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**The impact of orthognathic surgery on the quality of life; a comparison between orthodontic-first and surgery first approaches.**

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## The impact of orthognathic surgery on the quality of life; a comparison between orthodontic-first and surgery first approaches.

### Abstract

**Aim;** To compare the impact of the orthodontics-first approach (OFA) with the surgery-first approach (SFA), for the correction of dentofacial deformities, on quality of life, anxiety and depression. **Materials and methods;** Data were collected from 32 patients (aged 17-47 years), all treated through a single multidisciplinary orthognathic clinic. Patients completed a 22-item Orthognathic Quality of Life Questionnaire (OQLQ), a 7-item Generalized Anxiety Disorder (GAD-7) questionnaire and a 9-item Patient Health Questionnaire (PHQ-9), at one week preoperatively (T1), then 6 weeks (T2) and 6 months (T3) postoperatively. **Results;** the quality of life was statistically higher for the SFA group preoperatively ( $P = 0.010$ ,  $ES = 0.96$ ). The mean score and the individual domain scores, of the OQLQ, showed significant improvements at 6 weeks and 6 months postoperatively. The facial aesthetic domain showed the largest improvement ( $ES = 2.5$  in OFA and  $ES = 2.2$  in SFA). Patients in the OFA group experienced a lower quality of life and greater deterioration in social life immediately prior to surgery. The anxiety and depression scores did not significantly reduce postoperatively in either group. The assumption that all psychological aspects of the patient's life improve following orthognathic surgery is not supported by the results of this study. **Conclusion;** SFA eliminates the deterioration in social life which is associated with the presurgical orthodontic decompensation phase. results suggest that the

### Introduction

The impact of orthognathic surgery on the quality of life, psychosocial well-being, facial aesthetics and oral function is well documented.<sup>1,2,3,4,5</sup> In most of the cases the management constitute both orthodontics and surgical treatment. The conventional orthodontics-first approach for the correction of dentofacial deformities consists of pre-surgical orthodontics to decompensate the dentition, followed by surgery and post-surgical orthodontics. An alternative to this is the surgery-first approach (SFA), which commences with surgery, followed immediately by post-surgical orthodontics.<sup>6</sup> The SFA brings about an immediate improvement in facial aesthetics and has been shown to significantly reduce the total treatment time.<sup>7</sup> This might be expected to have a positive impact on patient satisfaction with the treatment.<sup>8</sup> However, the evidence regarding the effects of these two treatment approaches on patients' quality of life, psychological state, anxiety and depression is still limited.<sup>7, 9,10</sup>

Concerns regarding facial aesthetics and oral function are the main motives for seeking orthognathic surgery.<sup>11, 4</sup> The systematic review by Alanko et al.,<sup>12</sup> concluded that improvement in self-esteem and self-confidence, are important motivational factors. Previous studies, comparing the SFA with the OFA, have concluded that the SFA could result in progressive improvement in quality of life and the psychological

status of the patients, while the OFA may worsen the facial profile and the masticatory function pre-surgically. However, the short-term follow-ups, small sample sizes and absence of psychological assessments in these studies are limiting factors in drawing robust conclusions.<sup>9, 10, 13</sup>

Various methods have been used to assess the quality of life of orthognathic surgery patients. The Orthognathic Quality of Life Questionnaire (OQLQ) developed and validated by Cunningham et al.,<sup>14</sup> is a reliable, condition-specific questionnaire for the evaluation of quality of life after orthognathic surgery.<sup>14</sup> The Patient Health Questionnaire (PHQ-9) was developed in 1999. A meta-analysis of diagnostic properties of PHQ-9, including 17 validated studies, with more than 5000 participants, confirmed that PHQ-9 can correctly diagnose depression in different clinical settings with a sensitivity of 92%.<sup>15</sup> Kroenke et al.,<sup>16</sup> showed that the Generalized Anxiety Disorder Questionnaire (GAD-7) has a good sensitivity and specificity as a screening tool for generalized anxiety disorder, panic disorder, social anxiety and post-traumatic stress disorder.<sup>16</sup>

The aim of this study was the assessment of quality of life, anxiety and depression in two groups of orthognathic patients undergoing treatment for dentofacial deformity, one by the orthodontics-first approach and the other by the surgery-first approach.

