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Psychological impact and patient perception of occlusion and orthodontic treatment in periodontitis patients

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Abstract

Background: This study analyzed, in patients with periodontitis, the impact of the degree of self-perceived malocclusion, the experienced negative psychosocial impact of periodontitis, and the history and timing of orthodontic treatment.

Methods: For the study were enrolled 54 patients undergoing a routine dental health visit. They answered the Negative Impact of Dental Aesthetics Scale (NIDAS), the Perception of Occlusion Scale (POS). Moreover, undergoes to the Approximal Plaque Index (API), the Gingival Bleeding Index (GBI), and the number of decayed teeth (DT) and missing teeth (MT). All data were analyzed using different statistical procedures.

Results: The subjects ranging within the upper POS quartile scored higher on the GBI (contrast: P= 0.037) and DT (P= 0.028) than did those in the lower POS quartiles. Different to the patients who had minor negative impacts in the NIDAS, those with strong impacts had higher scores on the API (P<005). Compared to patients without previous orthodontic treatment, those with a history of orthodontic treatment lasting 24 months had a lower API (P <0.05), GBI and DT (each P = 0.008) scores.

Conclusion: The present results suggest that self-perceived dental irregularity and the negative impact of periodontitis might affect oral health, whereas previous extensive orthodontic treatment may have favourable effects by improving dental health compliance.

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1. Introduction

As emerged by scientific evidence, it was demonstrated the role of inflagmatory mechanisms together with clinical psychological synthomes in chronic diseases (Brooks et al., 2019; Erkic et al., 2018; Jordan et al., 2016; Martino et al., 2020c; Molodecky et al., 2012; Van Houtum et al.,

2015). The predictive role of psychopathological symptoms in chronic conditions and in medical disease is supported by common inflagmatory mechanisms. (Conversano, 2019; O'Donnell & Meaney, 2020; Martino et al., 2020a; Shahar, 2020; van de Pavet et al., 2017). It is known as the above-mentioned issues, could impact psychological well-being throughout the life-span (Di Giuseppe et al., 2018, 2019, 2020; Gangemi et al., 2018; Kiebles et al., 2010; Martino et al., 2020b). Increasing interest in diseases with particular reference to personal identification process, through perception and self-representation of body image, highlights the impact of estetical issues (Ben-Tovim & Walker, 1995; Benrud-Larson et al., 2003; Gugliandolo et al., 2020; McDermott et al., 2015; Rosa et al., 2019; Thombs et al., 2008).

Adult orthodontics has seen steady growth within the last 3 decades. In the United States, reported numbers of adult orthodontic cases grew between 1981 and 2017 (Bos et al., 2003). In 2018, a survey by the British Orthodontic Society reported members treating 5% more adult patients in private practice than in 2016 (Bos et al., 2003).

Naturally, a proportion of adult patients seeking orthodontic treatment are likely to have received orthodontics as an adolescent and are commonly referred to as retreatment patients. The majority of published research regarding adult orthodontics is focused on patients who receive orthodontics for the first time, reporting retreatment as an incidental finding (Leonardi et al., 2011, 2012; Shaw et al., 1991). Anxiety linked to physical issues, as for dental treatment, is well reported in the literature (Caputo, 2013, 2019: Merlo, 2019a, 2019b; Settineri et al., 2018, 2019a, 2019b) and mainly associated with oral cancer lesions (Ferlazzo et al., 2017; Lo Muzio et al., 2007); however, there are few dedicated studies regarding adult orthodontic treatment in patients with advanced periodontitis the literature and psychopathological issues considering general psysical concerns due both to clinician and patient's perspective (Ashley et al., 1998; Merlo et al., 2020a). The reasons why adults seek orthodontic treatment are multifaceted, and for an orthodontist to retreat successfully, a clear appreciation of the complexities leading to failure is needed; moreover, if extended to multifactorial domains, further studies are necessary (Finkenberg et al., 1998; Isola et al., 2016; Merlo et al., 2020b). They tend to avoid not only the presentation of their body in public but also self-confrontation with the mirror image (Smith, 2004). As a consequence, such individuals tend to exercise less10 and show more maladaptive nutritional habits than attractive individuals do. It has been suggested that such a relationship between attractiveness, chewing muscles, craniofacial characteristics and health behaviour might also apply to dentistry (Cutroneo et al., 2012; Isola et al., 2018a; Perillo et al., 2012, 2013; Piancino et al., 2017). A study on highly educated young adults found that individuals with a less esthetic dental appearance had less favourable attitudes toward dental health (Ni et al., 2019). In addition, they reported less oral hygiene practice and a higher incidence of

