Association between malpositioned teeth and periodontal disease

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Abstract

Objective: To identify malpositioned teeth in patients referred to periodontal treatment in the Brazilian Association of Dentistry, Pernambuco Division and evaluate the association of these irregularities with periodontal health. **Methods:** The sample comprised 90 individuals aged 15 to 69 years. First, each participant was examined to identify the types of abnormal tooth positions by means of visual inspection. After that, their periodontal health was assessed according to the following clinical parameters: Gingival bleeding on probing, periodontal attachment loss, and probing depth. In bivariate analysis, a chi-square test was used to calculate significance of the associations. **Results:** Several types of changes in tooth position were detected in the participants, and the most significant were: Rotated teeth (86.7%); crowding (52.2%); and mesially tipped molar (48.9%). All participants had periodontal changes associated with these abnormalities: 100% had gingival bleeding; 67.8%, gingival recession; 54.4%, gingival enlargement; and 28.9%, chronic periodontitis. There were significant associations between gingival recession and the variables buccally tipped tooth and excessive proclination of maxillary incisors, and also between chronic periodontitis and mesially tipped molar, crowding, excessive proclination of maxillary and mandibular incisors, and diastema ($p<0.05$). The need of multidisciplinary treatment was clear in all the cases. **Conclusions:** Malpositioned teeth negatively affected the health of periodontal tissues, which draws attention to the importance of a multidisciplinary approach that includes, primarily, periodontal and orthodontic care to improve the oral health of patients.

Keywords: Malpositioned teeth. Periodontal health. Orthodontic treatment.

How to cite this article: Gusmão ES, Queiroz RDC, Coelho RS, Cimões R, Santos RL. Association between malpositioned teeth and periodontal disease. Dental Press J Orthod. 2011 July-Aug;16(4):87-94.

» The authors report no commercial, proprietary, or financial interest in the products or companies described in this article.

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INTRODUCTION

The diagnostic combination of periodontics and orthodontics should be a usual practice in dental clinics, particularly among specialists. Early diagnoses of any type of abnormal tooth position provide information to direct treatment and, therefore, prevent periodontal diseases. Orthodontic treatments, as part of periodontal rehabilitation programs, may bring benefits, such as the improvement of access for dental hygiene, reestablishment of occlusal balance, and even adequate lip sealing. Orthodontics acts in the tooth repositioning and presents a close relationship with the periodontal tissues, both because its execution manner as for the results achieved, reducing the possibility of tooth loss and gingival infections caused by tooth malpositioning.

Of the several pathologies that affect the oral cavity, malocclusion is the third most important problem in the world population. Abnormal tooth positions may already be present in the deciduous dentition. Therefore, dental care professionals, such as pediatric dentists and orthodontists, should act preventively to ensure correct tooth positioning and to avoid or reduce malocclusion that may perpetuate in the mixed and permanent dentitions.[3,5,6,12,13,18,25] This is clearly illustrated in Figure 1.

Malocclusion alone does not result in periodontal disease.[1,2] Studies with children, adolescents and young adults evaluated the effects of several types of malocclusion, as well as of isolated malpositioned teeth, on clinically healthy periodontal tissues. Results showed that most individuals had deficient oral hygiene and consequent accumulation of bacterial plaque, which may cause, in some cases, gingival inflammation, the most common periodontal problem. However, other individuals may have no periodontal changes (Fig 2). Those studies also revealed the importance of oral hygiene instructions and referral to orthodontic treatment as preventive measures. When the periodontium has already been affected, its response is different and, in addition to the physiological response to the accumulation of bacterial plaque, each individual's genetic susceptibility may affect the chances of an increase in disease severity, which is always positive.[1,2,7,9,14,21-24,26-29]

All types of tooth malposition, such as diastemas, crowding, rotated teeth, incisor proclination and mandibular molar tipping, may result in early tooth loss due to the formation of periodontal pockets on the mesial surface of the tooth involved, because the bone crest tends to follow the cementoenamel junction.[15] When any type of malposition is diagnosed, teeth should be aligned to redirect occlusal forces that act along the tooth axis and are harmoniously distributed and to rule out occlusal trauma, which may affect periodontal health.[15,20] According to Freitas et al,[10] mandibular second molar movement enables easier oral hygiene in the mesial re-

FIGURE 1 - Clinical aspect of malocclusion in mixed dentition, with emphasis on tooth 41 proclined and with gingival recession.