## **Material and methods**

This prospective study was carried out on 32 consecutive patients (17-47 years old), who had attended a multidisciplinary orthognathic planning clinic between December 2017 and December 2018. Patients with cleft lip and palate and those who required additional treatment (e.g. distraction osteogenesis) were excluded from the study. The cases were divided into two groups: SFA (n = 18) and OFA (n = 14). The patients in each group underwent Le Fort I osteotomy and/or bilateral sagittal split ramus osteotomy, with or without genioplasty and/or malar augmentation with iliac crest bone graft. Figures 1, 2 show an example of a case from each group respectively. Cases in the SFA had orthodontic braces applied on the teeth immediately before surgery, no orthodontic treatment was carried out before the surgical intervention. The postsurgical orthodontic treatment started within two weeks postoperatively (Figure 1). Cases in the OFA had the standard course of orthodontic decompensation before the planned surgical correction (figure 2)

Patients completed the self-administered 22-item Orthognathic Quality of Life Questionnaire (OQLQ), Generalized Anxiety Disorder Questionnaire (GAD-7) and Patient Health Questionnaire (PHQ-9) at one week preoperatively (T1) and then 6 weeks (T2), and 6 months (T3) postoperatively, during their routine visits to the orthognathic clinic. The OQLQ consists of 22 questions; each is rated on a 5-point scale ranging from “does not bother me at all” (score 0) to “bothers me a lot” (score 4). The total score ranges from 0 to 88, with the lower score indicating a better quality of life. The questionnaire consists of four sub-domains: facial aesthetics (score range 0 to 20), oral function (score range 0 to 20), awareness of dentofacial deformity (score range 0 to 16), and social aspect (score range 0 to 32). The PHQ-9 consists of nine questions, each of which score from 0 to 3. The total score ranges from 0 to 27, with

cut-off points at 5, 10, 15 and 20, representing mild, moderate, moderately severe and severe, levels of depression. The GAD-7 consists of seven questions, each of which score from 0 to 3, providing a total score of 0 to 21. Scores of 5, 10, and 15 are taken as the cut-off points for mild, moderate and severe anxiety.

## Data Analysis

Data were analyzed using the IBM SPSS Statistics version 24 software (Inc., Chicago, IL). The Shapiro-wilk normality test was performed to check that the data conformed to a normal distribution. The means and standard deviations were calculated at T1, T2, and T3 and the changes in OQLQ, PHQ-9 and GAD-7 scores over the time intervals T1-T2, T1-T3 and T2-T3 were evaluated using a paired t-test. Comparisons between the two groups of patients were carried out using a non-paired t-test. The magnitude of the statistical change was determined by Effect Size (ES). The ES was calculated by dividing the mean change in scores by the standard deviation. The ES of less than 0.2 is considered as minimal, 0.2 to 0.49 as small, 0.5 to 0.8 as moderate, and more than 0.8 as large impact. Statistical significance was set at  $P < 0.05$ .

## Results

All 32 patients completed the OQLQ, PHQ-9 and GAD-7 questionnaires at T1, T2 and T3. There was no statistically significant difference in the demographic characteristics between the 2 groups including age, gender, and type of deformity. Prior to surgery the total OQLQ score in the SFA group was lower than in the OFA group ( $P = 0.010$ ). The social domain score was also lower in the SFA group ( $P = 0.007$ ). The scores for the depression and anxiety showed no significant difference between the two groups at T1, T2 or T3.

Changes in the mean OQLQ and domain scores for the SFA and OFA groups are shown in Tables 1 and 2. Over the 6-week interval from T1 to T2, the mean OQLQ and domain scores (except oral function,  $P = 0.055$ ) showed significant reductions for the SFA group, while the mean OQLQ and all domain scores, showed significant reductions in the OFA group. No significant change from T1 to T2 was seen in either group for depression and anxiety scores.

