Original article

Anxiety and post-traumatic stress symptoms in orthognathic surgery patients

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Summary

Objective: To assess the impact of orthognathic surgery in terms of anxiety and stress levels in pre-treatment and post-treatment groups compared with controls and the role of previous trauma exposure on anxiety and stress levels following treatment.

Materials and methods: A case–control study was performed involving three age-gender matched groups: 38 ‘pre-surgery’, 39 ‘post-surgery’ and 39 ‘control’ subjects. All subjects had assessment of dental anxiety, post-traumatic stress responses and frequency of previous distressing events. Seventeen subjects were followed up prospectively for 1 year after surgery.

Results: ‘Post-surgery’ group reported lower dental trait anxiety (S-DAI) scores than other groups (P = 0.001). S-DAI was significantly associated with frequency of previous traumatic events in ‘pre-surgery’ and ‘post-surgery’ groups (P < 0.01), and was significantly associated with post-traumatic stress disorder (PTSD) symptoms in ‘pre-surgery’ subjects (P < 0.01) who had the highest PTSD symptoms among the three groups (P = 0.005). Symptom severity (IES-R) levels were significantly associated with frequency of previous distressing dental events in ‘pre-surgery’ (P < 0.05) and ‘post-surgery’ groups (P < 0.01). Post-operative S-DAI and IES were significantly associated with pre-operative PTSD symptoms (P < 0.01).

Conclusions: The two orthognathic groups were associated with low levels of anxiety and PTSD symptoms in comparison with the control group of the study. Trauma exposure prior to orthognathic treatment can be considered as a risk factor for the development of dental anxiety and PTSD symptoms. The need to improve communication between patients and team is emphasized, especially during the assessment of patients’ emotional state pre-operatively, in addition to discussing psychological issues and psychosocial treatment implications.

Introduction

Orthognathic surgery has a significant impact on patients with dentofacial deformities, as problems with body image are profound and lead to lower self-esteem and poor psychological well-being (1). Although the range of motivating factors for orthognathic surgery is generally linked to the deformity, in a few patients, it might be related to a complex array of other factors (2). Several studies investigated various psychosocial implications of orthognathic surgery, which was found to have a positive impact on the personal and social attitude and behaviour of patients (3–5). It was also associated with an improvement in patients’ oral health-related quality of life levels, involving the functional and aesthetic aspects (6–9).

Evidence from studies in the medical literature suggests that certain medical events and surgical procedures (child birth, heart transplant, and other procedures) have the capacity to confront the individual with horror, helplessness, and fear and create symptoms similar to those seen in individuals with post-traumatic stress disorder (PTSD) (10, 11). Such medical events when experienced by highly anxious individuals with a history of past exposure to horrific
medical events resulted in trauma-related sequelae that can be observed in individuals suffering from PTSD.

Only a few studies have investigated the effect of oral surgical procedures on post-traumatic symptoms and associated anxiety, with the main focus being on the psychological impact of the surgical removal of wisdom teeth (12). Jongh et al. (13) found that pain and frequency of previous traumatic experiences were found to increase the risk for the development of symptoms of anxiety and post-traumatic stress among their patients who underwent surgical removal of third molars. In another study, Jongh et al. (14) found that surgical removal of a third molar has minimal impact on the development of dental anxiety or symptoms of psychological trauma in individuals with moderate pre-operative anxiety levels.

Despite the favourable impact of orthognathic surgery on patients, it can be associated with life threatening complications (15, 16). It has been shown that orthognathic patients experience significantly higher levels of social anxiety than the general population (17). Moreover, orthognathic patients may require treatment in the intensive care unit during the immediate post-surgical period, which can lead to the development of PTSD and its related symptoms (18).

Breslau and Anthony (19) reported the sensitizing effects of a prior trauma on the PTSD response to a subsequent trauma, and this could be the case for orthognathic patients. However, there is paucity of information on the relationship between orthognathic surgery and PTSD and the information is limited mainly to case reports (20). Furthermore, identifying orthognathic patients who are at risk from developing PTSD could greatly help to reduce the incidence and severity of this disorder and hence improve the treatment outcome. Therefore, the aim of this study was to assess the impact of orthognathic surgery in terms of anxiety and stress levels in pre-treatment and post-treatment groups compared with controls and the role of previous trauma exposure on anxiety and stress levels following treatment.

