ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 09, Issue, 08, pp. 29371-29374, August, 2019

REVIEW ARTICLE OPEN ACCESS

ORTHODONTIC TREATMENT IN PATIENTS WITH DIABETES MELLITUS: LITERATURE REVIEW

[1]Emanuelle Morais Pereira, [1,2]Marcelo de Melo Quintela, [1]Sabrina B. Rossi, [1,3]Rui Manuel Freire Sampaio, [3]Maria da Graça Naclério Homem and [1,2]Caio Vinicius G. Roman-Torres

[1]Department of Dentistry, University Metropolitan of Santos, SP, Brazil
[2]Department of Dentistry, University Santo Amaro, SP, Brazil
[3]Department of Dentistry, University São Paulo, SP, Brazil

ARTICLE INFO

Article History:
Received 11th May, 2019
Received in revised form
26th June, 2019
Accepted 06th July, 2019
Published online 30th August, 2019

Key Words:
Orthodontics; Diabetes mellitus;
Orthodontic appliances, Fixed.

ABSTRACT

Orthodontic tooth movement is achieved by remodeling of the alveolar bone in response to mechanical loading. A change in metabolic state that interferes with bone remodeling may result in a different rate of tooth movement. Diabetes mellitus (DM) may adversely affect bone remodeling and tooth movement during the application of orthodontic forces. The aim of this literature review was to evaluate the implementation of orthodontic therapy in patients with DM. Orthodontic treatment and DM, between 1986 and 2019. There are currently few studies on orthodontics and dental movement in patients with DM in animals and humans. Bone response in diabetic rats after the application of orthodontic forces show a significant decrease in bone formation. Given that orthodontics is based on the principle that prolonged application of forces on the tooth results in tooth movement, which is a consequence of the surrounding bone remodeling, the success of this treatment lies mainly in the response of the bone to the applied forces. There is no treatment preference over fixed or removable appliances, being of good importance good oral hygiene and postponing orthodontic treatment in uncontrolled diabetics, until they are compensated by the endocrinologist. There is a lack of studies evaluating orthodontic treatment in patients with DM, the vast majority are animal studies and single case reports that do not allow extrapolating the results to clinical practice. Biofilm control is essential and will avoid major tissue and bone complications, which would interfere with orthodontic therapy.

Citation: ***Emanuelle Morais Pereira, Marcelo de Melo Quintela, Sabrina B. Rossi, Rui Manuel Freire et al.*** **2019.** "Orthodontic treatment in patients with diabetes mellitus: literature review", *International Journal of Development Research*, 09, (08), 29371-29374.

INTRODUCTION

Diabetes mellitus (DM) is a global epidemic disease. It is estimated that more than half a million children 14 years old and younger live with type 1 diabetes and there are already 415 million adults between 20 and 79 years old with diabetes worldwide. By the end of 2015, diabetes had caused 5.0 million deaths and cost $ 673 billion to $ 1,197 billion in health spending. If this increase is not stopped, by 2040 there will be 642 million people living with the disease. Half of DM patients are undiagnosed, and an oral exam may provide the first diagnosis of the disease. Oral characteristics of DM include: dry mucosae (xerostomia), oral candidiasis, burning in the mouth or tongue, poor healing, recurrent oral infections, ketone breath, kiloquemia, dryness and cracking of the mucosa, changes in the oral cavity flora and an enlargement. in the rate of dental caries (Bensch, 2003 and Rizvi, 2014). It is a recognized fact that diabetes mellitus is closely associated with various problems in the oral, facial and mandibular regions (Reichert, 2009). Orthodontic tooth movement is achieved by remodeling of the alveolar bone in response to mechanical loading. Bone resorption is caused by osteoclastic activity on the compression side and the formation of new osteoblast-induced bone on the tension side. A change in metabolic state that interferes with bone remodeling may result in a different rate of tooth movement (Braga, 2011). MD patients with medical follow-up and well-controlled blood tests are not contraindicated for orthodontic treatment. During orthodontic therapy, special attention is required regarding periodontal problems. Patients should be informed of the increased

