the OHIP-14

questionnaires. Participation in this study was voluntary. Ethical approval was obtained from the Ethics Review Committee of the Joint Municipal Authority of the Pirkanmaa Hospital District, Finland.

Statistical analyses

Between the study groups, age groups and genders, differences in OQLQ and OHIP-14 dimensions were analysed using the Mann-Whitney test (IBM SPSS Statistics V23.0). p -Values $< .05$ were considered statistically significant.

Results

In general, the results showed that patients who had received orthognathic treatment (Groups 1 and 2) had better QoL than prospective patients (Group 3). The differences were statistically significant. Between Groups 1 and 2, only a few statistically significant differences in QoL were found. Patients in Group 3 had lower QoL in all categories except in the subcategories 'functional limitations' and 'physical disability' of the OHIP-14. Comparisons between Groups 1–3 (all sum- and subscores of the OQLQ and OHIP-14) are shown in Table 1.

Based on the replies, women had better QoL than men in combined Groups 1 and 2, as compared to Group 3 (OQLQ: $p=.001$ women, $p=.023$ men; OHIP-14: $p=.003$ women, $p=.943$ men). Among all participants, one special group was distinguished: in Group 2, patients over 40 years of age ($n=15$) had better QoL than patients in all other Groups 1–3.

Discussion

The aim of this study was to analyse QoL several years following orthognathic treatment in patients with initially retrognathic mandible advanced with BSSO. Both of the applied questionnaires, OHIP-14 and OQLQ, showed similar, positive results post-treatment in terms of patients' functional, social and psychological wellbeing. They also indicated statistically significant positive results between treated patients (Groups 1 and 2) and those who were about to begin treatment (Group 3). A total of 24 patients (Group 2) who did not respond to the invitation letter from the initial group of 151 that were invited, were interviewed by phone, and their replies to OQLQ and OHIP-14 questionnaire were received. According to the OHIP-14 scores, there were no statistically significant differences between Groups 1 and 2. Interestingly, in the OQLQ, the subscores of 'oral function' differed (ranges 0–20 vs. 0–13), which was also reflected in the sum scores.

The results by Choi and co-workers [20] suggest that patients' age is playing a major role in their QoL. However, on the basis of current results there might be some association. In Group 2, 15 patients aged over 40 years had better QoL than other participants in Groups 1–3. Nevertheless, the association between age and life quality should be studied in a broader context; the results of our small subgroup can only be seen as suggestive.

Table 1. Comparisons of treated (Group 1 and Group 2) and prospective (Group 3) orthognathic patients' quality of life according to the OQoL and OHIP-14 sum and subscores.

OQoL	G1 (n = 77)				G2 (n = 24)				G3 (n = 22)				p G1–G2	p G1–G3	p G2–G3
	MEAN	SD	MAX	MIN	MEAN	SD	MAX	MIN	MEAN	SD	MAX	MIN			
Sum score	12.0	14.0	55.0	0.0	7.5	11.9	43.0	0.0	26.5	17.3	64.0	6.0	.017	.000	.000
Oral function	4.3	4.4	20.0	0.0	2.7	4.0	13.0	0.0	8.0	5.6	17.0	1.0	.022	.002	.000
Facial aesthetics	3.3	4.4	16.0	0.0	2.2	3.8	13.0	0.0	7.9	5.5	19.0	0.0	.131	.000	.002
Awareness of dentofacial deformity	2.2	3.0	13.0	0.0	1.4	2.2	7.0	0.0	4.2	4.0	14.0	0.0	.181	.006	.000
Social aspects	2.2	4.2	20.0	0.0	1.3	3.3	12.0	0.0	6.4	6.6	22.0	0.0	.088	.000	.000
OHIP-14															
Sum score	64.3	8.1	70.0	26.0	64.7	8.4	70.0	36.0	57.6	9.0	69.0	40.0	.111	.003	.001
Functional limitation	9.1	1.5	10.0	3.0	9.3	1.4	10.0	5.0	9.1	1.7	10.0	4.0	.548	.987	.603
Physical pain	7.6	2.1	10.0	2.0	8.4	2.0	10.0	4.0	9.1	1.7	10.0	4.0	.057	.274	.027
Psychological discomfort	8.8	1.8	10.0	2.0	9.2	1.7	10.0	4.0	6.7	2.3	10.0	3.0	.108	.000	.000
Physical disability	9.5	1.2	10.0	3.0	9.5	1.0	10.0	6.0	9.0	1.8	10.0	4.0	.575	.269	.620
Psychological disability	9.2	1.4	10.0	4.0	9.5	1.4	10.0	5.0	8.1	1.6	10.0	5.0	.243	.001	.001
Social disability	9.4	1.1	10.0	4.0	9.5	1.3	10.0	6.0	8.4	1.5	10.0	5.0	.384	.002	.008
Handicap	9.4	1.1	10.0	4.0	9.5	1.1	10.0	6.0	8.9	1.1	10.0	6.0	.354	.025	.016

Statistically significant differences ($p < .05$) in bold.

