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Original Article

Evaluating the impact of orthognathic surgery on mental health, function, and quality of life

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Depression;
Facial satisfaction

Abstract *Background/Purpose:* Prior research highlights the psychological burden of facial deformities, yet there remains a lack of evidence regarding which postoperative variables most strongly influence mental well-being. This study explored the relationship between psychological status, physical function, and quality of life in patients with craniofacial malocclusion undergoing orthognathic surgery, aiming to identify predictors of psychiatric referral and patient satisfaction.

Materials and methods: A retrospective, single-center study was conducted at Chung Shan Medical University Hospital, reviewing 60 de-identified medical records of patients who received orthognathic surgery between 2019 and 2024. Variables assessed included pain, oral function, anxiety, depression, body image, facial satisfaction, and quality of life, using validated scales. Spearman correlation analyses were used, followed by binary logistic regression with psychiatric referral as the outcome variable.

Results: Significant correlations were found between oral function and depression (negative), and between oral function and mood disturbance (positive). Quality of life was significantly associated with emotional stability, while facial satisfaction was positively correlated with self-image. Logistic regression analysis identified facial satisfaction as a significant negative predictor of psychiatric referral (OR = 0.64, 95 % CI: 0.45–0.92, $P = 0.021$). Other predictors, including eating difficulty and psychological distress scores, did not reach statistical significance.

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Conclusion: Orthognathic surgery exerts a multifaceted impact on patients' emotional well-being, self-perception, and life quality. Postoperative functional and aesthetic improvements are associated with improved psychological outcomes, especially self-image and emotional stability. Among various predictors, patient satisfaction with facial appearance and function was the strongest factor in reducing psychiatric referral needs.

Introduction

The etiology of dentofacial malocclusion can stem from dental alignment issues or congenital skeletal discrepancies. Management options include orthodontic treatment alone or in combination with orthognathic surgery. Patients with dentofacial deformities often aspire to achieve a facial appearance comparable to that of individuals without such anomalies. This desire influences their interpersonal relationships, social engagement, personality traits, and overall quality of life, often leading to introversion, conservativeness, or even feelings of inferiority. Therefore, psychological evaluation prior to orthognathic surgery is essential.

Previous studies have indicated that approximately 25 % of patients may require psychiatric evaluation before undergoing orthognathic surgery.[1] Postoperatively, patients often experience challenges in adapting to their altered facial appearance, which may affect their psychological well-being and satisfaction levels.[2] These findings underscore the importance of assessing patients' psychological satisfaction both before and after surgical intervention as part of healthcare quality evaluation.

Patients typically seek orthognathic surgery to improve self-confidence, facial esthetics, and oral function. Most patients report an enhanced quality of life (QoL) following the procedure.[3] However, another study found no clear association between craniofacial deformities and psychiatric disorders prior to surgery, although symptoms such as anxiety or depression may emerge after the operation.[4] A multidimensional survey further demonstrated that orthognathic surgery leads to significant improvements in QoL, self-esteem, and emotional stability, reinforcing its positive psychological impact. Nonetheless, persistent depressive symptoms in a subset of patients highlight the need for psychological support throughout the treatment process.[5]

The type of orthognathic procedure performed can influence patients' satisfaction with the treatment outcome. From an aesthetic perspective, maxilla-only surgery improves midfacial proportions, mandible-only surgery enhances lower facial balance, and bimaxillary surgery yields the most comprehensive facial improvements.[6] While these assessments are generally made from a clinician's viewpoint, surgical approach may also affect patients' psychological acceptance of the outcomes. For instance, complex bimaxillary orthognathic surgeries, including concurrent intranasal and other procedures, have been associated with high patient satisfaction.[7]

Studies comparing skeletal Class II and Class III patients have shown that those with Class III malocclusion tend to feel more insecure about their facial appearance. This may be because Class II patients can consciously protrude the mandible to mask their skeletal discrepancy, potentially reducing psychological distress.[8,9] In patients with facial asymmetry, there were no significant differences in Rosenberg's Self-Esteem (RSE) and quality of life (QoL) scores overall; however, female patients showed significantly lower scores in both self-esteem and QoL.[10]

The aim of this study was to explore the changes in psychiatric status, physical condition, and quality of life in patients with craniofacial malocclusion who have undergone orthognathic surgery. Using patient medical records, a multidimensional analysis will be conducted to investigate the correlations between physical and psychological status, life quality, and self-perception of appearance post-treatment.

