

Volume 9, n 1, 2021

Articles

Impact of periodontitis and orthodontic treatment on dental anxiety  
and self-esteem

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Abstract

*Background and aims:* The concept of dental anxiety related to patients' concerns about the psychosocial impact of their dental appearance has been demonstrated to have a significant influence on the initiation and adherence to certain dental treatments, particularly in adult patients with periodontitis undergoing orthodontic treatment. This study analyze the relationship between dental appearance and self-esteem and anxiety in adult periodontitis patients undergoing orthodontic treatment.

*Methods:* For the study were enrolled 38 patients, divided into test and control groups. The impact of dental appearance was measured using the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ). State anxiety was assessed with the State Anxiety Inventory (STAI-S) and self-esteem with Rosenberg's self-esteem scale.

*Results:* In both groups, self-esteem correlates negatively with all dimensions of dental appearance impact except for the positive dental self-confidence dimension, where all correlations were positive. Anxiety correlates positively with social impact, psychological impact and aesthetic concern, although it maintains no significant correlations with dental self-confidence. Nevertheless, in patients undergoing orthodontic treatment, anxiety plays a mediating role between dental impact dimensions and self-esteem, whilst for the control group anxiety only plays a mediator role between psychological impact and self-esteem.

*Conclusion:* Anxiety plays a fundamental role in the effect of perceived dental impact on self-esteem in adult patients undergoing orthodontic treatment. These results have important practical implications for the design of bio-psycho-social intervention programs that contemplate cognitive-affective variables as an essential part of orthodontic treatment in adults with periodontitis.

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**Keywords:**

Clinical Psychology; Dental treatment; Pain; Periodontitis; Self-esteem.

**Received:** 1 February 2020

**Accepted:** 14 April 2021

**Published:** 29 April 2021

**Citation:** Santonocito, S., Indelicato, F., Polizzi, A., Palazzo, G. (2021). Impact of periodontitis and orthodontic treatment on dental anxiety and self-esteem. *Mediterranean Journal of Clinical Psychology*, 9(1).

<https://doi.org/10.6092/2282-1619/mjcp-2971>

## 1. Introduction

In spite of patients' differences regarding ethnic, economic, cultural and social aspects (Yu et al., 2013), it can be said that most of those who demand orthodontic treatment request it because of concerns about their physical appearance and other psychosocial factors related to this, such as self-confidence (Azuma et al., 2008). This influence has been studied mostly in children and adolescents; less literature has focused on these aspects in adult samples (Frejman et al., 2013; Pabari et al., 2011).

Current clinical psychological trends are increasingly considering the role of psychological dynamics in the field of medical research and somatic issues. Current and previous research increased knowledge about the impact of psychological issues in the onset of functional and structural lesions, in line with risk factors contributing to the maintenance of pathologies (Belar & Deardorff, 1995; Conversano et al., 2020; Craparo et al., 2016; Di Giuseppe et al., 2018, 2020a; Merlo et al., 2020a, 2020b; Merlo, 2019; Rodensky, 2006; Tanzilli et al., 2021; Tovian et al., 2003). Moreover, current pandemic appears as improving psychological maladjustment and subsequent psychopathology, increasing subjects' concerns and other psychopathological issues both related to patients and clinicians (Ahmed et al., 2020; Di Giuseppe et al., 2020; Imperatori et al., 2020; Merlo et al., 2020a, 2020b, 2021a, 2021b; Shigemura et al., 2020; Tramakis et al., 2020; Vicario, 2013). In these terms, somatic concerns often occur together with psychopathological issues. Somatic concerns can be of various form, including psychosomatic domains (Martino et al., 2020a, 2020b; Myles & Merlo, 2020; Settineri et al., 2019a), body image and self-esteem problems. As emerged through recent research contributions, most studies centre on samples of children and adolescents. It appears that malocclusion and an unattractive dental appearance have a negative social impact on an individual (Rodd et al., 2012), suggesting that the negative perception of the dentofacial region is more important for self-esteem than the severity of the malocclusion itself (Phillips & Beal, 2009).