Over the 6-month time interval from T1 to T3, there was a significant reduction in the mean OQLQ score and its sub-domain scores, for both the SFA and OFA groups. The only significant differences found over the period from 6 weeks to 6 months postoperatively (T2-T3) was in social aspects for the OFA group and oral function for the SFA group (table 3). No significant differences were found in depression and anxiety scores for the same periods (T1-T3 and T2-T3).

## Discussion

This study showed that there was a significant improvement in patients' quality of life at 6 weeks and 6 months after orthognathic surgery in both SFA and OFA groups. However, the patients in the OFA group showed a significantly lower quality of life and more deterioration of social aspects immediately before surgery than patients in the SFA group. This is most likely to be due to the negative impact of pre-surgical orthodontic decompensation on facial profile.<sup>17</sup> The studies by Nagasaka et al.,<sup>18</sup> and Hernandez-Alfaro et al.,<sup>19</sup> confirmed that pre-surgical orthodontics may intensify the patient's perception of their facial disharmony.<sup>18, 19</sup> This is in contrast to previous studies comparing SFA and OFA groups, which have shown that the quality of life in the OFA group was better or equal to the SFA group before surgery.<sup>9, 13</sup> This could be explained by the fact that patients in the SFA group in the study by Bruccoli et al.,<sup>13</sup> were suffering from higher level of physical and psychological deterioration related to their dentofacial deformities. In addition, four out of eight patients (50%) in their SFA group had been diagnosed with a personality disorder.<sup>13</sup> In the study by Pelo et al.,<sup>9</sup> information relating to severity of the dentofacial deformity and psychological factors, was missing.<sup>9</sup>

In the present study, the early improvement in quality of life, facial aesthetics and social aspects at 6 weeks following surgery was significant in both groups, which is consistent with the results of previous studies.<sup>20, 21</sup> In addition, the patients in the OFA group showed a significant improvement in awareness of their dentofacial deformity and a moderate improvement in oral function. This is in contrast to other studies, which showed that oral function and awareness of dentofacial deformity did not show significant improvements at 6 weeks following surgery.<sup>20, 21, 22</sup> Oral function in the SFA group showed only a small improvement at 6 weeks following surgery ( $P=0.055$ ,  $ES=0.48$ ) and this could be due to the secondary malocclusion that is often created after surgery in these cases. At 6 weeks post-surgery, both groups showed an improvement in quality of life and social aspects of the OQLQ, with the OFA group showing the greatest improvement. This may well reflect the greater change in facial aesthetics produced by surgery in patients having had pre-surgical decompensation.

In the present study, there was a significant improvement in all domains of OQLQ at 6 months after surgery for both groups. The greatest change found in both the OFA and SFA groups was in facial aesthetics and social aspects. This is consistent with the findings of studies by Sun et al.,<sup>23</sup> and Eslamipour et al.,<sup>24</sup> who also reported the largest changes in facial esthetics and social aspects at five to seven months after surgery.<sup>23, 24</sup> The improvement in awareness of dentofacial deformity was significant in both the OFA group ( $ES = 1.5$ ) and the SFA group ( $ES = 0.8$ ), at 6 months. This shows that the patients' level of concern regarding their facial profile was reduced as a result of surgery in the present study. However, this is in contrast to previous studies, which reported no changes at 6 months.<sup>21, 22, 25</sup>

This study found a significant improvement in oral function for patients in both the OFA group ( $ES = 1.1$ ) and the SFA group ( $ES = 1.0$ ) at 6 months following surgery. By contrast, the study by Rustemeyer et al.,<sup>26</sup> reported no significant change in oral function even after completion of post-surgical orthodontics. However, their study suggested that patients who suffer from extreme malocclusions and severe TMJ symptoms, may have persisted problems after orthognathic surgery.<sup>26</sup> In this study patients in the OFA group continued to show improvement in social aspects ( $ES = 0.8$ )

from 6 weeks to 6 months after surgery, perhaps because they are experiencing the benefits of the correction of their decompensated pre-surgical malocclusion. Patients in the SFA group, on the other hand, showed a significant improvement in oral function ( $ES = 0.8$ ) during the same period which might be explained by the progressive orthodontic correction of their secondary post-surgical malocclusion.