Materials and methods

Study design

This retrospective, single-center study was conducted at the Department of Orthodontics, Chung Shan Medical University Hospital, Taichung, Taiwan. The electronic medical records of all patients who underwent orthognathic surgery between 2019 and 2024 were reviewed. A total of 60 fully documented cases were collected, each with at least 6 months of postoperative follow-up. Patient records were de-identified prior to analysis. The distribution of sex, age, and surgical type is shown in Table 1.

Inclusion and exclusion criteria

Inclusion criteria consisted of patients aged over 18 years who underwent bilateral sagittal split osteotomy (BSSO), Le Fort I osteotomy, or bimaxillary surgery, with a postoperative follow-up period of at least 6 months.

The exclusion criteria included patients who had undergone other craniofacial surgeries unrelated to orthognathic procedures or secondary surgeries for facial trauma; those with severe systemic or psychiatric conditions, such as neurological disorders, developmental disabilities, or mental retardation; and patients diagnosed with oral cancer.

Table 1 Baseline demographic data of participants.

Age distribution	Male number	Female number
< 21 years	1	0
21–25 years	8	15
26–30 years	8	17
31–35 years	5	5
36–40 years	0	3

Ethical considerations

This study was approved by the Institutional Review Board of Chung Shan Medical University Hospital (IRB approval no. CSMUH CS1-25043).

Variable definitions

Table 2 presents the definitions of variables collected and analyzed in this study, categorized into three main sections.

Section A: physical condition & functional assessment

A-1: Pain score — Assessed using a visual analogue scale (VAS) ranging from 0 to 10. A-2: Oral function (eating, speaking, swallowing) — Recorded as a binary variable (Yes/No).

Section B: psychological assessment

B-1: Hospital Anxiety and Depression Scale (HADS) — Scored using a 4-point Likert scale (1–4); treated as a continuous variable. B-2: Body Image Scale (BIS) — Satisfaction with facial appearance measured on a 5-point Likert scale; perception of change recorded as a binary variable. B-5: Psychiatric referral need — Postoperative need for psychiatric intervention, recorded as a binary variable (Yes/No).

Section C: quality of life assessment

C-1: Short Form-36 (SF-36) — Assesses multiple life domains using 5-point Likert scales. C-2: FACE-Q — Evaluates satisfaction with facial appearance and function.

Statistical analysis

All statistical analyses were conducted using SPSS software, version 29 (IBM Corp., Armonk, NY, USA). The variables were categorized as follows: A1: pain level, A2: oral function, B1-1: anxiety, B1-2: depression, B1-3: mood, B2: self-image and body image, C1: quality of life, C2: satisfaction with facial appearance and function. Correlations among these variables were assessed using Spearman's rank correlation coefficient for categorical explanatory and outcome variables. Multivariate analyses of key outcome variables were performed using binary logistic regression. A *P*-value of <0.05 was considered statistically significant. A gender subgroup analysis was conducted using the Mann–Whitney U test to compare outcomes between male and female participants. The variables assessed included current pain level (A1), eating difficulty (A2), average psychological distress (B1_avg), and facial satisfaction and function (C2_avg).

Results

Univariate correlation and group comparisons

The outcomes of all analyzed parameters are presented in Figs. 1–7. Comprehensive summary of all variable comparison results (Table 3).

Statistically significant differences ($P < 0.05$) were observed in several correlations. A2 versus B1-1 (Eating Difficulty and Anxiety) and A2 versus B1-2 (Eating Difficulty and Depression) both demonstrated negative correlations (Fig. 2A and B), indicating that patients experiencing greater eating difficulties were more likely to report higher levels of anxiety and depression. A2 versus B1-3 (Eating

Table 2 Definition of collected data variables.

Category	Variable name	Description
A1	Pain_A1_week1, pain_A1_current	Pain level (by visual analogue scale)
A2	Eating_difficulty_A2, eating_difficulty_current_A2	Postoperative oral function
B1	Anxiety_B1_current, epression_B1_current, mood_B1_current, Stress_B1_current + B1_avg._current	Anxiety and depression
B2	Self image_B2	Self-image & body image (BIS)
B5	Psych referral_B5	After surgery, did you require psychiatric intervention
C1	Quality of life assessment	Quality of life assessment
C2	FACEQ_C2, facial_function_C2	Satisfaction with facial appearance and function

A1: pain level. A2: oral function.
B1: anxiety and depression. B2: self-image & body image. B5: psychiatric intervention.
C1: quality of life. C2: satisfaction with facial appearance and function.
Avg: average.