Periodontitis is a chronic multifactorial inflammatory disease associated with dysbiotic plaque biofilms and characterized by progressive destruction of the tooth-supporting apparatus that eventually may result in tooth loss (Isola et al., 2021a, 2021b). Several diseases have been associated with the development of periodontitis, such as cardiovascular disease, coronary heart disease, diabetes, metabolic disorders and rheumatic diseases (Isola et al., 2020c, 2020d, 2021b). Dental plaque and neglect of oral hygiene are generally believed to be the most important risk factors for periodontal disease (Isola et al., 2020b).

Stress is another important factor in the etiology and maintenance of many inflammatory diseases including periodontal disease (Özhayat, 2013). Moreover, a systematic review included 25 studies scientific articles published up to July 2015, demonstrated that periodontal disease was associated with a negative impact on quality of life, with severe periodontitis exerting the most significant impact by compromising aspects related to function and esthetics (de Paula Junior et al., 2009).

De Baets et al. (2012) found a significant relationship between orthodontic treatment need and oral health-related quality of life, and between self-esteem and oral health-related quality of life, but no evidence was found to suggest that self-esteem moderates the relationship between oral health-related quality of life and treatment need.

However, despite this suggested relationship between dental aesthetics and self-esteem, the specific results of orthodontic treatment in improving self-esteem are not consistent across studies. Thus, while several studies show that orthodontic treatment influences the level of self-esteem, showing a marked improvement at the end of treatment (Jung, 2010; Vaida et al., 2009) and impacting on improving social relationships (Badran, 2010), others have found no differences in self-esteem after completion of orthodontic treatment (Birkeland et al., 2000). It is important to highlight the negative psychosocial impact of orthodontic treatment in patients with periodontitis, where different studies have analyzed the relationship between orthodontic treatment and self-esteem in bullying (Seehra et al., 2013). Özhayat (2013) and other authors (Iorio-Siciliano et al., 2019, 2021) in patients with partial tooth loss, found that negative affectivity had the strongest and most clinically meaningful influence, but both negative affectivity (high) and self-esteem (low) were found to influence worse oral health-related quality of life (Isola et al., 2019) especially during the presence of systemic diseases (Isola et al., 2015; Matarese et al., 2016).

Some studies suggest, in a study conducted before orthodontic treatment, that patients with Class II and Class III dentofacial deformities had a more negative oral health-related quality of life and lower self-esteem compared with controls with harmonious faces. Also, the studies focused on the development of self-esteem during the course of treatment have also shown contradictory results. Whilst some have found no differences in self-esteem after completion of orthodontic treatment (Varela & Garcia-Camba, 1995), others found improved self-esteem and diminished depressive symptoms due to surgical intervention (Nicodemo et al., 2008).

Nevertheless, in spite of the above evidence about the association of anxiety and orthodontic treatment, there are few studies that examine the role of anxiety on the impact of dental appearance on self-esteem or other psychosocial outcomes in adult patients with periodontitis who undergo orthodontic treatment. The aim of this study was to analyze the relationship between the impact of dental appearance, self-esteem and anxiety in a sample of adult periodontitis patients undergoing orthodontic treatment compared to a matched control group and to investigate the possible mediator role of anxiety between dental impact and self-esteem.

## **2. Methods**

To address the research purpose, we designed an observational, cross-sectional study with two groups: test (periodontitis patients undergoing orthodontic treatment) and control (periodontitis patients without orthodontic treatment).

A total of 38 Caucasian patients participated in this study among patients who all patients in the study attended at the Dental School of the University of Catania, Italy. Of them, 19 constitute the test group. All patients were treated with fixed appliances (metal brackets) for around 18 months. Treatment procedures in all patients were very similar. The inclusion criteria were the presence of periodontitis, Class I, Class II and Class III malocclusion with upper and/or lower anterior malalignment with various degrees of overbite and overjet and no need for extractions as part of the orthodontic treatment, with dental crowding less than 6 mm and good general health. The control group comprised 19 participants. The exclusion criteria for both groups were the presence of chronic diseases, diagnosis of a mental disorder, daily use of antidepressant medication or severe dentofacial anomalies such as cleft lip and palate. The main exclusion criteria for the control group was the need for orthodontic treatment. All participants signed a declaration of informed consent prior to their inclusion in the study.