In this study, the application of PHQ-9 and GAD-7 questionnaires revealed no improvement in the levels of anxiety and depression at 6 weeks and 6 months after surgery. These findings suggest that the timing of the surgery has no effect on the measured anxiety and depression. Patients in both groups had psychological assessment prior to surgery and no psychological disorders were identified. The assumption that orthognathic surgery improves all psychological aspects of a patient's life is therefore not supported by this study. This agrees with Brunault et al.,<sup>27</sup> who reported that more than two thirds of patients, who were depressed at baseline, also reported depression at 12 months following surgery, suggesting that orthognathic surgery might improve self-esteem but not all the symptoms of depression.

The motivation for seeking orthognathic surgery may influence the choice of approach for correction. The findings of our study suggest that the OFA may be more suitable for patients who are primarily concerned about quality of occlusion, rather than facial aesthetics. Conversely, the SFA may be more suitable for patients whose main concern is facial appearance. The pre-operative consultation allows the patient to have a realistic expectation and understand the benefits and challenges of each approach. However, the decision should be based on multidisciplinary team assessment.

This study has some limitations. Although statistically significant results were found, the sample size for each group was small. In addition, most patients in both groups had not completed orthodontic treatment at 6 months post-surgery and so had not yet experienced the final result of their treatment. There could also have been bias in subject selection, since the allocation of patients to the two groups was made on clinical grounds and some patients allocated to the OFA group, for example, might not have been considered suitable for SFA due to features of their malocclusion or the type of surgery required. However, this study brings new insights into the different approaches of orthognathic surgery and their impact on the psychosocial status of the patients.

## **Conclusion**

The results obtained in this study showed that both SFA and OFA resulted in an immediate improvement in quality of life and facial aesthetics at 6 weeks after surgery. Pre-surgical orthodontics was shown to cause a deterioration in quality of life and social aspects in the OFA group. The timing of the surgery was shown to have no effect on the symptoms of anxiety and depression.

## **Conflict of interest**

The authors have no conflicts of interest.

## **Ethics statement/confirmation of patients' permission**

Approval was obtained to conduct this study from the West of Scotland Research Ethics Service. We obtained a written consent from all patients and data were anonymised.

## **Acknowledgements**

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## **Legends of the figures:**

**Figure 1:** A cases which has surgery first showing the immediate change in facial appearance. **Figure 2:** The gradual improvement in the occlusion during the postsurgical orthodontic phase.

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Table 1

Table 1. OQLQ and its subdomains, PHQ-9 and GAD-7 scores in SFA group												
Variables	T1	T2	T3	T1-T2			T1-T3			T2-T3		
	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)	<i>P</i>	ES	Mean(SD)	<i>P</i>	ES	Mean(SD)	<i>P</i>	ES
<b>OQLQ</b>	47.33(18.9)	21.61(14.3)	15.29(10.60)	25.72(21.2)	0.000	1.2	31.58(17.8)	0.000	1.7	5.11(10.03)	0.052	0.5
<b>Social</b>	14.39(9.1)	5.83(5.0)	3.88(4.37)	8.56(10.4)	0.003	0.82	10.64(9.1)	0.000	1.1	1.52(4.77)	0.205	0.3
<b>Facial Aesthetic</b>	14.89(4.3)	4.44(4.1)	3.64(2.69)	10.44(5.1)	0.000	2	11.05(4.8)	0.000	2.2	0.411(3.06)	0.587	0.1
<b>Oral Function</b>	10.17(5.8)	7.06(4.4)	4.11(3.64)	3.11(6.4)	0.055	0.48	5.64(5.2)	0.000	1	2.76(3.45)	0.005	0.8
<b>Awareness</b>	7.67(4.6)	4.22(3.1)	3.52(2.74)	3.44(6.08)	0.028	0.56	4.35(5.2)	0.004	0.8	0.47(2.8)	0.530	0.1
<b>PHQ-9</b>	3.33(3.6)	3.22(4.3)	2(2.23)	0.11(4.7)	0.922	0.02	1.41(3.2)	0.090	0.4	1.11(3.4)	0.197	0.3
<b>GAD-7</b>	3.11(3.9)	1.83(2.3)	1.11(1.65)	1.27(2.7)	0.070	0.45	1.64(2.6)	0.080	0.3	0.47(1.3)	0.163	0.3