FIGURE 2 - Young adult patient with malpositioned teeth and gingival hyperplasia.

gion of the tooth and eliminates the pathological periodontal environment, corrects the proximal bone defect, improves the crown/root ratio and prevents occlusal trauma. In the anterior teeth, excessive mandibular incisor proclination is a frequent cause of gingival recession.[29]

Because of scientific and technological advances in orthodontics, the use of appliances with accurate control of the forces applied and the improved preparation of dental care workers for the correction of anomalies in tooth position, orthodontic treatments are no longer exclusively prescribed for children and adolescents. Adult patients may undergo orthodontic treatment primarily due to esthetic considerations, although dental care workers may stress the functional results of this type of treatment.[4,9] Moreover, patients with periodontal disease or treatment sequelae should also undergo orthodontic interventions. Several authors pointed out the importance of a multidisciplinary treatment approach, combining orthodontics, periodontics, restorative dentistry, prosthetic dentistry and implant dentistry, to respond to all patient needs.[4,8,9,11,17,19]

This study identified the types of tooth position anomalies in patients attended in an outpatient service and referred to periodontal treatment in the public healthcare system and investigated whether these anomalies were pathologically associated with periodontal health.

METHODS

One hundred and fifty adult men and women took part in the sample selection process. They had all been referred to treatment in the outpatient service of the Specialization Course in Periodontics of the Brazilian Association of Dentistry, Pernambuco Division, by professionals in the public healthcare system of the city of Recife, Brazil. All patients received written and oral information about the objective of the study, and all signed an informed consent term prepared according to the guidelines established in Directive #196/96 of the Brazilian National Health Council. This study was approved by the Ethics Committee of University of Pernambuco under number 03/05, SISNEP 065782. Visual inspection excluded individuals that had no malpositioned teeth, had orthodontic appliances or any systemic disease, or were taking any type of medication, as well as smokers, ex-smokers and mouth breathers. After checking these criteria, a convenience sample of 90 patients, aged 15 to 69 years, was selected. A clinical form was used to record, for each patient, the type of tooth malposition. Immediately after that, a periodontal diagnosis was made using the index made up of results of gingival bleeding on probing (marginal), probing depth and, by means of visual inspection, presence or absence of attachment loss (gingival recession) according to the parameter of whether the cementoenamel junction was exposed.

All participants were examined by only one examiner previously trained and calibrated.

Data were analyzed according to univariate and bivariate analyses and described as absolute and percentage distributions of the variables in a nominal scale of descriptive statistical measures: minimum and maximum values, mean, standard deviation, and variation coefficient. A chi-square test was used for analyses and, when the conditions for its use were not met, the Fisher exact test was used. The level of significance was set at 5.0%.

RESULTS

Age of the 90 patients ranged from 15 to 69 years, and mean age was 28.18 years; 60% were women.

Table 1 shows the results of type of tooth position anomalies found in the study sample. One single patient might have one or more teeth with position anomalies. The most prevalent anomalies affected patients with rotated teeth (86.7%), crowding (52%) and mesially tipped molar (48.9%)

The distribution of periodontal changes seen

in Table 2, in which one patient might have one or more periodontal problem, shows that 100% of the patients had chronic marginal gingivitis defined by gingival bleeding on probing (Figs 3A and 3B), 28.9% had chronic periodontitis at different degrees of severity, 67.8%, teeth with gingival recession, and 54.4%, areas of gingival enlargement.

Table 3 shows the results of the analysis of malpositioned teeth and their association with teeth with or without gingival recession. Of all types of abnormalities found in the study sample and listed in Table 1, only isolated buccally tipped teeth and excessive maxillary incisor proclination had a significant association with gingival recession ($p<0.05$). These clinical findings can be seen in Figure 4.

The association between chronic periodontitis and tooth malposition is described in Table 4. The greatest percentage differences for patients with chronic periodontitis were found among those that had a buccally tipped molar, excessive proclination of maxillary incisors, excessive proclination of mandibular incisors, crowding, generalized spacing between teeth or diastemas, which confirms the significant association between these variables and chronic periodontitis ($p<0.05$) (Fig 5).