### **2.1 Data collection**

The Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) (Klages et al., 2006) is a psychometric instrument containing 23 items. Structurally, it is composed of four subscales of four domains: aesthetic concern (AC; 3 items), psychological impact (PI; 6 items), social impact (SI; 8 items) and dental self-confidence (DSC; 6 items). The aesthetic concern is the positive subscale. A 5-point Likert scale is used, ranging from 0 [no impact of dental aesthetics on quality of life (QoL)] to 4 (maximal impact of dental aesthetics on QoL) for each item.

To assess self-esteem, it was applied Rosenberg's self-esteem scale (37), a 10-item instrument with a 4-point Likert scale. A high score reflects positive self-esteem. Moreover, the State Anxiety Scale from State-Trait Anxiety Inventory (STAI) was used (38). The STAI is a self-report instrument, which is comprised of separate self-report scales measuring two distinct anxiety concepts: state anxiety (how one feels at a particular moment or situation; e.g. dental visit) and trait anxiety (how one usually feels). The State Anxiety Scale consists of 20 items, using a four-point Likert scale ranging from 0 to 3 (0 indicates rarely; 1 sometimes; 2 often; 3 almost always). Patients at their initial orthodontic screening (T1) had no prior interaction with an orthodontist before this survey. After 3–6 months of treatment, it was assessed the target variables (dental impact, anxiety and self-esteem).

The control group was included in the study consecutively as they sought dental services. The control group was matched for age, gender, educational level and employment status.

## 2.2 Statistical analysis

The relationships between socio-demographic variables and self-esteem, anxiety and PIDAQ dimensions were explored by conducting the appropriate test for each variable (Pearson's correlations, t-tests and one-way ANOVAs). Student's t test was used to compare differences in target variables (self-esteem, anxiety and PIDAQ dimensions) between the test and control groups. The significance of the post hoc comparisons was calculated with the Scheffé test. The relationships between self-esteem, anxiety and PIDAQ dimensions were analyzed using Pearson's correlations. To test for the presence of mediating effects, it was conducted an ordinary least squares multiple regression analysis. The relevant regression diagnostics were conducted, and the normality of the distribution of residuals was analyzed with the Kolmogorov–Smirnov test. Differences were considered significant at a p level <0.05. Data were analyzed with the SPSS statistical package (v.22.0; SPSS Inc, Chicago, IL).

## 3. Results

The average age of the test group was of  $48.65 \pm 0.55$  years. No significant differences were found for any of the socio-demographic variables considered for both groups.

When the relevant variables were considered for both groups, significant differences were found for three of the four PIDAQ dimensions. Specifically, the test group showed significantly higher scores for social impact, psychological impact and aesthetic concern than the control group (Table 1).

**Table 1.** Means, standard deviations (SD) and Pearson's correlation coefficients for all variables. \*p < 0.05; \*\*p < 0.01

Mean (SD)	Range Mean (SD)	Test group	Control group	t (p)	1	2	3	4	5	6
<b>1. Dental self-confidence</b>	0–24	13.26 (6.50)	13.66 (5.51)	1.235 (0.92)		-0.31* (-0.07)	-0.33** (-0.51**)	-0.57** (-0.54**)	-0.05 (-0.22)	0.42** (0.31**)
<b>2. Social Impact</b>	0–32	14.45 (9.55)	9.58 (7.66)	3.589**		(0.66)	0.52** (0.44**)	0.42** (0.41**)	0.42** (0.31*)	-0.35** (-0.22)
<b>3. Psychological impact</b>	0–24	12.21 (8.51)	8.86 (4.48)	2.858**			(0.66)	0.42** (0.66**)	0.38** (0.34**)	-0.22* (-0.41**)
<b>4. Aesthetic concern</b>	0–12	6.41 (4.19)	4.12 (3.29)	3.666**				(0.91)	0.34** (0.27*)	-0.31** (-0.21*)
<b>5. Anxiety (state)</b>	0–60	18.21 (9.51)	18.01 (9.56)	-0.258					(0.81)	-0.35** (-0.62**)
<b>6. Self-esteem</b>	10–40	32.19 (4.21)	30.55 (4.79)	0.857						(0.84)