Table 2

Table 2. OQLQ and its subdomain, PHQ-9 and GAD-7 scores in OFA group

Variables	T1	T2	T3	T1-T2			T1-T3			T2-T3		
	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)	<i>P</i>	ES	Mean(SD)	<i>P</i>	ES	Mean(SD)	<i>P</i>	ES
<b>OQLQ</b>	63.00(11.0)	28.50(18.8)	16.64(14.1)	34.50(21.8)	0.000	1.5	46.35(20.5)	0.000	2.2	11.85(18.9)	0.036	0.6
<b>Social</b>	22.00(6.0)	9.79(7.7)	4.07(4.4)	12.21(9.5)	0.000	1.3	17.92(7.7)	0.000	2.3	5.71(7.1)	0.011	0.8
<b>Facial Aesthetic</b>	17.42(2.4)	6.50(4.6)	4.28(4.1)	10.93(5.0)	0.000	2.1	13.14(5.1)	0.000	2.5	2.21(4.6)	0.10	0.4
<b>Oral Function</b>	12.57(4.7)	7.21(4.8)	4.57(4.1)	5.36(6.8)	0.011	0.7	8(7.08)	0.001	1.1	2.64(5.2)	0.081	0.5
<b>Awareness</b>	10.50(3.7)	5.21(3.4)	3.64(3.0)	5.29(3.9)	0.000	1.3	6.85(4.4)	0.000	1.5	1.57(3.8)	0.147	0.4
<b>PHQ-9</b>	4.85(3.0)	3.42(3.0)	3(2.8)	1.43(4.5)	0.260	0.31	1.85(3.8)	0.097	0.4	0.42(3.6)	0.666	0.1
<b>GAD-7</b>	5.29(5.4)	2.85(2.7)	3.2(4.5)	2.43(5.2)	0.109	0.45	2.07(5.03)	0.147	0.4	0.35(3.5)	0.712	0.1

Table 3

**Table 3.** Comparison of the changes in OQLQ and its subdomain, PHQ-9, GAD-7 scores between the SFA and OFA groups

Variables	T1			T2			T3			T1-T2			T1-T3			T2-T3		
	Mean(SD)	<i>P</i>	ES	Mean(SD)	<i>P</i>	ES	Mean(SD)	<i>P</i>	ES	Mean(SD)	<i>P</i>	ES	Mean(SD)	<i>P</i>	ES	Mean(SD)	<i>P</i>	ES
<b>OQLQ</b>	15.67(15.9)	0.010	0.96	6.89(16.4)	0.249	0.41	1.34(12.3)	0.764	0.3	8.78	0.260	0.40	14.77	0.041	0.7	6.74	0.214	0.3
<b>Social</b>	7.61(7.9)	0.007	0.93	3.95(6.3)	0.090	0.61	0.18(4.3)	0.906	0.09	3.65	0.315	0.35	7.28	0.025	0.8	4.18	0.060	0.5
<b>Facial Aesthetic</b>	2.54(3.6)	0.059	0.68	2.06(4.3)	0.196	0.46	0.63(3.3)	0.606	0.3	0.49	0.788	0.09	2.09	0.253	0.4	1.79	0.207	0.3
<b>Oral Function</b>	2.40(5.4)	0.223	0.43	0.16(4.6)	0.924	0.03	0.45(3.7)	0.743	0.2	2.22	0.350	0.33	2.4	0.286	0.3	0.12	0.939	0.02
<b>Awareness</b>	2.83(4.2)	0.073	0.65	0.99(3.2)	0.403	0.29	0.11(2.8)	0.914	0.06	1.85	0.330	0.34	2.5	0.169	0.4	1.1	0.364	0.2
<b>PHQ-9</b>	1.52(3.4)	0.219	0.43	0.21(3.8)	0.881	0.05	1(2.5)	0.285	0.4	1.32	0.428	0.28	0.74	0.572	0.2	0.69	0.591	0.2
<b>GAD-7</b>	2.17(4.6)	0.200	0.45	1.02(2.5)	0.270	0.39	2.09(3.08)	0.086	0.4	1.16	0.420	0.28	1.6	0.216	0.3	0.12	0.898	0.03