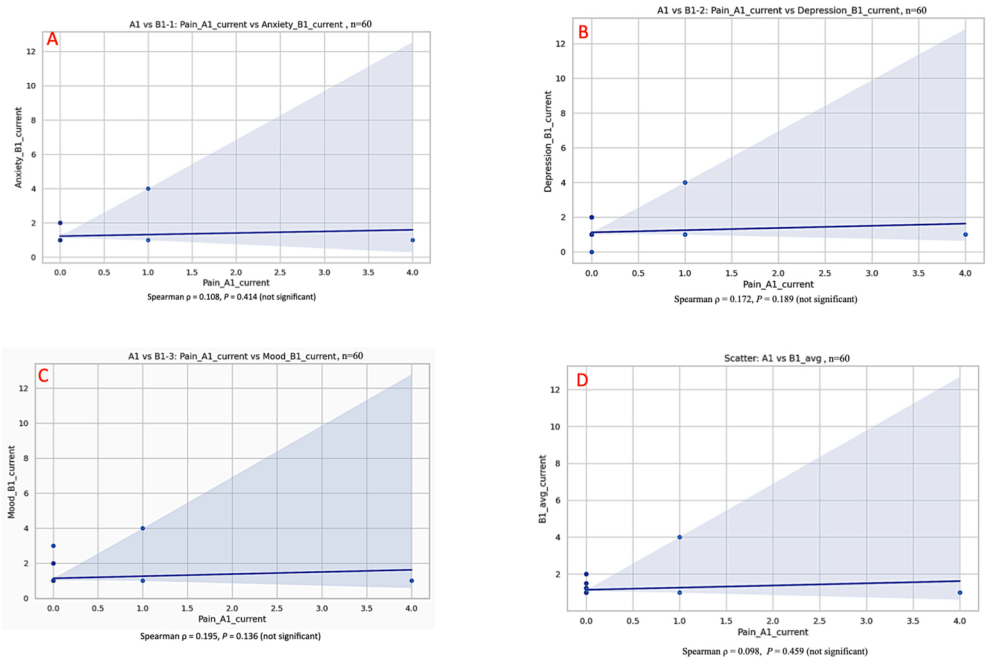


Figure 1 A. it shows the correlation plot of A1 vs B1-1 (pain and anxiety). A positive trend is observed but not statistically significant, indicating no linear relationship between pain and anxiety. B. It illustrates the correlation between A1 and B1-2 (pain and depression). Although no statistically significant relationship was found, the data show a slight positive trend. C. It presents the correlation between A1 and B1-3 (pain and mood). A weak positive correlation was observed, but the association between mood fluctuation and pain did not reach statistical significance. D. The scatter plot of A1 (pain) and the average B1 psychological score shows a flat trend, supporting the absence of a significant linear or rank correlation.