The analysis of need of periodontal treatment in the study sample revealed that 100% of the patients should undergo basic periodontal treatment (oral hygiene instructions, scaling and root planing),

TABLE 1 - Distribution of types of tooth position anomalies.

Tooth position anomalies	Yes n (%)	No n (%)	Total n (%)
Mesially tipped molar	44 (48.9)	46 (51.1)	90 (100.0)
Isolated buccally tipped tooth	24 (26.7)	66 (73.3)	90 (100.0)
Crowding	47 (52.2)	43 (47.8)	90 (100.0)
Maxillary incisor proclination	20 (22.2)	70 (77.8)	90 (100.0)
Mandibular incisor proclination	16 (17.8)	74 (82.2)	90 (100.0)
Generalized spacing	25 (27.8)	67 (72.2)	90 (100.0)
Diastema	26 (28.9)	64 (71.1)	90 (100.0)
Rotated teeth	78 (86.7)	12 (13.3)	90 (100.0)

TABLE 2 - Distribution of pathological periodontal changes.

Periodontal Changes	Yes n (%)	No n (%)	Total n (%)
Mesially tipped molar	90 (100.0)	-	90 (100.0)
Isolated buccally tipped tooth	61 (67.8)	29 (32.2)	90 (100.0)
Crowding	49 (54.4)	41 (45.6)	90 (100.0)
Maxillary incisor proclination	26 (28.9)	64 (71.1)	90 (100.0)

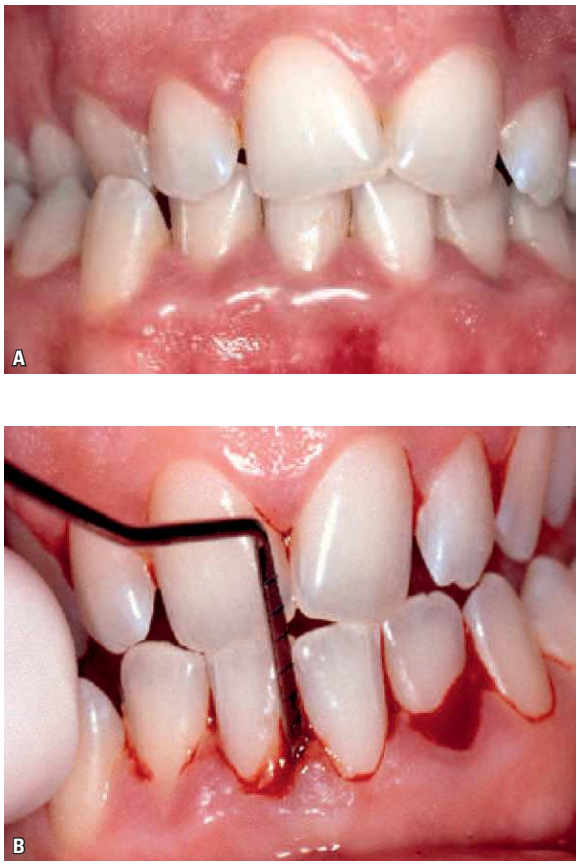

FIGURE 3 - Malpositioned teeth, gingival inflammation and gingival bleeding after marginal probing.

TABLE 3 - Percentage of patients with gingival recession according to types of tooth position anomalies that presented statistical significance.

Periodontal changes	Gingival recession			
	Yes	No	Total	p
	n (%)	n (%)	n (%)	
Buccally tipped tooth				p(1) = 0.0035*
Yes	22 (91.7)	2 (8.3)	24 (100)	
No	39 (59.1)	27 (40.9)	66 (100)	
Total	61 (67.8)	29 (32.2)	90 (100)	
Maxillary incisor proclination				p(1) = 0.0159*
Yes	18 (90.0)	2 (10.0)	20 (100)	
No	43 (61.4)	27 (38.6)	70 (100)	
Total	61 (67.8)	29 (32.2)	90 (100)	

(*) – significant association at the level of 5.0%.
(1) – chi-square test.