Subjects and methods

This study was approved by the Clinical Research Ethics Committee of the University of Jordan and followed the guidelines of the Helsinki II Declaration. Consecutive Jordanian patients from the Department of Oral & Maxillofacial Surgery, University of Jordan Hospital were recruited for this study.

The study involved two experimental groups and one control group (Table 1). The pre-surgery group were consecutive patients referred by orthodontists for orthognathic surgery from October 2010 to October 2012. The post-surgery group included patients who had orthognathic intervention during the years 2008–11, with an average follow-up period of 21 months after completing their treatment, with a minimum follow-up period of 6 months. All patients in this group had completed their orthodontic treatment and did not have orthodontic fixed appliances at the time of investigation. The control group was formed by patients attending outpatient dental clinics of University of Jordan Hospital during the same period for routine oral health care, with no congenital deformity, physical disabilities, symptoms of body pain, or previous jaw surgery, and with good maxillomandibular relations and normal occlusion. This group was selected by questioning the patients before any treatment. In the pre-surgery group, 17 patients were followed up to 1 year after completing the surgical procedure.

Inclusion criteria for the experimental groups were adults diagnosed with moderate to severe malocclusion or dentofacial deformities that were beyond the scope of orthodontic treatment alone and required surgical correction judged clinically by the oral maxillofacial surgeon and by one of the orthodontists who treated the patients in this study. Exclusion criteria were as follows: Those with facial deformities due to trauma or clefts, congenital malformation, craniofacial syndromes, psycho-organic disorders, behaviour disorders, and systemic arthritis or muscular disease were not included in the study. All patients were given the same, verbal and written, pre-operative and post-operative instructions and information and had similar reassurance methods by the team.

Subjects in the treatment group underwent pre- and post-surgical orthodontic treatment that was carried out by three consultant orthodontists using the same bracket system (022 slot straight wire system, MBT prescription) with very similar archwire sequencing. Orthognathic surgery was undertaken by one oral maxillofacial surgeon, and all patients had uneventful recoveries with no significant complications such as infection, condylar resorption, or relapse. Subjects from all groups were asked to participate in the study and provided written consent before the investigation.

All subjects were categorized as ASA 1 (normal healthy patient) or ASA 2 (patient with mild systemic disease), according to the American Society of Anesthesiologists (21). All subjects were given a questionnaire booklet to be completed in the waiting room which was collected by the researchers on the same visit. Subjects in the pre-surgery group had their evaluation appointment scheduled an average of 7 days prior to surgery (range 5–10 days), while 17 patients from this group were followed up at 1 year after their orthognathic intervention.

Subjects in the post-surgery group had their evaluation after completion of surgery, with an average follow-up period of 21 months,

### Table 1. Characteristics of the three groups.

<table>
<thead>
<tr>
<th></th>
<th>Pre-surgery group, N = 38</th>
<th>Post-surgery group, N = 39</th>
<th>Control group, N = 39</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>14 (36.8%)</td>
<td>12 (30.8%)</td>
<td>21 (53.8%)</td>
</tr>
<tr>
<td>Female</td>
<td>24 (63.2%)</td>
<td>17 (49.2%)</td>
<td>18 (46.2%)</td>
</tr>
<tr>
<td><strong>Diagnosis</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mandibular prognathism</td>
<td>24 (57.9%)</td>
<td>24 (61.5%)</td>
<td></td>
</tr>
<tr>
<td>Mandibular retrognathism</td>
<td>4 (10.5%)</td>
<td>6 (15.4%)</td>
<td></td>
</tr>
<tr>
<td>Anterior open bite</td>
<td>3 (7.9%)</td>
<td>1 (2.6%)</td>
<td></td>
</tr>
<tr>
<td>Facial asymmetry</td>
<td>1 (2.6%)</td>
<td>2 (5.1%)</td>
<td></td>
</tr>
<tr>
<td>Vertical maxillary excess</td>
<td>8 (21.1%)</td>
<td>6 (15.4%)</td>
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</tbody>
</table>
and a minimum follow-up period of 6 months, and subjects in the control group had their evaluation during the same period.