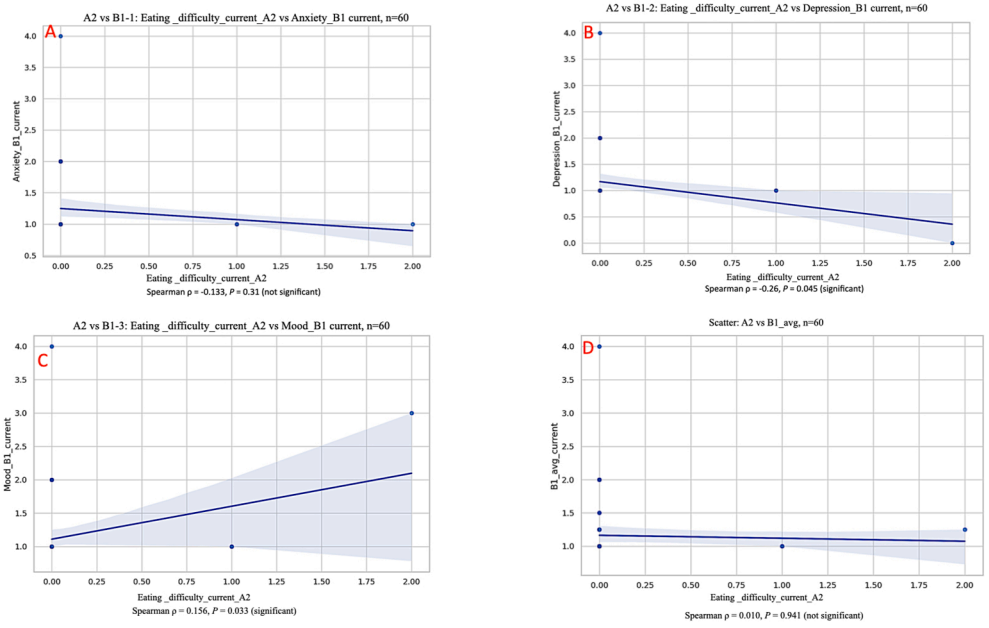


Figure 2 A. A2 vs B1-1 (eating difficulty and anxiety) presents a negative association was observed, suggesting that patients experiencing more eating difficulties tended to report higher anxiety levels. However, the correlation did not reach statistical significance, indicating that this relationship may be weak or inconsistent in the current sample. B. A2 vs B1-2 (eating difficulty and depression) presents a significant negative correlation was found, indicating that individuals with eating difficulties were more likely to experience higher levels of depression. C. It presents the correlation between A2 vs B1-3 (eating difficulty and mood). A significant positive correlation was observed, suggesting that functional impairments are associated with greater emotional dysregulation. D. A2 (eating difficulty) and Average B1 psychological score: The data points are widely scattered with no clear clustering or discernible slope. The scatter plot and box plot indicate that psychological stress levels are widely distributed among participants regardless of whether they experienced eating difficulties. There is no clear clustering or trend between the two groups.

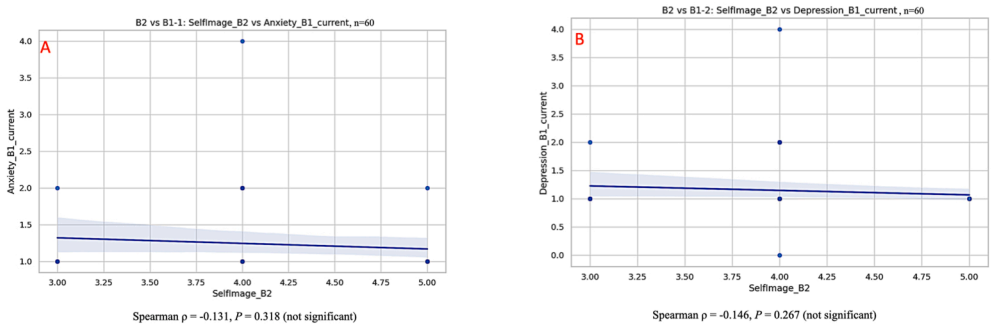


Figure 3 A. B2 vs B1-1 (body image and anxiety): The analysis revealed no statistically significant correlation between self-perceived body image and anxiety levels. This suggests that variations in body image perception were not consistently associated with changes in anxiety among the participants. B. B2 vs B1-2 (body image and depression): The correlation analysis indicated no statistically significant association between self-perceived body image and depression. This implies that differences in body image perception were not reliably linked to depressive symptoms in this sample.

Difficulty and Mood) showed a positive correlation (Fig. 2C), suggesting that functional impairments are associated with greater emotional dysregulation. Additionally, C1 versus B1-3 (Quality of Life and Mood) revealed a negative correlation (Fig. 4C), implying that better perceived quality of life is linked to greater emotional stability. A negative correlation was also found between C2 and B1 (Facial Satisfaction and Average Psychological Distress) in Fig. 6A, suggesting that while higher facial satisfaction may be associated with reduced psychological distress, the relationship was not strong or consistent within this sample. Finally, C2 versus B2 (facial satisfaction and body image) demonstrated a significant positive correlation (Fig. 6C), indicating that greater satisfaction with facial appearance and functional recovery is associated with a more positive self-image.

Gender-based analysis of psychological and functional outcomes

Among the psychological and functional outcome variables assessed, only eating difficulty (A2) showed a statistically significant difference ($P = 0.046$), with female participants reporting more difficulty (Table 4). No significant gender differences were found for pain level (A1), psychological distress (B1_avg), or facial satisfaction and function (C2_avg). These findings support the inclusion of gender-sensitive considerations particularly regarding post-operative functional support.