**Table 2.** Predicting self-esteem from dental impact dimensions. Significant mediations for the control group are presented in italics. Step 1: gender (1: men, 0: women). \*p < 0.05; \*\*p < 0.01. <sup>a</sup> Beta value after introduction of anxiety.

	F	R 2	IncR2	Beta	t
<b>VD: Self-esteem</b>					
<b>Step 1: age</b>	0.145	0.002		-0.012	0.102
<b>Step 2: social impact</b>	2.658	0.089	0.096	-0.3012 (-0.3012*) <sup>a</sup>	-2.312*
<b>Step 3: anxiety</b>	4.415**	0.202	0.152	-0.366	-2.934**
<b>Step 1: gender</b>	0.206	0.015		0.085	0.347
<b>Step 2: psychological impact</b>	2.414*	0.158	0.125	-0.369 (-0.269) <sup>a</sup>	-2.645**
<b>Step 3: anxiety</b>	3.085*	0.195	0.066	-0.252	-2.058*
<b>Step 1: psychological impact</b>	12.568 **	0.154		-0.425 (-0.231*) <sup>a</sup>	-3.678**
<b>Step 2: anxiety</b>	21.354 **	0.412	0.224	-0.536	-5.041**
<b>Step 1: aesthetic concern</b>	1.719	0.066		-0.303 (-0.184) <sup>a</sup>	-2.166*
<b>Step 2: anxiety</b>	2.306	0.155	0.079	-0.136	-2.136*

As shown in Table 1, for the test group, there was a significant positive correlation between psychological, social and aesthetic dimensions of dental impact and negative correlations between these dimensions and dental confidence. Self-esteem maintains significant correlations with the dimensions of dental impact. State anxiety maintains significant correlations with all dimensions of dental impact, except for dental confidence. The control group maintains very similar associations, except for the absence of a correlation between social impact and dental self-confidence, and social impact and self-esteem, although in the latter, associations approach significance. The correlations analysis (Table 1) indicated that, for both groups, the preconditions are met for mediation analysis using all dimensions of dental impact (except dental confidence that does not maintain a positive correlation with state anxiety) as predictors. For the test group, the analyses showed that anxiety mediated the relationship between the three dental impact dimensions (social impact, psychological impact and aesthetic concern) and self-esteem (Table 2), and in psychological impact and aesthetic concern cases the mediation effect was total, whereas for the social impact the mediation effect is partial. Regarding the control variables, we found that neither age nor gender plays a significant predictor role in explaining self-esteem, so it does not appear to be a relevant variable to consider. For the control group, it was observed the mediational role (partial) of anxiety between psychological impact and self-esteem.

#### **4. Discussion**

The present study analyzed the relationship among the impact of dental appearance, anxiety and self-esteem in a sample of adult patients with periodontitis undergoing orthodontic treatment. Regarding PIDAQ descriptive indicators, dental self-confidence scores are similar to the scores obtained in other studies both with non-clinical and adolescent samples (de Paula Junior et al., 2009) as well as in a sample of adults seeking orthodontic treatment (Cannavale et al., 2013; Gazit-Rappaport et al., 2010). As for the other dimensions (social impact, psychological impact and aesthetic concern), scores observed in our study are higher than those found in previous studies, specifically in the study of Gazit-Rappaport et al. (Gazit-Rappaport et al., 2010) in adult patients seeking orthodontic treatment. When we compared the results for the patients with orthodontic treatment with the control group, it was observed significant differences for social impact, psychological impact and aesthetic concern, so that the patients with orthodontic treatment had a higher perception of a dental impact than the healthy patients.