The results regarding gender are controversial. Despite Esperao et al. [21] suggesting that women are more sensitive than men to the negative impacts of malocclusion, Choi et al. [20] and Silva et al. [22] failed to find any gender difference in QoL. Instead, our long-term results indicate that women have a better QoL than men.

Strengths and weaknesses

In this study, several factors can be seen as strengths: First, the study group was fairly large ($n = 77$). Pre-treatment, all participants had Class II malocclusion with mandibular retrognathia; Groups 1 and 2 were treated according to the same guidelines, in the same hospital, and by same orthodontists and maxillofacial surgeons. Secondly, the follow-up time was rather long, ranging from 4 to 8 years postsurgery. Further, the validity of the OHIP-14 and OQoL questionnaires has been tested [17–19], and several studies have indicated that they can be used to identify differences between patient groups [20–23]. According to Cunningham [17,18], OQoL may be more sensitive with regard to aesthetics than OHIP-14.

As limitations, two factors should be mentioned: In this follow-up study, preoperative QoL data from Groups 1 and 2 were not collected. Further, the group consisting of prospective patients (Group 3) was rather small ($n = 22$). However, all patients in this group had a similar diagnosis as that of patients in Groups 1 and 2.

The sample size (Groups 1–3 together, $n = 123$) in the current study exceeds the sample sizes in previously published studies by Lee et al. ($n = 36$), Esperao ($n = 117$), Silva et al. ($n = 50$), and Silvola et al. ($n = 52$) [9,21–23].

On the other hand we could not define the number of patients of each group before the study and had to satisfy with the final number of patients that was random and not based on statistical analyses.

However, the benefit of longitudinal studies [9,21–23] is that they enable comparisons between the same patients pre- and postsurgery. Present study is cross-sectional, meaning that no follow-up of patients and pertinent

interpretations can be made. Yet our study revealed new data on long-term outcomes.

Significance of this study

Many short-term studies (6–24 months) on QoL after orthognathic treatment report positive results [3,4,9,22,24,25]. However, to our knowledge, only one long-term study has focussed on QoL specifically in patients with retrognathic mandible treated with BSSO; the assessments five years after surgery showed positive results [26]. An opposite view to these as well as to the current results was expressed in a recent review whose authors suggested that orthognathic treatment cannot be expected to have a long-lasting positive effect on QoL. They argued that corrected facial and dental appearance and function over the time come to be seen as 'normal' [27]. The current study contributes to data on the long-term effects of orthognathic treatment.

Conclusion

In light of the current results, conventional orthognathic treatment, including mandibular advancement with BSSO, seems to have a positive long-term effect on patients' QoL. However, more long-term follow-up studies are needed to confirm this finding and to further explore the impact on patients' lives.

Disclosure statement

No potential conflict of interest was reported by the author(s).

References

- [1] Cunningham SJ, Shute J. Orthognathic treatment: see how they feel? *J Orthod.* 2009;36(1):61–66.
- [2] World Health Organization. Measuring quality of life: the development of the world health organization quality of life instrument (WHOQOL). Geneva, Switzerland: WHO; 1993. WHO/MSA/MNH/PSF/97.4