Since undertaking orthognathic surgery has an impact on dental aesthetics and oral function, the severity of dental anxiety was assessed using the dental anxiety inventory (S-DAI), which is a 36-item scale measuring dental anxiety (22). Responses are scored 1–5, giving total scores ranging from 36 (not anxious at all) to 180 (extremely anxious). Cronbach’s alphas in the current study for the S-DAI was 0.755 in the pre-surgery group, 0.759 in the post-surgery group, and 0.757 in the control group.

Precipitating level of trauma exposure was assessed by the Level of Exposure-Dental Experiences Questionnaire (LOE-DEQ), a self-report checklist inquiring about potentially overwhelming events (23). This inventory allows for calculating separate trauma scores with respect to 16 potential traumatic dental experiences and 7 general traumatic life events fulfilling the DSM-IV-TR stressor criterion (24). Participants are requested to indicate, using a yes/no response format; whether they had ‘ever’ (1) or ‘never’ (0) experienced any of these events. Items are scored and summed to give an overall frequency score ranging from 0 to 7 for general traumatic experiences and 0 to 16 for dental traumatic experiences. Cronbach’s alpha was 0.68 in the pre-surgery group, 0.773 in the post-surgery group, and 0.734 in the control group.

The Trauma Screening Questionnaire (TSQ) was used to screen for PTSD (25). The TSQ has 10 items covering re-experiencing or arousal symptoms of PTSD. Subjects are asked to tick either ‘yes’ (1) or ‘no’ (0). The TSQ has been found to be accurate at detecting both current PTSD and the risk of future PTSD (25). Cronbach’s alpha in the current study for the TSQ was 0.74 in the pre-surgery group, 0.732 in the post-surgery group, and 0.763 in the control group.

Post-operative PTSD symptomatology and measurement of its severity was assessed using the Impact of Event Scale-Revised (IES-R), which consists of 22 items constituting the subscales intrusions, avoidance, and hyperarousal (26). When scoring the IES-R, subjects are asked to indicate the frequency of symptoms during the past 7 days. The frequency of each symptom is scored using a 5-point (0–4) response format with equal intervals, ranging from ‘not at all’ (0) to ‘very much’ (5). The scores can be summed to produce a total IES-R score (range 0–110) with a higher score indicating a greater severity of post-traumatic stress phenomena. Cronbach’s alpha of in the present study was 0.755 in the pre-surgery group, 0.75 in the post-surgery group, and 0.765 in the control group.

All statistical analyses were performed using the statistical software SPSS version 15 (SPSS, Chicago, Illinois, USA). The results were analysed by one-way analysis of variance (ANOVA). Multiple comparisons between groups were performed by post hoc Tukey test and paired sample t-test was used to compare subjects mean scores pre and post-operatively. Frequency of primary diagnoses and differences on demographic variables among the three groups were determined using chi-squared tests. Pearson correlations test was used to determine the nature and degree of relationships between quantitative variables. Finally, Cronbach’s alpha coefficients were computed to evaluate the reliability of the measures. A statistical significance was set at 5% level of significance ($P < 0.05$).

An overall type of power analysis for one way ANOVA was calculated based on the following arguments: number of groups equals 3, overall sample size equals 116, effect size equals 0.5, and significance level equals 0.01. The power of study was found to be 0.99. The website (http://webpower.psychstat.org) was used for the calculation of power of study.

**Results**

The response rate was 95% (39/41) of the post-surgery group, 88% (38/43) of the pre-surgery group, and 90% (39/43) of the control group. The final sample consisted of 116 subjects in the three study groups, with 38 subjects in the pre-surgery group [14 male (M), 24 female (F)], 39 in the post-surgery group (12 M, 17 F), and 39 in the control group (21 M, 18 F) (Table 1).

There was no statistical difference between the three groups in terms of age, gender, or between the two groups of patients with deformities according to their diagnosis.