The level of self-esteem observed in the sample is similar to that found in other studies in non-clinical population (Baños & Guillén, 2000). It should be noted that no significant differences

were found in relation to self-esteem between the groups, as opposed to findings by Frejman et al. (2013), in spite of the important differences found in perception of dental impact.

Anxiety scores in our study are very similar, using the same instrument, to those found in samples of adolescents undergoing orthodontic treatment and their parents (Sari et al., 2005; Traklyali et al., 2009), and considerably lower than those found (Sud et al., 2012) in patients with dental problems affecting oral hygiene. Most dimensions of dental impact (social impact, psychological impact and aesthetic concern), chewing muscles (Cutroneo et al., 2012; Piacino et al., 2012), and malocclusions (Cavuoti et al., 2016; Perillo et al., 2012, 2013) maintain negative correlations with self-esteem, consistent with what has been presented throughout the literature (Frejman et al., 2013), maybe mediated by pain induced to dental procedures, such as third molar surgery (Briguglio et al., 2011) and their inflammatory mediators (Curro et al., 2014; Ferlazzo et al., 2017; Matarese et al., 2012, 2013, 2015) present in periodontal ligament (Isola et al., 2021a; Piacino et al., 2017). It should be taken into account that this pattern of correlations is maintained for both groups, although the correlations are slightly stronger in the group undergoing orthodontic treatment. In literature, the association between dental impact and self-esteem is not always consistent (Briguglio et al., 2013; De Baets et al., 2012) and has mainly been carried out on samples of children and adolescents, the results found in our study show a clear association between dental impact and self-esteem both in patients undergoing orthodontic treatment and those who are not, in the same way that others have found in previous studies carried out on adults (De Baets et al., 2012; Özhayat, 2013). As for the mediating role of anxiety between dental impact and self-esteem found in our study, it should be highlighted that these results are interesting due to how rare previous studies about this relation. In the same critical direction as what Kenealy et al. (2007) pointed out in relation to the scarce predictive power of dental status over self-esteem, and in the light of our findings, we can point to the role of anxiety as a possible explicative variable of this relationship. The mediation analysis highlights the role that anxiety plays between three dimensions of dental impact and self-esteem, so that the relationship between two of the dental impact dimensions and self-esteem can be explained entirely through anxiety. Further, the mediator role of anxiety between dental impact and self-esteem is highly relevant in patients undergoing orthodontic treatment (because in patients without orthodontic treatment this mediating role of anxiety between dental impact and self-esteem is only observed for the psychological impact dimension). Also, the important role of anxiety in patients undergoing orthodontic treatment in the relationship between dental impact and self-esteem that improvement in dental and/or facial aesthetics does not necessarily lead to an increase in self-esteem.



In this sense, it could be argued that the inconsistent and even contradictory results found in relation to the possible increase in self-esteem during treatment, in samples of adults and adolescents (Settineri et al., 2019b), could be due to the absence of controlling for variables such as anxiety that could be responsible for part of the variance. However, these results allow us to advance our understanding of the complex relationships between the impact of dental appearance, anxiety, and self-esteem and have important practical implications for the design of bio-psycho-social intervention programs that address cognitive emotional variables as an essential part of treatment.

In adult orthodontic patients, there is a clear association between their perception of dental impact and self-esteem. Nevertheless, state anxiety affects the relationship with dental treatment. Within the biopsychosocial model of health, these results are particularly relevant, given the need to consider the psychological and social aspects as part of a comprehensive treatment.

In adults undergoing orthodontic treatment, anxiety plays a fundamental role in the effect of perceived dental impact on self-esteem. Therefore, if the orthodontic treatment would have a positive impact on the image and self-esteem of the patient, it would need to incorporate anxiety as a key variable in successful treatment. A good dental health education, regular dental visits, good patient– dentist relationships, and suitable communication with patients may all contribute to the control of the anxiety associated with orthodontic treatment.

### **Conflict of Interest Statement**

The authors declare that the research was conducted in the absence of any potential conflict of interest.

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**DOI:** 10.6092/2282-1619/mjcp-2971