periodontitis and caries than did subjects with excellent dental esthetics (Isola et al., 2018b, 2019a; 2020c, 2020f). On the basis of this observation, it is of interest whether the results derived from self-reports would be replicated using clinical oral health measures such as scoring of plaque accumulation, gingival bleeding, caries, and missing teeth. Results of psychosocial attractiveness research suggest that the perception of one's own physical appearance is often associated with concerns about other people's reactions and a negative body concept (Isiekwe et al., 2016), which additionally discourage efforts to maintain or enhance the physical condition by health behaviours and TMJ stable functions (Cavuoti et al., 2016; Isola et al., 2019e; Loreto et al., 2011, 2016; Mercuri et al., 2013). It has been shown, in people with periodontitis for instance, that minor dental esthetic impairment in young adults was associated with social apprehension, appearance disapproval, and appearance-related insecurity (Al-Asfour et al., 2018; Matarese et al., 2016).

On the basis of these findings, we decided to investigate whether these periodontitis and related impairments of psychosocial well-being might have clinically measurable effects on oral health. The second aim of this study was to investigate whether individuals with varying degrees of perceived negative impacts of dental appearance differ in their oral health. A potential beneficial effect of orthodontics may result from oral hygiene training, as repetitive oral hygiene instructions and performance assessment are an integral part of orthodontic treatment.

According to several studies, oral hygiene is readily attained in the short-term perspective, but without reinforcement, it tends to relapse (McCaul et al., 1992). Orthodontic treatment is a convenient opportunity for long-term monitoring of oral hygiene behaviour, and it is possible that treatments of long duration might help establish a stable oral health behaviour pattern (Leonardi et al., 2010; Lo Giudice et al., 2020b, 2020c, 2020d, 2020e). The average orthodontic treatment duration of about 24 months has been reported in various studies (Shaw et al., 1991) and was used subjectively as a cut-off point discriminating between former patients with long or short orthodontic treatment (Leonardi et al., 2020; Lo Giudice et al., 2020a). Moreover, it was investigated whether recruits with a history of long orthodontic therapy differ in their oral health from those with shorter or no treatment.

2. Materials and methods

For the study, 110 patients were firstly recruited. However, 37 declined to participate and 19 returned incomplete questionnaires, so the final number of enrolled patients was 54 participants. The mean age of the subjects was 38.6 years (SD = 1.2). During the questionnaire procedure, the subjects followed the instruction not to exchange their views with other participants. Two dentists conducted the clinical examination.

2.1 Perception of Occlusion Scale and Negative Impacts of Dental Appearance Scale

The participants were requested to evaluate the arrangement of their teeth using six items referring to upper and lower crowding and irregularity, the spacing between upper incisors, and open bite. A 4-point answering format was presented with 1 = not at all, 2 = a little, 3 = moderate, and 4 = strong.

This measure represents a short form of the Psychosocial Impact of Dental Appearance Questionnaire (Ni et al., 2019) and includes 12 items referring to the perceived negative social and psychological impacts of their dentition. The internal consistency of this form is $\alpha = 0.83$. Example items are "I don't like to see my teeth in the mirror," I am somewhat distressed when I see other people's teeth," or "I am afraid other people could make offensive remarks about my teeth."

