

Individuals requiring orthognathic surgery have more depression and pain than controls

Aline Monise SEBASTIANI^(a) 

Jennifer Tsi GERBER^(b) 

Isabela Polesi BERGAMASCHI^(a) 

Maria Fernanda PETINATI^(b) 

Michelle Nascimento MEGER^(b) 

Delson João da COSTA^(a) 

João Armando BRANCHER^(b) 

Erika Calvano KÜCHLER^(c) 

Rafaela SCARIOT^(a) 

^(a)Universidade Federal do Paraná – UFPR, Department of Stomatology, Curitiba, PR, Brazil.

^(b)Universidade Positivo, School of Health and Biological Sciences, Curitiba, PR, Brazil.

^(c)Universidade de São Paulo – USP, Ribeirão Preto Dental School, Department of Pediatric Dentistry, Ribeirão Preto, SP, Brazil.

Abstract: The objective of this study was to evaluate if individuals with dentofacial deformities (DFD) who require orthognathic surgery are affected more by depression and pain. A case-control study was performed with 195 individuals. In the DFD group, 145 individuals with Class II and III malocclusion requiring orthognathic surgery were selected. The control group was composed of 50 individuals with no DFD. All patients were diagnosed according to the *Research Diagnostic Criteria for Temporomandibular Disorders* (RDC/TMD). Data were analyzed with a significance level of 0.05. The DFD group more often presented severe depression ($p = 0.020$) and chronic pain ($p = 0.017$). They also presented higher prevalence of Nonspecific Physical Symptoms Including Pain ($p = 0.002$) and Nonspecific Physical Symptoms Excluding Pain ($p = 0.002$). Concerning TMD symptoms, the DFD group had more myofascial ($p = 0.002$) and articular pain ($p = 0.041$). Therefore, the results of this study suggest that depression and pain are more common in individuals with DFD requiring orthognathic surgery compared with individuals without DFD.

Keywords: Orthognathic Surgery; Chronic Pain; Depression; Temporomandibular Joint Disorders.

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Corresponding Author:

Aline Sebastiani

E-mail: sebastiani.aline@gmail.com

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Introduction

Individuals with dentofacial deformities (DFD), especially those that require orthognathic surgery, commonly present psychological alterations¹ due to esthetic impairment, functional problems, orofacial pain, and chronic headaches,² which may influence their self-esteem and personal relationships owing to difficulty in establishing effective social ties.¹

Normally, during orthognathic surgery planning, surgeons give more importance to the skeletal alterations and functional and esthetics parameters than to psychological aspects. However, in order to achieve a successful outcome, patients should be treated as a whole. Therefore, it is fundamental that surgeons understand all the physical and psychological symptoms associated with patients requiring orthognathic surgery, since the majority of them experience a negative influence of their appearance on their psychosocial well-being.³

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Individuals with DFD have a higher prevalence of depression than the general population,¹ and depression is a major predictor of a poorer quality of life. However, orthognathic surgery seems to improve these conditions.⁴ Depression is a complex disorder manifested in many different ways.⁵ The characteristics of people with depression include not only an increase in negative emotions such as hopelessness or anger, but also a relative depletion of positive effective resources, such as the ability to experience reward-related pleasure. A striking feature of depression is the collapse of the motivational drive to deal with challenges of life, leading to withdrawal and behavior inhibition.⁶ Biological pathways are also related with this condition, such as decreased level of endogenous dopaminergic release, which can significantly contribute to the pathology of depression.⁷

Depression seems to be more common in patients with DFD who also have temporomandibular disorders (TMD).⁸ Pain, especially chronic pain, makes lives unbearable for many people.⁹ Chronic pain can also result in a hypodopaminergic state, interfering with motivation.¹⁰

Thus, the aim of this study was to compare the level of depression and pain in individuals with DFD who require orthognathic surgery with that of a control group.

Methodology

Study design and sample

The research project was approved by the local Ethics in Research Committee protocol number: CAEE 69240817.7.0000.0093 and CAEE 69725317.5.0000.0102, and complies with the Declaration of Helsinki for studies involving human subjects.

A case-control study was performed with a total of 195 individuals composing the DFD group and the control group. The inclusion criteria were adult patients of both sexes under treatment at the Maxillofacial Service at Positivo University and Federal University of Parana. The DFD group was composed by 145 individuals previously diagnosed by orthodontists and referred for ortho-surgical treatment, who were consecutively select during

a period of three years. They were evaluated by a group of senior surgeons who selected patients with Class II or III skeletal malocclusion according to facial analysis and clinical exam of the occlusion. For the control group, 50 individuals with no DFD were selected in the preoperative evaluation for dental extraction. The people in the control group were checked by the same group of surgeons to confirm that there was no skeletal discrepancy and that they presented a Class I molar relationship. The exclusion criteria for both groups were patients who had a previous history of temporomandibular joint (TMJ) surgery, any syndrome, diagnosis of neuronal diseases, dental inflammatory processes, and several missing teeth.