Multivariate logistic regression analysis

To further investigate the effect of multiple predictors on psychiatric referral (B5), binary logistic regression was conducted. Variables showing significant or borderline significance in univariate analysis—namely A2 (oral function difficulty), C2 (facial satisfaction), B1 (psychological distress index), and B2 (self-image)—were included in the model.

The results of the regression model (Fig. 7) as follows: Facial satisfaction (C2) demonstrated a significant negative association with psychiatric referral need (OR = 0.64; 95 % CI: 0.45—0.92; $P = 0.021$), indicating that greater satisfaction with facial appearance and functional recovery reduced the likelihood of psychiatric intervention. Eating Difficulty (A2) showed a positive trend toward increased psychiatric referral need (OR = 1.45; 95 % CI: 0.83—2.51; $P = 0.191$), though this did not reach statistical significance. Average psychological distress score (B1): OR = 1.08; 95 % CI: 0.87—1.34; $P = 0.482$. Self-Image score

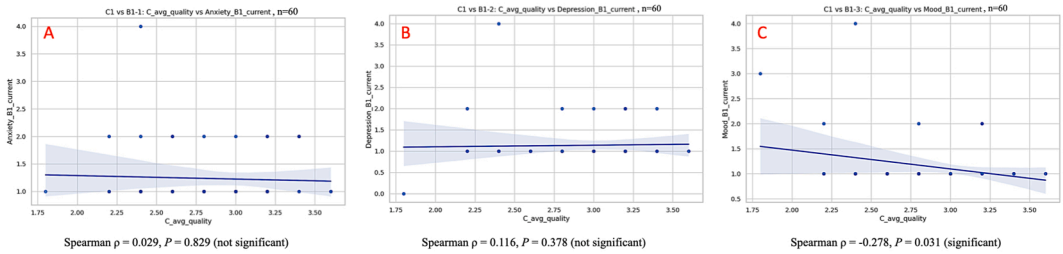


Figure 4 A. C1 vs B1-1 (quality of life and anxiety): The correlation analysis showed no statistically significant association between overall quality of life and anxiety. This suggests that variations in perceived life quality did not meaningfully correspond to anxiety levels in the current sample. B. C1 vs B1-2 (quality of life and depression): No statistically significant correlation was found between overall quality of life and depression, indicating that perceived life quality did not show a consistent relationship with depressive symptoms in this sample. C. C1 vs B1-3 (quality of life and mood): A significant negative correlation was observed, indicating that better perceived quality of life is associated with greater emotional stability.