2.2 Approximal Plaque Index and Gingival Bleeding Index

The indices were assessed by probing the interdental spaces on the buccal aspect of the upper left and lower right quadrants and the lingual aspect of the upper right and lower left quadrant. Plaque on the probe was recorded as a positive finding. The number of findings divided by the number of examined sites resulted in a percentage index.

A periodontal probe was gently guided through the gingival sulcus of the same examination sites as in the Approximal Plaque Index (API). The number of bleeding points was divided by the number of the probing sites, resulting in a percentage bleeding index.

The number of teeth showing carious lesions in need of treatment was recorded. Missing teeth were counted, not including first premolars extracted for orthodontic reasons.

2.3 Statistical Analyses

In all analyses, the Statistical Program for Social Sciences was applied. According to the first two aims of the study, exposure thresholds24 of the Perception of Occlusion Scale (POS) and the Negative Impacts of Dental Appearance Scale (NIDAS) were defined by their quartile points. Cut-off points were determined by the test values meeting or transgressing the respective quartile. One-way analyses of variance were conducted to test the API and Gingival Bleeding Index (GBI) differences between subjects included in the quartiles. To assess mean value increments, difference contrasts were calculated comparing subjects of the second to the fourth quartile, each with the preceding ones. The Kruskal-Wallis test was used with decayed teeth (DT) as a dependent variable on the general level. Mann-Whitney tests were applied to compare the second to fourth quartile with the preceding ones. Percentages of subjects with at least one missing tooth (MT) were examined for differences across quartiles by χ^2 tests on the general

and specific level. To analyze the DT and MT scores, nonparametric tests were used. One-way analyses of variance were applied, including simple contrasts to compare subjects with histories of long treatment duration to those with short and no treatment, with API and GBI as dependent variables.

3. Results

Table 1 presents the results regarding the question of whether respondents with varying degrees of perceived malocclusion differ in their oral health. On the general level, the F values indicate significant differences between the groups for the GBI and DT, both with $P< 0.05$. The inspection of API, GBI, and DT mean values revealed that they were not different between the first three quartiles but that there were marked increases in the highest quartile. Statistically, the difference between subjects scoring high on the POS and the remaining subjects was significant at a low level of $P< 0.05$ in the API and at a moderate level ($P< 0.05$) in the GBI and DT. All other contrasts were not significant, with $P> 0.05$.

Table 1. Comparisons Between respondents of the quartiles of the Perception of Occlusion (POS)

Parameters	Perceived malocclusion				P-values
	1 (n=18)	2 (n=8)	3 (n=13)	4 (n=15)	
API mean (SD)	38.52 (6.5)	37.89 (6.5)	36.59 (6.1)	44.25 (5.7)	F= 1.59 (0.155)
GBI mean (SD)	13.3 (2.1)	14.1 (5.8)	13.5 (4.5)	19.6 (4.9)	F= 2.58 (0.037)
DT mean (SD)	1.04 (0.58)	1.36 (0.9)	1.19 (1.1)	1.78 (1.2)	χ^2= 5.69 (0.028)
Patients ≥ 1 missing tooth (%)	8.9	12.3	13.1	17.6	χ^2= 1.89 (0.062)
Scale (POS) for respondents' oral health: means (M) and standard deviations (SD). Statistical tests (F or χ^2 coefficients)					

The results of testing the assumption that subjects with varying degrees of negative impacts of periodontitis differ in their oral health are shown in Table 2. Generally, the F values indicate significant differences between NIDAS quartiles on all dependent variables, with error probabilities ranging from $P< 0.05$ (GBI) to $P < 0.001$ (DT). When the API, GBI, and DT mean values were compared, remarkable increments were found only in the fourth NIDAS quartile. In subjects of this group, more plaque, gingival bleeding, and DT were found than in the remaining ones. This effect was moderately significant for the GBI at $P< 0.001$ and strongly significant for the API and DT, both at the level of $P< 0.001$.