Data collection

Individual characteristics were collected like sex, age, and ethnicity. The self-reported ethnicity was dichotomized in Caucasian and non-Caucasian.

Both groups were evaluated with the *Research Diagnostic Criteria for Temporomandibular Disorders-RDC-TMD* index.¹¹

According to axis II of the RDC-TMD, the individuals were evaluated for Depression, Chronic Pain, Nonspecific Physical Symptoms Including Pain (NPSIP), and Nonspecific Physical Symptoms Excluding Pain (NPSEP). According to these criteria, chronic pain was classified in grades from 0 to IV, being: 0 - no limitation; I - low intensity, II - high intensity, III - moderate limitation, and IV - severe limitation. The variable was dichotomized into absence or presence of chronic pain, being absence of chronic pain individuals with grade 0, and presence of chronic pain, individuals with grade I or higher. For the Depression variable, participants were classified into normal, moderate, or severe. The NPSIP and NPSEP variables were dichotomized into presence or absence of these conditions, being a normal diagnosis considered as "absence" and a moderate or severe diagnosis, "presence" of the condition. With respect to axis I, individuals were evaluated for the three different diagnoses of TMD, as having presence or absence of myofascial pain, disc displacement on at least one side, and TMJ painful conditions (arthralgia and osteoarthritis).

Statistical analysis

The results were submitted to inferential analyses with a significance level of 0.05 using the Statistical Package for the Social Sciences software (SPSS, v. 24.0, IBM, city, USA). In order to verify the matching of groups, the Chi-square and Mann-Whitney tests were used. In the logistic regression model, the groups were compared with regard to all diagnoses of RDC-TMD. Adjustments by sex were performed because it is known that depression and pain symptoms are more common in women than in men^{12,13}. Odds ratio (OR) was calculated to quantify the strength of the association.

Results

The groups were similar with regard to sex and ethnicity ($p > 0.05$). The median age in the case group was 28.0 (16–66), and in the control group, 23.5 (18–61). These data are shown in Table 1. The statistical power varied from 65% to 92% for axis II outcome variables.

The DFD group was composed of 52 men and 93 women, and 48 and 97 presented Class II and Class III malocclusion, respectively. In the Class II group, 6 individuals presented asymmetry, 12, vertical maxillary excess, and 3, open bite. In the Class III group, 33 had asymmetry, 5 had vertical maxillary excess, and 5 had open bite.

Table 2 compares the RDC-TMD diagnosis between groups. The individuals with DFD had 5.89 times

higher chance of having severe depression, 2.36 times higher chance to have chronic pain, 3.97 times higher chance to have NPSIP, and 4.01 times higher chance to have NPESP when compared to the control group. Besides, the DFD group had 7 times higher chance to have myofascial pain and 3.12 times higher chance to have articular pain ($p < 0.05$).

Discussion

Our results demonstrated that emotional and physical problems were more prevalent in individuals with DFD who require orthognathic surgery when compared to the control group. Severe depression was one of the more substantial results obtained from our study, with five times more chance of occurrence in individuals who require orthognathic surgery. Moderate depression occurrence did not differ between groups. Our results agree with a study conducted by Yao et al.¹ that also showed more depressive symptoms in patients requiring orthognathic surgery.

Although orthognathic surgery provides a moderate improvement in psychological and social quality of life in the patients, depression is a major predictor of poor quality of life in this population, and interferes significantly with the vitality, social aspects of the individual, and mental health after surgery.¹⁴ Thus, the importance of diagnosis and treatment of these individuals before surgery is demonstrated. Chronic pain and somatization (NPSIP and NPESP) were also higher in individuals with DFD. Zhang et al.¹⁵ showed significantly higher values of somatization, obsessive-compulsiveness, interpersonal sensitivity, depression, anxiety, and paranoid ideation in people with malocclusion compared to individuals with normal malocclusion.

Chances to have myofascial pain were seven times higher in cases compared to controls, which corroborates the results of other studies.^{16,17,18} The correlation between facial skeletal morphology and muscular functionality were previously studied¹⁹. The patients with skeletal malocclusion and DFD seemed to present muscular incoordination and instability. In a study by Di Palma et al.,¹⁹ electromyographic evaluations demonstrated improvements in

Table 1. Individual characteristics of individuals with dentofacial deformities (DFD) and control group.

Diagnose	DFD group	Control group	p-value
	n (%)	n (%)	
Sex			
Male	52 (35.9)	19 (38.0)	0.564
Female	93 (64.1)	31 (62.0)	
Ethnicity			
Caucasian	115 (79.3)	43 (86.0)	0.336
Non-caucasian	29 (20.7)	7 (14.0)	
Age			
Median (min-max)	28.0 (16-66)	23.5 (18-61)	0.015

Qui-square, and Mann Whitney, with confidence level of 0.05.