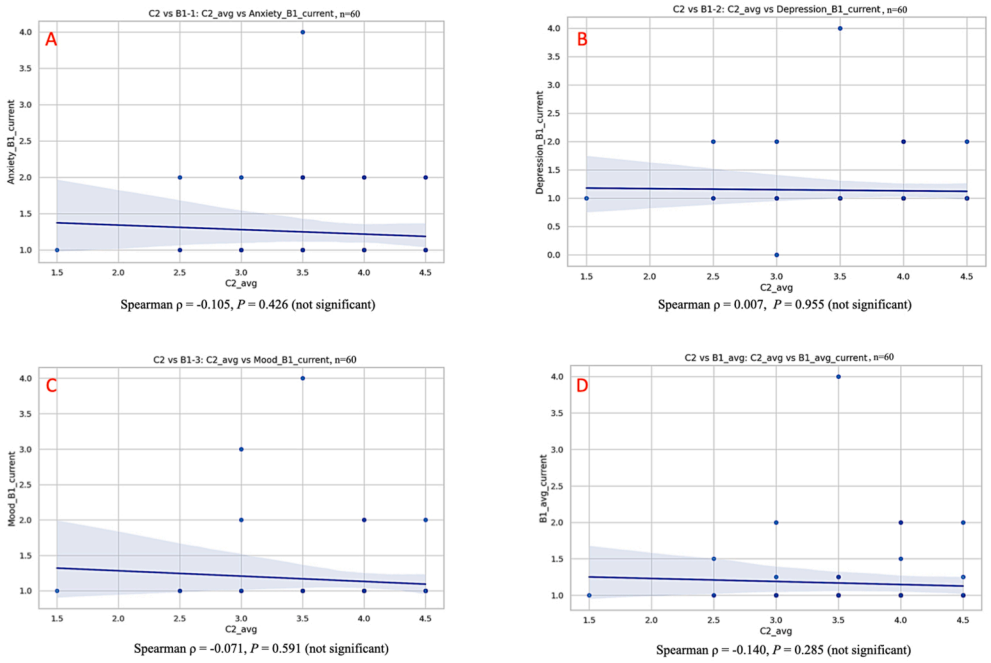


Figure 5 A. C2 vs B1-1 (facial satisfaction and anxiety): No statistically significant correlation was found. B. C2 vs B1-2 (facial satisfaction and depression): No statistically significant correlation was observed. C. C2 vs B1-3 (facial satisfaction and mood): No statistically significant correlation was identified. D. C2 vs B1 (facial satisfaction and overall psychological score): No statistically significant correlation was found.

(B2): OR = 0.91; 95 % CI: 0.66–1.26; $P = 0.565$. The overall model fit improved with the inclusion of B1 and B2, achieving a Nagelkerke R^2 of 0.38, indicating moderate explanatory power.

Discussion

Postoperative acute pain has been shown to adversely affect patients' emotional states. In individuals who had low preoperative depression levels (0–11.8 %), the incidence of depression rose to 21–50 % postoperatively, highlighting that pain can negatively influence the prognosis and treatment outcomes of depression.[11] Similarly, anxiety has been found to intensify the perception of pain. As pain perception varies significantly among individuals, its clinical impact is substantial. Chronic pain—defined as pain lasting longer than three months—affects nearly 50 % of individuals who report any pain, and approximately 20 % of the global population.[12,13] In this study, although no statistically significant correlations were found between pain (A1) and psychological distress variables (B1-2, B1-3), a slight positive trend was noted (Fig. 1B and C), suggesting that increased pain may be mildly associated with mood disturbance and depression.

Orthognathic surgery is more commonly performed in women (female-to-male ratio = 1.4:1).[14] Our sample similarly comprised predominantly female patients, mostly aged between 20 and 30 years, with mandibular surgery being the most common procedure. Across all surgical types, patient satisfaction and psychological adaptation are

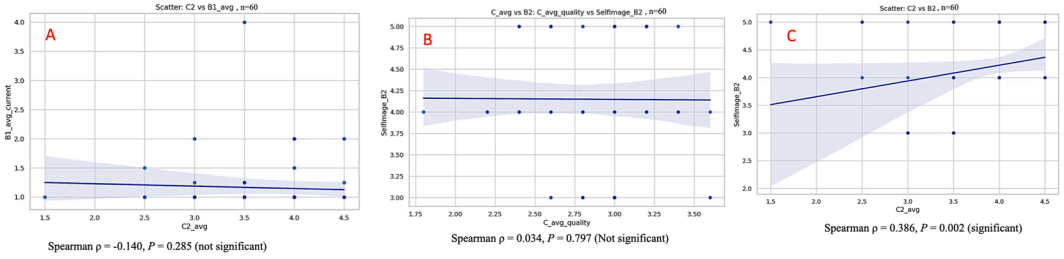
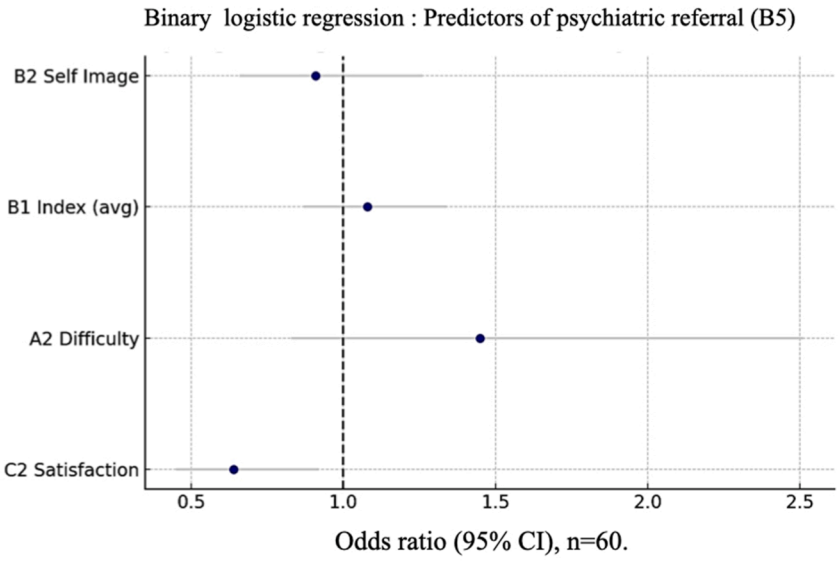