Most patients in the three groups reported exposure to at least one general traumatic life event or a distressing dental event (92% of pre-surgery subjects, 90% of post-surgery subjects and 95% of control subjects). However, there was no significant difference in the prevalence of traumatic life or dental events among the three experimental groups (Table 2). Mean scores for S-DAI, LOE-DEO, IES-R, and TSQ are shown in Table 2.

There was a significant association between dental trait anxiety and frequency of previous traumatic life events in the pre-surgery group ($P < 0.01$) (Table 3). There was also a significant association between dental trait anxiety and frequency of previous distressing dental events ($P < 0.01$) as well as traumatic life events in the post-surgery group ($P < 0.01$).

With regard to PTSD symptom level, subjects in the pre-surgery group were found to have higher levels compared to those in the post-surgery group and significantly higher than those in the control group ($P = 0.004$). PTSD symptom levels were significantly associated with S-DAI in the pre-surgery group ($P < 0.01$).

Patients in the post-surgery group reported lower symptom severity levels (IES-R) than patients in the pre-surgery group, however, the difference was not significant. On the other hand, symptom severity (IES-R) levels were significantly associated with the frequency of previous distressing dental events in the pre-surgery ($P < 0.05$) and post-surgery groups ($P < 0.01$).

The mean pre-operative scores of S-DAI, PTSD symptoms, and symptom severity levels IES were compared with the post-operative scores for 17 patients 1 year after completion of their surgical treatment. The mean scores for these patients improved post-operatively (Figure 1), although this difference was not significant. While the post-operative S-DAI and symptom severity levels IES were significantly associated with the PTSD symptom level pre-operatively ($P < 0.01$) (Table 4).

**Discussion**

The results of the present study indicate that patients with dentofacial deformities who are awaiting their surgical orthognathic treatment experience increased levels of emotional distress. These findings are consistent with those of Bertolini et al. (27), who reported that all of their patients experienced medium to high levels of pre-surgical anxiety. The severity of anxiety among our patients was related to the magnitude of past exposure to traumatic life events. After completion of the surgical treatment, patients were found to respond favourably to this potentially stressful surgical encounter, however, their emotional distress levels were also determined by the degree of exposure to previous traumatic situations.

Interestingly, when comparing the dental anxiety levels among the three study groups, patients in the control group reported the highest levels, with the lowest dental anxiety found among patients in the post-surgery group. A possible explanation for that could be...
Table 2. Mean score scores and pair-wise comparisons of the three experimental groups.

<table>
<thead>
<tr>
<th></th>
<th>Pre-surgery versus post- surgery</th>
<th>Pre-surgery versus control</th>
<th>Post-surgery versus control</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-DAI</td>
<td>70.53 (± 7.25)</td>
<td>69.31 (± 7.76)</td>
<td>62.71 (± 29.06)</td>
</tr>
<tr>
<td>LOE-DEO total score</td>
<td>7.86 (± 3.38)</td>
<td>6.28 (± 4.44)</td>
<td>6.03 (± 2.39)</td>
</tr>
<tr>
<td>Number of distressing dental events</td>
<td>7.03 (± 5.36)</td>
<td>3.92 (± 3.92)</td>
<td>0.83 (± 0.92)</td>
</tr>
<tr>
<td>IES-R</td>
<td>13.89 (± 13.27)</td>
<td>11.79 (± 11.86)</td>
<td>11.36 (± 11.39)</td>
</tr>
<tr>
<td>TSQ</td>
<td>2.59 (± 2.44)</td>
<td>1.92 (± 1.92)</td>
<td>1.54 (± 2.07)</td>
</tr>
</tbody>
</table>

S-DAI, Short version of the Dental Anxiety Inventory; LOE-DEO, Level of Exposure-Dental Experiences Questionnaire; IES-R, Impact of Event Scale-Revised version; TSQ, Trauma Screening Questionnaire. Asterisks denote statistically significant (* post hoc P = 0.001). Multiple comparisons between groups were performed by post-hoc Tukey test and paired sample t-test was used to compare subjects mean scores pre- and post-operatively.