Figure 1

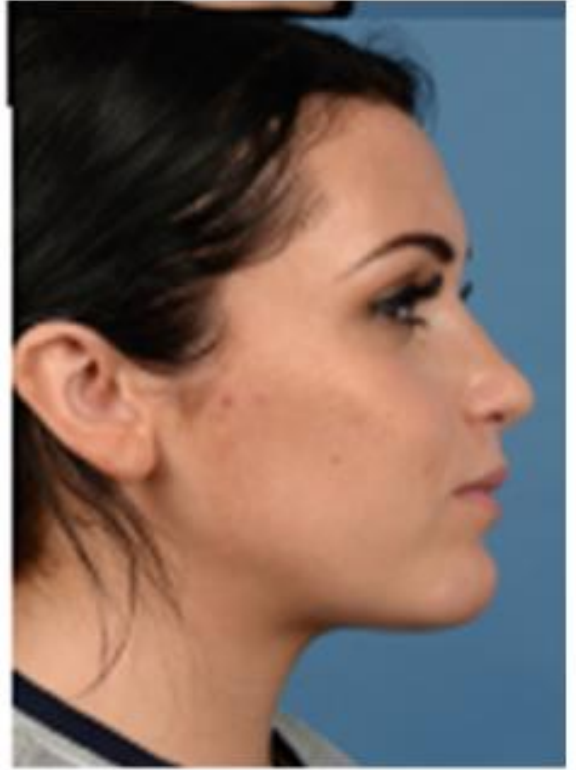
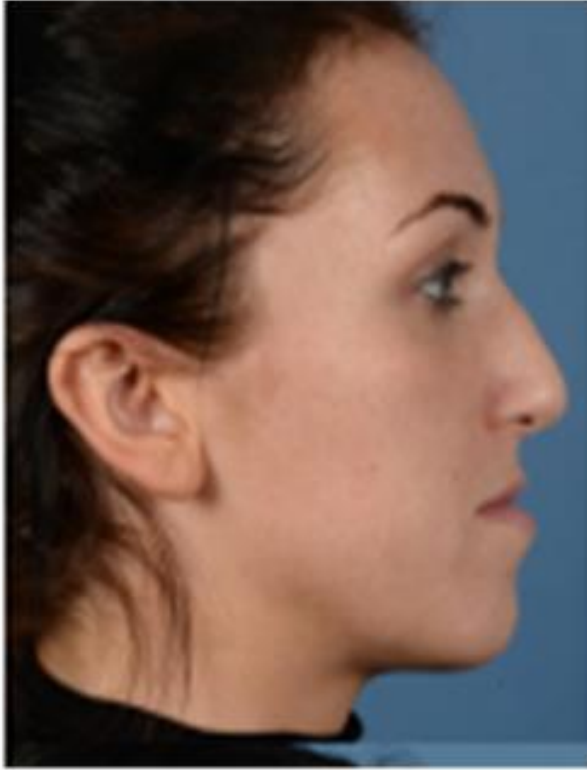


Figure 2