Corresponding author: **Emanuelle Morais Pereira,**
1Department of Dentistry, University Metropolitan of Santos, SP, Brazil

propensity for gingival inflammation when braces are planned and the importance of maintaining good oral hygiene to prevent the progression of periodontal collapse. Especially in patients with type 1 DM - presumed to be more fragile - the oral cavity should be monitored regularly because they are more prone to gingivitis and acute and chronic periodontal disease. When a patient with type 1 DM has hypoglycemic comas, it can be assumed that the diabetic state is not well controlled (Bensch, 2003). The cellular and molecular mechanisms associated with diabetic staging that may influence orthodontic movement are unknown (Braga, 2011). Since DM is usually characterized by a proinflammatory state, the increase in proinflammatory mediators in periodontal tissues could increase osteoclast activity, facilitating the resorption of the alveolar bone and, consequently, accelerating tooth movement. Thus, patients with DM may respond to orthodontic treatment differently from those without diabetes. 4 In animal studies some particularities have been observed in patients with DM. Bone remodeling resulting from mechanical action occurs from the combination of osteoclastic / osteoblastic activity, but a change in the metabolic state that interferes with the expression of tooth movement rate, differentiating the response from what usually happens under normal glycemic conditions (Braga, 2011 and Arita, 2016) Osteoclastic activities with periodontal resorption in the dental socket showed a significant decrease in bone formation and erosive areas in diabetic animals compared to controls (Villarino, 2011). DM can adversely affect bone remodeling and tooth movement during the application of orthodontic forces. However, further long-term, well-planned studies are needed before the exact mechanism and impact of DM on orthodontic treatment outcomes can be fully understood. 8

During treatment, special attention is required regarding periodontal problems. Proper circulation of periodontal tissues is essential for the recruitment, activation and functioning of cells involved in the remodeling of periodontal ligament and alveolar bone tissues.9,10 Patients should be informed of the increased propensity for gingival inflammation when fixed appliances are planned. and the importance of maintaining good oral hygiene to prevent the progression of periodontal collapse. The aim of this literature review was to evaluate the implementation of orthodontic therapy in patients with diabetes mellitus, gingival and periodontal manifestations, osteoclastic activities and differentiated care in relation to patients without DM.

MATERIALS AND METHODS

This study had as methodology the active search for information in MEDLINE, LILACS, SciELO and Cochrane virtual libraries databases. The bibliographic research was searched on the two main themes of this work: orthodontic treatment in patients with diabetes mellitus, and the terms searched were: orthodontic treatment in diabetics, orthodontic treatment in patients with diabetes; orthodontics and diabetes and tooth movement and diabetes; between 1986 and 2019. We included in this review 12 articles that report the problem of orthodontics and DM. Of these 12 articles, 8 were animal studies, 3 literature reviews and 1 case report.

DISCUSSION

Diabetes mellitus (DM) is the endocrinological disorder that most commonly affects the population, characterized by dysfunction of glucose metabolism due to pancreatic beta cell destruction, insulin resistance, inadequate insulin secretion, inadequate glucagon secretion or a combination of one or more of these mechanisms. Being a systemic disease, DM has a major negative impact on different organs and systems, including adjacent teeth and structures. During the past decades, researchers have explored the effect of diabetes mellitus on oral health and the outcome of dental procedures. This requires detailed knowledge of the diagnosis, management of DM, and measures to consider before proceeding with orthodontic interventions (Almadiha, 2018). Low bone turnover found in patients with DM is a contributing factor to bone destruction and misalignment of the teeth due to possible erosion of the alveolar bones. Braga et al, in their mouse model study, stated that diabetes had a major negative impact on alveolar bone remodeling, and that reversal of diabetes was associated with a significant improvement in bone health and reduced inadequate tooth movement. Diabetes is also known to be associated with periodontal disease, that is, diabetics are at higher risk for the development and progression of gingivitis or periodontitis. Because there is virtually no age limit for orthodontic treatment, and the fact that our current lifestyle is leading to an increased prevalence of diabetes, orthodontists will be increasingly faced with type 1 and type 2 diabetics in the future. 4