• These findings underline the need to improve communication between patients and team especially during the assessment of the emotional state of patients pre-operatively.

In conclusion, the results of the present study indicate that:

- The two orthognathic groups were associated with low levels of anxiety and PTSD symptoms in comparison with the control group of the study.
- The magnitude of trauma exposure prior to orthognathic treatment can be considered as a risk factor for the development of dental anxiety and PTSD symptoms among patients awaiting surgery.
- These findings underline the need to improve communication between patients and team especially during the assessment of the emotional state of patients pre-operatively.

Limitations of the study

The first limitation refers to the case–control design of the first part of the study. This design enabled the comparison between the three age–gender matched groups and significant associations were found. However, a prospective longitudinal study to assess changes in anxiety and PTSD symptom levels at different time points post-operatively with a larger number of patients can provide a better analysis of the patients' progress and the possible risk factors. To compensate for that, further analysis was performed on 17 of our patients who had a prospective assessment one year after completing their treatment. The second limitation was related to the post-surgical recovery of patients in the post-surgery group, which was uneventful with no significant surgical complications. As a result, the possible effect of complications on patient’s anxiety and PTSD symptom levels could not be investigated. The third limitation was the sample size and the lack of matching of patients according to the type orthognathic surgical procedure.

In conclusion, the results of the present study indicate that:

- The two orthognathic groups were associated with low levels of anxiety and PTSD symptoms in comparison with the control group of the study.
- The magnitude of trauma exposure prior to orthognathic treatment can be considered as a risk factor for the development of dental anxiety and PTSD symptoms among patients awaiting surgery.
- These findings underline the need to improve communication between patients and team especially during the assessment of the emotional state of patients pre-operatively. Furthermore, the psychological issues and psychosocial implications of treatment...
should be addressed in detail, in addition to the information about the technical details and outcome of the operation, which can be enhanced by the inclusion of psychiatrists in the orthognathic team.

References


Table 3. Univariate associations between psychological variables on the one hand, and the PTSD symptoms and dental trait anxiety on the other hand for subjects in the pre-surgery and post-surgery groups.

<table>
<thead>
<tr>
<th></th>
<th>Pre-surgery group</th>
<th>Post-surgery group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IES-R</td>
<td>S-DAI</td>
</tr>
<tr>
<td>Frequency of previous distressing dental events</td>
<td>0.545*</td>
<td>0.268</td>
</tr>
<tr>
<td>Frequency of previous traumatic life events</td>
<td>0.432</td>
<td>0.737**</td>
</tr>
<tr>
<td>S-DAI</td>
<td>0.743**</td>
<td>—</td>
</tr>
<tr>
<td>TSQ</td>
<td>0.814**</td>
<td>0.692**</td>
</tr>
</tbody>
</table>

S-DAI, Short version of the Dental Anxiety Inventory; IES-R, Impact of Event Scale-Revised version; TSQ, Trauma Screening Questionnaire.

*Correlation is significant at the 0.05 level (two-tailed).
**Correlation is significant at the 0.01 level (two-tailed).

Table 4. Univariate associations between psychological variables for 17 subjects before their surgery (T0) on the one hand, and their PTSD symptoms and dental trait anxiety scores 1 year after surgery (T1) on the other hand.

<table>
<thead>
<tr>
<th></th>
<th>IES-R (T1)</th>
<th>S-DAI (T1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of previous distressing dental events (T0)</td>
<td>0.389</td>
<td>0.345</td>
</tr>
<tr>
<td>Frequency of previous traumatic life events (T0)</td>
<td>0.28</td>
<td>0.455</td>
</tr>
<tr>
<td>S-DAI (T0)</td>
<td>0.589**</td>
<td>0.692**</td>
</tr>
<tr>
<td>TSQ (T0)</td>
<td>0.691**</td>
<td>0.680**</td>
</tr>
</tbody>
</table>

S-DAI, Short version of the Dental Anxiety Inventory; IES-R, Impact of Event Scale-Revised version; TSQ, Trauma Screening Questionnaire.

*Correlation is significant at the 0.05 level (two-tailed).
**Correlation is significant at the 0.01 level (two-tailed).