Table 2. Comparisons between respondents of the quartiles of the negative impact of dental aesthetics scales in their oral health

Parameters	Negative impact of Periodontitis				P-values
	1 (n=10)	2 (n=16)	3 (n=11)	4 (n=18)	
API mean (SD)	39.24 (5.5)	38.59 (5.1)	37.66 (5.3)	45.54 (4.9)	F= 3.89 (0.078)
GBI mean (SD)	14.5 (2.3)	14.4 (5.1)	16.2 (4.8)	22.5 (5.2)	F= 2.48 (0.002)
DT mean (SD)	0.79 (0.21)	1.19 (0.8)	1.64 (1.3)	2.28 (1.4)	χ^2=26.54 (0.003)
Patients ≥ 1 missing tooth (%)	8.6	10.6	9.5	21.4	χ^2= 15.23 (0.003)
Scale (POS) for respondents' oral health: means (M) and standard deviations (SD). Statistical tests (F or χ^2 coefficients)					

Twenty-three per cent of the respondents in the upper NIDAS quartile had at least 1 MT, while in the remaining quartiles, this proportion was about 10%. This difference was also highly significant with P< .001. In addition, the contrast comparison of the second and first NIDAS quartile in DT was significant at P< 0.05. The difference in treatment procedures was significant at a low level (P< 0.05). Table 3 presents results of testing the question as to whether subjects with a history of a longer orthodontic treatment (≥24 months) differ in their oral health from those with shorter treatment (≥12 and <24 months).

Table 3. Comparisons Between Respondents With Different Orthodontic Treatment History in Their Oral Health

Parameters	Orthodontic treatment			P-values		
	Never Received	Short Term	Long Term	Among groups	Long term vs never	Long term vs short term
API mean (SD)	41.21 (8.5)	41.25 (5.9)	37.28 (5.5)	F=2.65 (0.051)	*t*= 2.15 (0.36)	*t*= 1.65 (0.065)
GBI mean (SD)	13.3 (2.1)	14.1 (5.8)	13.5 (4.5)	F= 6.51 (0.002)	*t*= 2.58 (0.037)	*t*= 3.25 (0.001)
DT mean (SD)	1.04 (0.58)	1.36 (0.9)	1.19 (1.1)	χ^2= 11.32 (0.004)	Z= 5.69 (0.028)	Z= 2.96 (0.003)
Patients ≥ 1 missing tooth (%)	8.9	7.5	7.8	χ^2= 10.69 (0.004)	χ^2= 3.25 (0.004)	χ^2= 0.01 (0.854)
Scale (POS) for respondents' oral health: means (M) and standard deviations (SD). Statistical tests (*t*, Z, or χ^2 coefficients)						

F values indicate significant differences between groups in the GBI, DT, and MT at a general level (all P <0.001). Compared to the no-treatment group, subjects with at least 24 months of orthodontic treatment showed less interdental plaque (P < 0.05) and gingival bleeding as well as fewer DT and MT (all three at P < 0.001). In addition, there was a difference in the GBI and DT (both P < 0.001) between the subjects with a long and short treatment history.

4. Discussion

The general purpose of the present study was to test the putative relationship of oral health to self-perceived occlusion, negative impacts of dental esthetics, and a history of orthodontic treatment in young adults with periodontitis. The first assumption tested in the present study was that individuals varying in the degree of self-perceived malocclusion would differ in their oral health. This was confirmed by the results of the dental examination, which revealed that subjects ranging within the upper quartile of the POS had more gingival bleeding sites and DT. This assumption was derived from the social psychology knowledge of interrelations between general physical attractiveness and health behaviour. It may be concluded that these associations also apply to the specific domain of dentistry.