Figure 6 A. C2 (facial satisfaction and functional recovery) vs B1 average psychological score: A weak negative correlation was observed, but it did not reach statistical significance. This suggests that while higher facial satisfaction may be linked to slightly lower psychological distress, the association was not strong or consistent in this sample. B. C1 vs B2 (quality of life and body image): No statistically significant correlation was observed, indicating that perceived quality of life was not strongly associated with self-perceived body image in this sample. C. C2 vs B2 (facial satisfaction and body image): A significant positive correlation was found, indicating that higher satisfaction with facial appearance and function is associated with a more positive self-image. The data points are clustered in the higher score range, supporting a consistent and positive relationship between C2 and B2.



Predictor variable	Odds ratio (OR)	95% CI	*P*-value	Significance
C2 Satisfaction	0.64	0.45 – 0.92	0.021	*
A2 Difficulty	1.45	0.83-2.51	0.191	NS
B1 Index (avg)	1.08	0.87 – 1.34	0.482	NS
B2 Self image	0.91	0.66-1.26	0.565	NS

* : Significant, NS: Non significant

Figure 7 Binary logistic regression: Predictors of psychiatric referral (B5). This figure displays the Odds ratios (ORs) and 95 % confidence intervals for four predictor variables included in the logistic regression model: C2 satisfaction (facial appearance and functional recovery): A statistically significant negative predictor of psychiatric referral. Patients with higher satisfaction in appearance and function were significantly less likely to require psychiatric intervention. A2 difficulty (eating/speaking/swallowing problems): It shows a positive trend but is not statistically significant. B1 index (avg) (overall psychological distress score): Not a significant predictor. B2 Self image (body image perception): Not statistically significant.

influenced by the pre-, peri-, and postoperative experiences. In severe cases, post-surgical trauma symptoms may emerge, potentially compromising the patient's psychological state and surgical outcome.

Given this, studies that explore the psychological well-being, quality of life, and influencing factors throughout the orthognathic treatment process are crucial—not only to assess treatment efficacy but also to ensure patient-centered care. Anxiety and depression rank among the most prevalent mental health disorders and are listed among the top 10 causes of global disability. The hospital anxiety and depression scale was adopted in this study to evaluate psychological conditions in patients undergoing physical treatment. This self-reported tool is widely used in both clinical and research settings and is especially suited for assessing anxiety and depression in physically ill patients.[15–17]

Our findings revealed a significant negative correlation between postoperative eating function (A2) and depression (B1-2), indicating that functional impairment contributes to deteriorated psychological states. Moreover, a significant positive correlation was found between eating difficulty (A2) and mood disturbance (B1-3), suggesting that compromised oral function could lead to greater emotional instability (Fig. 2B). These results align with previous studies reporting significant gender differences in postoperative psychological outcomes. Female patients have been shown to experience improvements in self-esteem and reductions in depressive symptoms following surgery, whereas male patients tend to report no significant psychological change.[18] Additionally, women were more likely than men to experience preoperative depression, yet they also tended to show greater enthusiasm and satisfaction with surgical results.[19]

One study suggested that male patients more often rely on social support systems for coping, while female patients are more inclined to express and share their concerns.[20] Furthermore, a comparative study of orthognathic surgery and conventional orthodontic treatment found that some patients demonstrated depressive symptoms preoperatively, likely due to heightened anxiety about surgical outcomes, postoperative discomfort, and functional impairments.[21] Although our study focused on postoperative responses,

Table 3 Comprehensive summary of all variable comparison results based on Spearman correlation analysis.