FIGURE 4 - Proclined lower tooth and gingival recession in adult patient with gingivitis and periodontitis.

FIGURE 5 - Malpositioned teeth in a patient with periodontitis.

TABLE 4 - Percentage of patients with chronic periodontitis according to types of toot position anomalies.

Periodontal changes	Chronic periodontitis			
	Yes	No	Total	p
	n (%)	n (%)	n (%)	
Mesially tipped molar				p(1) = 0.0139*
Yes	18 (40.9)	26 (59.1)	44 (100)	
No	8 (17.4)	38 (82.6)	46 (100)	
Total	26 (28.9)	64 (71.1)	90 (100)	
Maxillary incisor proclination				p(1) = 0.0182*
Yes	10 (50.0)	10 (50.0)	20 (100)	
No	16 (22.9)	54 (77.1)	70 (100)	
Total	26 (28.9)	64 (71.1)	90 (100)	
Crowding				p(1) = 0.0004*
Yes	6 (12.8)	41 (87.2)	47 (100)	
No	20 (46.5)	23 (53.5)	43 (100)	
Total	26 (28.9)	64 (71.1)	90 (100)	
Mandibular incisor proclination				p(1) = 0.0022*
Yes	10 (62.5)	6 (37.5)	(100)	
No	16 (21.6)	58 (78.4)	(100)	
Total	26 (28.9)	64 (71.1)	90 (100)	
Spacing				p(1) = 0.0001*
Yes	17 (68.0)	8 (32.0)	(100)	
No	9 (13.8)	56 (86.2)	(100)	
Total	26 (28.9)	64 (71.1)	90 (100)	
Diastema				p(1) = 0.0049*
Yes	13 (50.0)	13 (50.0)	(100)	
No	13 (20.3)	51 (79.7)	(100)	
Total	26 (28.9)	64 (71.1)	90 (100)	

(*) = significant association at the level of 5.0%.
(1) = chi-square test.

TABLE 5 - Percentage of patients that needed periodontal or orthodontic treatment.

Treatment	Yes	No	Total
	n (%)	n (%)	n (%)
Basic periodontal treatment	90 (100.0)	-	90 (100.0)
Periodontal surgery	40 (44.4)	50 (55.4)	90 (100.0)
Minor orthodontic movement	60 (66.7)	30 (33.3)	90 (100.0)
Full orthodontic treatment	30 (33.3)	60 (66.7)	90 (100.0)

whereas 44.4% should also undergo surgery after those procedures. The analysis of need of orthodontic treatment revealed that 66.7% of the patients needed minor movement of malpositioned teeth, and 33.3% should undergo complete orthodontic treatments.

DISCUSSION

The results of this study confirmed that the diagnostic and therapeutic interrelation between orthodontics and periodontics is a consensus in the literature.[7,8,10,13] Clinical periodontal health is essential for the success of any type of orthodontic treatment, in the same way that orthodontic correction should not result in damage to periodontal tissues. Therefore, dental care professionals should combine their efforts and act according to a predetermined treatment plan for each patient.

Few studies in the literature investigated the interrelation between irregular tooth positioning and malocclusion with periodontal health in groups of adult patients. Most studies focused on children and adolescents. Our study examined patients referred to periodontal treatment and evaluated malpositioned teeth and their possible effects on periodontal tissues. Data showed that there were pathological periodontal changes associated with orthodontic anomalies, which corroborates previous findings.[1,2,7,8,14]

Although the main etiological factor of periodontal disease is the bacterial plaque, other factors are usually associated and may lead to changes in host responses. Of these factors, malpositioned teeth are predisposing factors because oral hygiene becomes more difficult, bacterial plaque is retained and accumulates and, therefore, proliferates and leads to pathological periodontal changes. Our results contribute to the literature, as all patients that had malpositioned teeth also had some type of periodontal disease, such as chronic marginal gingivitis, gingival enlargement, gingival recession and chronic periodontitis in several degrees of severity. However, this predisposition does not invariably lead to the development of periodontal disease, particularly in cases when there is regular follow-up by a dentist that gives instructions to patients about the correct oral hygiene procedures for their current anatomic condition[1,2,7,14,21-24,26].