- [3] Yi J, Lu W, Xiao J, et al. Effect of conventional combined orthodontic-surgical treatment on oral health-related quality of life: a systematic review and meta-analysis. *Am J Orthod Dentofacial Orthop.* 2019;156(1):29–43.
- [4] Göelzer JG, Becker OE, Haas Junior OL, et al. Assessing change of 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(11):1352–1359.
- [5] Forssell H, Finne K, Forssell K, et al. Expectations and perceptions regarding treatment: a prospective study of patients undergoing orthognathic surgery. *Int J Adult Orthodon Orthognath Surg.* 1998;13:107–113.
- [6] Zhou Y, Hägg U, Rabie A. Patient satisfaction following orthognathic surgical correction of skeletal Class III malocclusion. *Int J Adult Orthodon Orthognath Surg.* 2001;16(2):99–107.
- [7] Badran S. The effect of malocclusion and self-perceived aesthetics on the self-esteem of a sample of Jordanian adolescents. *Eur J Orthod.* 2010;32(6):638–644.
- [8] Lee S, McGrath C, Samman N. Quality of life in patients with dentofacial deformity: a comparison of measurement approaches. *Int J Oral Maxillofac Surg.* 2007;36(6):488–492.
- [9] Lee S, McGrath C, Samman N. Impact of orthognathic surgery on quality of life. *J Oral Maxillofac Surg.* 2008;66(6):1194–1199.
- [10] Alanko O, Tuomisto MT, Peltomäki T, et al. A longitudinal study of changes in psychosocial well-being during orthognathic treatment. *Int J Oral Maxillofac Surg.* 2017;46(11):1380–1386.
- [11] Lee R, Hwang S, Lim H, et al. Treatment satisfaction and its influencing factors among adult orthodontic patients. *Am J Orthod Dentofacial Orthop.* 2018; 153(6):808–817.
- [12] Mavreas D, Athanasiou AE. Factors affecting the duration of orthodontic treatment: a systematic review. *Eur J Orthod.* 2008; 30(4):386–395.
- [13] Häll B, Jämsä T, Soukka T, et al. Duration of surgical-orthodontic treatment. *Acta Odontol Scand.* 2008;66(5):274–277.
- [14] O'Brien K, Wright J, Conboy F, et al. Prospective, multi-center study of the effectiveness of orthodontic/orthognathic surgery care in the United Kingdom. *Am J Orthod Dentofacial Orthop.* 2009;135:709–714.
- [15] Paunonen J, Helminen M, Peltomäki T. Duration of orthognathic-surgical treatment. *Acta Odontol Scand.* 2017;75(5):372–375.
- [16] Mala NG, Normando D, Maia FA, et al. Factors associated with long-term patient satisfaction. *Angle Orthod.* 2010;80(6): 1155–1158.
- [17] Cunningham SJ, Garrat AM, Hunt NP. Development of a condition-specific quality of life measure for patients with dentofacial deformity: I. Reliability of the instrument. *Commun Dent Oral Epidemiol.* 2000;28(3):195–201.
- [18] Cunningham SJ, Garrat AM, Hunt NP. Development of a condition-specific quality of life measure for patients with dentofacial deformity: II Validity and responsiveness testing. *Commun Dent Oral Epidemiol.* 2002;30(2):81–90.
- [19] Slade G, Spencer AJ. Development and evaluation of the Oral Health Impact Profile. *Community Dent Health.* 1994;11(1):3–11.
- [20] Choi WS, Lee S, McGrath C, et al. Change in quality of life after combined orthodontic-surgical treatment of dentofacial deformities. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2010; 109(1):46–51.
- [21] Esperão PTG, de Oliveira BH, de Oliveira Almeida MA, et al. Miguel JA. Oral health related quality of life in orthognathic surgery patients. *Am J Orthod Dentofacial Orthop.* 2010;137(6): 790–795.
- [22] Silva I, Cardemil C, Kashani H, et al. Quality of life in patients undergoing orthognathic surgery – a two centered Swedish study. *J Cranio Maxill Surg.* 2016;44(8):973–978.
- [23] Silvola AS, Varimo M, Tolvanen M, et al. Dental esthetics and quality of life in adults with severe malocclusion before and after treatment. *Angle Orthod.* 2014;84(4):594–599.
- [24] Jung MH. Quality of life and self-esteem of female orthognathic surgery patients. *J Oral Maxillofac Surg.* 2016;74(6):1240.e1–7.
- [25] Corso P, Oliveira F, Costa D, et al. Evaluation of the impact of orthognathic surgery on quality of life. *Braz Oral Res.* 2016;30. DOI:10.1590/1807-3107BOR-2016.vol30.0004
- [26] Motegi E, Hatch JP, Rugh JD, et al. Health-related quality of life and psychosocial function 5 years after orthognathic surgery. *Am J Orthod Dentofacial Orthop.* 2003;124(2):138–143.
- [27] Ashton-James CE, Chemke-Dreyfus A. Can orthognathic surgery be expected to improve patients' psychological well-being? The challenge of hedonic adaptation. *Eur J Oral Sci.* 2019;127(3): 189–195.