Comparison	Sample (N)	Correlation coefficient (ρ)	*P*-value	Conclusion ($P < 0.05$)
A1 vs B-1-1 (anxiety)	60	0.108	0.414	Not significant
A1 vs B-1-2 (depression)	60	0.172	0.189	Not significant
A1 vs B-1-3 (mood)	60	0.195	0.136	Not significant
A2 vs B-1-1 (anxiety)	60	−0.133	0.31	Not significant
A2 vs B-1-2 (depression)	60	−0.26	0.045	Significant negative correlation (↓ depression)
A2 vs B-1-3 (mood)	60	0.156	0.033	Significant positive correlation (↑ mood)
B2 vs B-1-1 (anxiety)	60	−0.131	0.318	Not significant
B2 vs B-1-2 (depression)	60	−0.146	0.267	Not significant
C1 vs B-1-1 (anxiety)	60	0.029	0.829	Not significant
C1 vs B-1-2 (depression)	60	0.116	0.378	Not significant
C1 vs B-1-3 (mood)	60	−0.278	0.031	Significant (↑ mood)
C2 vs B-1-1 (anxiety)	60	−0.105	0.426	Not significant
C2 vs B-1-2 (depression)	60	0.007	0.955	Not significant
C2 vs B-1-3 (mood)	60	−0.071	0.591	Not significant
C2 vs B1 (average psychological score)	60	−0.140	0.285	Not significant
C2 vs B2 (body image)	60	0.386	0.002	Significant (↑ self-image)

A1: pain level. A2: oral function. B-1-1: anxiety. B-1-2: depression. B-1-3: mood. B2: self-image & body image.
C1: quality of life. C2: satisfaction with facial appearance and function. ρ: Spearman's rank correlation coefficient.

Table 4 The summarizes the sample sizes, medians, interquartile ranges (IQR), and *P*-values, obtained from the Mann–Whitney U test.

Variable	Male (n)	Female (n)	Male median [IQR]	Female median [IQR]	*P*-value	Significance
A1	20	40	0.00 [0.00–0.00]	0.00 [0.00–0.00]	0.2129	Not significant
A2	20	40	0.00 [0.00–0.00]	0.00 [0.00–0.00]	0.0464	Significant
B1_avg	20	40	1.00 [1.00–1.08]	1.00 [1.00–1.00]	0.4789	Not significant
C2_avg	20	40	4.00 [3.50–4.00]	4.00 [3.50–4.00]	0.9673	Not significant

A1: pain level. A2: difficulty eating. B1_avg: Average psychological index (including anxiety, depression, and mood instability), C2_avg: Satisfaction with appearance and functional recovery (average score of facial appearance and function).

future research should aim to investigate psychological variations before and after surgery.

A significant negative correlation was found between quality of life and mood disturbance, indicating that higher perceived quality of life is associated with better emotional stability (Fig. 4C). A weak negative correlation was noted between facial satisfaction and psychological distress. Although the trend was present, it did not reach statistical significance. This suggests a potential but subtle link, which may require a larger sample size to validate (Fig. 6A).

A strong and statistically significant positive correlation was observed between facial satisfaction and body image. Patients with higher satisfaction in appearance and functional recovery reported better self-image and higher confidence. These findings underscore the clinical importance of aesthetic outcomes in enhancing patients' self-perception and social engagement (Fig. 6C). Among all predictors, only facial satisfaction (C2) was significantly associated with psychiatric referral need. Patients with greater satisfaction in facial appearance and function were significantly less likely to require psychiatric support ($OR = 0.64$; 95 % CI: 0.45–0.92; $P = 0.021$). Other variables including eating difficulty (A2), psychological distress (B1), and self-image (B2) did not show statistically significant predictive power (Fig. 7).

Thus, this study highlights the multifaceted impact of orthognathic surgery on patients' psychological well-being, functional recovery, and quality of life. Significant associations were found between postoperative oral function and mood disturbance, as well as between facial satisfaction and self-image. Among all evaluated predictors, facial satisfaction emerged as the most consistent and statistically significant factor influencing the need for psychiatric referral. These findings emphasize the importance of incorporating psychosocial evaluation and support into the treatment planning and postoperative care of orthognathic surgery patients. Aesthetic and functional improvements not only enhance facial harmony but also contribute meaningfully to patients' emotional stability and self-confidence. Among the outcomes assessed, only eating

difficulty showed a significant gender difference, with females reporting more difficulty, supporting gender-sensitive considerations in postoperative functional care. Future prospective studies with larger sample sizes and pre-/post-operative psychological assessments are warranted to further validate these results and guide holistic, patient-centered care in orthognathic practice.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

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