Malocclusions, etiologically associated with several factors, such as poor tooth positioning, are sometimes detected in children and adolescents as a warning sign for early correction.[17,22] Their prevalence is significant in the world population, regardless of the socioeconomic development of countries such as, for example, Brazil. It is classified as a public health problem, as clearly reported by Bello[3] in 2004. However, in routine clinical practice, tooth malpositioning is often overlooked at the phase of early detection of dental problems, and teeth keep this preexisting condition until adulthood. Data from other studies are in agreement with our findings, and patients invariably report that tooth malpositions never received attention from specialists. Therefore, dental care professionals should make therapeutic decisions as early as in the first visit of a child or adolescent.[5,6,12,13,18,25,27]

Occlusion trauma that results from tooth malpositioning in cases, for example, of excessive mandibular incisor proclination, is a destructive factor for the tissues that support the periodontium. In this study, it was significantly associated with gingival recession, a pathological condition found in a high percentage of patients in our sample, and as a co-destructive factor when associated with preexisting periodontal disease, leading to greater mobility of affected teeth, which was confirmed in the patients that had chronic periodontitis, and in agreement with findings described by Gutiérrez Izquierdo, Martínez Pérez[14] and Vanzin et al.[29]

Our study showed that all patients in the study sample needed basic or surgical periodontal treatment. It also demonstrated that a misaligned tooth in the dental arch may produce a disease or change the intensity of a previous disease, which may be the result of no specific dental care and poor instructions about controlled oral hygiene.

Another remarkable finding was that all patients needed some type of orthodontic intervention, either some minor tooth alignment or full orthodontic treatment. Moreover, several patients also needed other types of dental procedures, which draws attention to the need of a multidisciplinary approach and corroborates findings reported in studies that focused on treatment combinations. Orthodontic follow-up should be prescribed to patients that have attachment loss due to disease severity and periodontal treatment.[4,8,9,11,17,19]

CONCLUSIONS

Various types of tooth position anomalies were found in this study sample, and they were significantly associated with periodontal changes, such as chronic marginal gingivitis, gingival enlargement, gingival recession and chronic periodontitis. Patients needed basic and surgical periodontal treatments, as well as orthodontic treatments. Therefore, the role of orthodontics and periodontics in the correction of tooth position should lead to improvements in oral health.

REFERENCES

1. Abu Alhaija ES, Al-Khateeb SN, Al-Nimri KS. Prevalence of malocclusion in 13-15 year-old North Jordanian school children. Community Dent Health. 2005;22(4):266-71.
2. Abu Alhaija ES, Al-Wahadni AM. Relationship between tooth irregularity and periodontal disease in children with regular dental visits. J Clin Pediatr Dent. 2006;30(4):296-8.
3. Bello FC. Maloclusão e o serviço público: um estudo em Belo Horizonte [monografia]. Belo Horizonte (MG): Universidade Federal de Minas Gerais; 2004.
4. Dvorkin C, Filipuzzi MA, Rizzo A. Ortodoncia en adultos. Criterios de tratamiento. Casos Clínicos. Rev Ateneo Argent Odontol. 1998;37(1):42-6.
5. Facal-García M, Suárez-Quintanilla D, De Nova-García J. Diastemas in primary dentition and their relationships to sex, age and dental occlusion. Eur J Paediatr Dent. 2002;3(2):85-90.
6. Farret MM, Jurach EM, Guimarães MB, Guimarães MB. Supervisão de espaço na dentição mista e sua correlação com o apinhamento dentário na região anterior do arco inferior: uma filosofia de tratamento. Ortodon Gaúch. 2005;9(1):5-12.
7. Feldens EG, Kramer PF, Feldens CA, Ferreira SH. Distribution of plaque and gingivitis and associated factors in 3- to 5-years-old Brazilian children. J Dent Child. 2006;73(1):4-10.
8. Feng X, Oba T, Oba Y, Moriyama K. An interdisciplinary approach for improved functional and esthetic results in a periodontally compromised adult patient. Angle Orthod. 2005;25(6):1061-70.
9. Fiedotín De Harfin J, Ureña A, Lapenta R, Alonso M. Lo real y lo ideal em el tratamiento estético de los diastemas anteriores. Ortodoncia. 2003;67(133):42-5.
10. Freitas JR, Ramalho SA, Vedovello Filho M, Vedovello SAS. Verticalização dos segundos molares inferiores. J Bras Ortodon Ortop Facial. 2001;6(36):449-56.
11. Fukunaga T, Kuroda S, Kurosaka H, Takano-Yamamoto T. Skeletal anchorage for orthodontic correction of maxillary protrusion with adult periodontitis. Angle Orthod. 2006;71(1):148-55.
12. Gábris K, Márton S, Madléne M. Prevalence of malocclusions in Hungarian adolescents. Eur J Orthod. 2006;28(5):467-70.