Gingival inflammation reflects mainly the long neglect of dental hygiene (Mariotti, 1999). Untreated DT is found in persons who report a long time span since their last dental visit and that are genetically predisposed (Curro et al., 2014; Matarese et al., 2012, 2013, 2015; Skaret et al., 1999). It may be suggested that persons with self-perceived malocclusion are prone to insufficient oral hygiene and dental appointment compliance. A previous study found that young adults with less favourable dental esthetics reported less frequently with less regular dental cleaning behaviour and appointment regularity (Cannavale et al., 2013; Isola et al., 2019b; Ni et al., 2019). In addition, they reported more frequent gingival bleeding and necessary periodontal treatment that can predispose to systemic diseases, such as cardiovascular disease (Isola et al., 2020a, 2020d, 2020e). Those findings, which were derived from self-reports, are substantiated and extended by the present data, which are based on clinical examination.

Moreover, the relationship of the NIDAS to the results of the oral health examination was tested. Subjects in the fourth NIDAS quartile were found to differ from the remaining ones in all four oral health measures, with the GBI on a medium level of significance and the API, DT, and MT on a high level (Isola et al., 2015). Participants ranging within the upper NIDAS quartile had 10% higher plaque scores than those in the lower quartiles. This is of clinical significance as these API grades reflect poorly as opposed to just satisfactory oral hygiene (Briguglio et al., 2013; Espeland & Stenvik, 1991). Respondents with high negative impacts of their dental arrangement also showed a gingival bleeding rate that indicates surgical treatment needs (Isola et al., 2019c, 2019d), while the GBI in all remaining quartiles was within the range of mild inflammation. Moreover, the high negative impact group had nearly two more DT (2.5 DT) than did those with the lowest impacts (0.8 DT).

The effect of the negative impacts of dental appearance on oral health was stronger than the effect of self-perceived occlusion. This suggests that the subjective meaning of dental

appearance relating to social experience and affective reactions might additionally contribute to oral health behaviour (Isola et al., 2019g, 2020g).

Moreover, this study investigated whether subjects with a history of long orthodontic treatment lasting 24 months or more in their oral health from those without treatment experience. A history of treatment was found to be associated with a more favourable oral health condition with respect to the API at a lower level of significance and GBI, DT, and MT at a higher level of significance. Gingival bleeding might be a better indicator of long-term oral hygiene performance (Isola et al., 2019a, 2019f, 2020b). It is conceivable that the subjects with 2½ year-long oral hygiene monitoring and training during their orthodontic treatment in the past might have maintained their learned skills to the time of the clinical examination in the present study. These results confirm a previous report of more frequent and regular oral hygiene behaviour in former orthodontic patients (Ni et al., 2019; Piancino et al., 2012).

The subjects with a history of longer orthodontic treatment had fewer DT and MT than did those without orthodontic experience. These results replicate the findings reported by Southard et al (Southard et al., 1986) for young people. Untreated carious teeth and tooth extractions may be indicative of irregular dental visits or dental avoidance (Southard et al., 1986). It may be assumed that orthodontic patients establish a habit of visiting dentists, thus developing appointment compliance.

Several limitations of this study have to be considered. First, the degree of malocclusion was based on subjective perception. Research on general body image found little agreement between physical attractiveness ratings of targets and judges (Ni et al., 2019). Moreover, it might be argued that the NIDAS reflects impairments based not only on tooth position but also on discoloured, yellow, or chipped teeth or a gummy smile. Further studies are needed to investigate whether additional aspects of dental aesthetics account for variations in NIDAS scores.

5. Conclusion

Patients who perceive their dental arrangement as irregular may tend to neglect oral hygiene practice, as indicated by an inferior oral health condition. This tendency may be even stronger in individuals who experience negative social and psychological impacts of their dental appearance. Adults patients with previous exposure to orthodontic treatment of a sufficient duration might have established a stable pattern of dental compliance, as indicated by their oral health status.

Orthodontic patients with periodontitis may benefit in their dental compliance and oral health indirectly by psychological factors because of improved appearance and directly from longer oral hygiene instructions and monitoring during orthodontic treatment.

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