Table 2. Comparison of RDC/TMD diagnoses between individuals with dentofacial deformities (DFD) and control group.

Diagnosis	DFD group (n = 145)	Control group (n = 50)	p-value ^a	OR ^a (95%CI)
	n (%)	n (%)		
Depression				
Normal	93 (65.0)	40 (80.0)	reference	reference
Moderate	25 (17.0)	8 (16.0)	0.481	1.39 (0.56–3.43)
Severe	26 (18.0)	2 (4.0)	0.020	5.89 (1.32–26.21)
Chronic pain				
Absence	80 (55.2)	37 (74.0)	reference	reference
Presence	65 (44.8)	13 (26.0)	0.017	2.36 (1.17–4.78)
NPSIP				
Absence	88 (61.5)	43 (86.0)	reference	reference
Presence	55 (38.5)	7 (14.0)	0.002	3.97 (1.65–9.53)
NPSEP				
Absence	88 (61.5)	43 (86.0)	reference	reference
Presence	55 (38.5)	7 (14.0)	0.002	4.01 (1.66–9.68)
Miofascial pain				
Absence	101 (69.6)	47 (94.0)	reference	reference
Presence	44 (30.4)	3 (6.0)	0.002	7.00 (2.08–23.49)
Disc displacement				
Absence	90 (62.1)	34 (68.0)	reference	reference
Presence	55 (37.9)	16 (32.0)	0.467	1.29 (0.65–2.57)
TMJ pain				
Absence	114 (78.6)	46 (92.0)	reference	reference
Presence	31 (21.4)	4 (8.0)	0.041	3.12 (1.05–9.29)

Logistic regression adjusted by sex, with confidence level of 0.05. OR^a: adjusted odds ratio; CI: confidence level; NPSIP: nonspecific physical symptoms including pain; NPSEP: nonspecific physical symptoms excluding pain; TMJ: temporomandibular joint.

neuromuscular equilibrium after surgical intervention due to better occlusal stability, suggesting that severe malocclusion affects muscular activity. We also found an increased prevalence in TMJ pain in cases but disk displacements was similar between groups. Our results are similar to the study by Abrahamsson et al.¹⁶ that also found a higher prevalence of myofascial pain and arthralgia in patients requiring orthognathic surgery compared to the control group and did not find differences in disc displacements. Thus, skeletal malocclusions do not seem to cause structural changes in TMJ, however they are related to more severe psychological suffering and painful symptoms.

Chronic pain is one of the critical determining factors for depression, and their coexistence tends to further aggravate the severity of both disorders.²⁰

According to Sheng et al.,²⁰ patients suffering from depression induced by chronic pain have worse prognosis than those suffering from chronic pain alone; and chronic pain and depression are closely correlated in terms of occurrence and development, and mutually promote their severity progression. Somatization is also associated with depression and an important predictor of altered central pain modulation in chronic musculoskeletal pain.¹⁵ These findings from the literature explain the high occurrence of depression, somatization, and chronic pain in our study, and also the correlation between them, suggesting a high interdependence of these symptoms.

To date, the pathophysiological mechanisms of chronic pain and depression, and their mutual correlation, have not been identified. However,

neuroplasticity changes induced by pain and depression and changes in the neurobiological mechanism have been revealed. Monoamine neurotransmitters have been studied with regard to the molecular mechanisms involved in chronic pain and depression. The classic hypothesis is that depression may occur as a result of decreased availability of serotonin and norepinephrine neurotransmitters in the central nervous system. Monoamine neurotransmitters are also vital in the occurrence and development of pain.²⁰

A study by Mladenovic et al.¹⁷ found that myofascial pain was related to a higher level of depression and somatization in people with Class III malocclusions. In another study, it was found that depression is higher in patients requiring orthognathic surgery that also had TMD.⁸

The inflammatory process and consequent afferent activity might be intense enough to establish a central process.²¹ Altered central pain modulation is the predominant pain mechanism in a proportion of chronic musculoskeletal pain disorders²². When TMD is chronic, especially with myofascial pain, it is considered a functional pain syndrome similar to fibromyalgia.²³ Functional disorders tend to be

related to central sensitization and amplified pain perception.²⁴ The pathophysiological mechanisms of such pain conditions remain unknown. However, it is believed that amplified pain perception, alterations in brain activity, immune and neuroendocrine activities, and genetic predisposition may be involved.²³

Our study had some limitations, and future studies are necessary with more precise diagnosis of psychological alterations performed by a specialist. Also, more investigation is needed about predictive variables of depression and chronic pain occurrence, like aesthetic perception, type of DFD, and social behaviors. Additionally, a study with a follow-up after orthognathic surgery is necessary to verify how these conditions evolve after the treatment to correct the DFD.

Conclusion

Individuals with DFD who require orthognathic surgery have higher prevalence of depression, chronic pain, NPSIP, and NPSEP, compared to individuals without DFD. They also present more myofascial pain and articular pain.

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