13. Glans R, Larsson E, Ogaard B. Longitudinal changes in gingival condition in crowded and noncrowded dentitions subjected to fixed orthodontic treatment. Am J Orthod Dentofacial Orthop. 2003;124(6):679-82.
14. Gutiérrez Izquierdo E, Martínez Pérez M. Pérdida ósea en dientes con periodontitis, sobrecargas e interferencias oclusales. Rev Cuba Estomatol. 1991;28(2):93-7.
15. Hallmon WW. Ocllusal trauma: effect and impact on the periodontium. Ann Periodontol. 1999;4(1):102-8.
16. Janson MRP, Janson RRP, Ferreira PM. Tratamento multidisciplinar I: considerações clínicas e biológicas na verticalização de molares. Rev Dent Press Ortod Ortop Facial. 2001;6(3):87-104.
17. Karaçay S, Gurton U, Olmez H, Koymen G. Multidisciplinary treatment of "twinned" permanent teeth: two case reports. J Dent Child. 2004;71(1):80-6.
18. Lestrel PE, Takahashi O, Kanazawa E. A quantitative approach for measuring crowding in the dental arch: Fourier descriptors. Am J Orthod Dentofacial Orthop. 2004;125(6):716-25.
19. Machuca G, Martínez F, Machuca C, Bullón P. A combination of orthodontic, periodontal and prosthodontic treatment in a case of advanced malocclusion. Int J Periodontics Restorative Dent. 2003;23(5):499-505.
20. Maino BG. Orthodontic treatment and periodontal problems. III. Mondo Ortod. 1989;4(6):839-46.
21. Mickenautsch S, Rudolph MJ, Ogunbodede EO, Chikte UM. Oral health among Liberian refugees in Ghana. East Afr Med J. 1999;76(4):206-11.
22. Miguel JAM. Estudo da associação entre a severidade das más oclusões e condições de saúde bucal em escolares de 12 anos de idade no Município do Rio de Janeiro. 2004 [tese]. Rio de Janeiro (RJ): Universidade Federal do Rio de Janeiro; 2004.
23. Ngom PI, Diagne F, Benoist HM, Thiam F. Intraarch and interarch relationships of the anterior teeth and periodontal conditions. Angle Orthod. 2006;76(2):236-42.
24. Silva ACA, Gusmão ES. Avaliação clínica da condição gengival e de placa bacteriana em crianças com mau posicionamento dentário. An Fac Odontol Univ Fed Pernamb. 2000;10(2):89-94.
25. Silva Filho OG, Rego MVN, Silva PRB, Silva FPL, Ozawa TO. Relação intra-arco na dentadura decídua: diastemas, ausência de diastemas e apinhamento. Ortodontia. 2002;35(4):8-20.
26. Simon C, Tesfaye F, Berhane Y. Assessment of the oral health status of school children in Addis Ababa. Ethiop Med J. 2003;41(3):245-56.
27. Stiz AL. Prevalência da doença periodontal e da má oclusão dentária em escolares de 5 a 12 anos de idade de Camboriú-SC [dissertação]. São Paulo (SP): Universidade de São Paulo; 2001.
28. Vanzin GD, Priestsch JR. Considerações entre recessão gengival e trauma oclusal. Rev Odonto Ciênc. 2001;16(33):182-6.
29. Vanzin GD, Marchioro EM, Berthold TB, Dolci GS. Considerações sobre recessão gengival e proclinação excessiva dos incisivos inferiores. J Bras Ortodon Ortop Facial. 2003;8(46):318-25.

Submitted: October 23, 2007
Revised and accepted: March 13, 2009

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