Mechanics involving orthodontic treatment can result in complications such as bone resorption, dehiscence, fenestration and gingival recession, and its extension is related to the initial characteristics of the periodontium, as well as the amount of movement. The placement of orthodontic devices also leads to increased bacterial biofilm accumulation, which can lead to a pathological condition of gingivitis, which if not properly treated, can lead to periodontitis. Although orthodontic treatment is more common in adolescents, there has been a significant increase in the number of adult individuals seeking orthodontic intervention. Half of individuals with DM are undiagnosed and often the first to notice symptoms through oral examination is the dentist. There are currently few studies on orthodontics and tooth movement in patients with diabetes in animals and humans (Villarino, 2011; Najeeb, 2017; Rizvi, 2014; Arita, 2016; Sun, 2017; Ferreira, 2018 and Mena Laura, 2019). The bone response of diabetic rats after the application of orthodontic forces and osteoclastic activities with periodontal resorption in the dental socket showed a significant decrease in bone formation and erosive areas in diabetic animals compared to controls (Braga, 2011 and Arita, 2016). The specific factors that affect bone remodeling during orthodontic tooth movement in diabetic patients are not determined, however, many theories have been proposed to explain the pathophysiology of dental complications in diabetes. Diabetes-related microangiopathy remains the most widely accepted theory. In diabetes mellitus, small and medium blood vessels are specifically affected. Microangiopathy results in a considerable decline in blood flow to the organs and tissues. Impaired vascular supply to teeth and dental structures leads to ischemic toothache, gum tenderness, bone erosion and even tooth loss (Almadiha, 2018). Given that orthodontics is based on the principle that prolonged application of forces on the tooth results in tooth movement, as noted above, and as a consequence of engaging bone remodeling, the success of treatment lies primarily in bone response. to the forces applied. Thus, periodontal protection and healthy support are essential to achieve the desired results.16 When the patient with DM is well

controlled, the bone and periodontal response tends to be normal; and if, on the contrary, the patient is not well controlled, there is a risk of periodontal and dental degradation, and it is essential for the orthodontist to monitor the patient's periodontal condition, to warn that gum edema is often common. diabetics (probably due to impaired neutrophil function) and advise you about the benefits of good oral hygiene. Biofilm accumulation is still the most prevalent etiological factor for the onset and perpetuation of gingival and periodontal pathologies (Colombo, 2019). Dentists should be aware and ready to deal with potential diabetic emergencies that may occur during orthodontic treatment. A well-controlled diabetes patient with no significant complications can usually be handled in the same way as a non-diabetic patient, with rare exceptions of signs and symptoms of hypoglycaemia during treatment. Key considerations regarding diabetic dental treatment include: stress reduction, diet modification, antibiotic use, changes in medication regimen, and appointment times (Cervino, 2019). It is important that a diabetic patient when undergoing orthodontic treatment is glycemic well controlled, ie these procedures should never be performed on an individual with poor glycemic control and altered HbA1c levels.15. Good control of high blood pressure and cholesterol is essential, as these two risk factors can aggravate diabetes complications. It is essential to maintain a balance between diet (responsible for increasing blood sugar levels), insulin and exercise, and good control of glycemic levels results from the balance between these three factors. In the literature consulted, there is no treatment preference in relation to appliances being fixed or removable, and good oral hygiene is of great importance under any apparatus chosen for the treatment of malocclusions. Postponing orthodontic treatment in uncontrolled diabetics until compensated by the endocrinologist may also be considered, especially in orthodontic cases with the following characteristics:

- Cases in which extensive dental movements are planned, both in sets and for each specific dental part, such as the movements that are required by orthodontic retraction in extraction cases or the insertion into the dental arch of elements included in marked supraversion or erupted teeth. in exaggerated language. In such cases, the alveolar remodeling that will be required for complete tooth or tooth block management. The new positions require efficient blood supply, adequate microvascularization, and normalized glycemic compensation bone healing - conditions that should, to some degree, contribute to stability. of the movements made.
- Cases in which the use of absolute anchorage methods is inevitably planned through the installation of orthodontic mini-implants or mini-plaques, both positioned in interradicular as well as extraalveolar sites. Unlike traditional dental implants for the addition of dental prostheses in cases of edentulism, orthodontic mini-implants do not require osseointegration and their surface is machined so as not to allow osteoconduction. In addition, mini-implants and orthodontic mini-plaques are used from a noninvasive surgical approach. However, its stability in the elected site is only possible in the presence of 1) bone corticals of optimal thickness and quality, and 2) adequate control of the biofilm around the screw heads, which should always be in healthy periodontium. The advent and increasingly requested application of absolute anchorage for orthodontic purposes has characterized modern orthodontics; however, the stabilization for the necessary time and the healing conditions involving such bone anchorage points in view of the low bone turnover found in patients with DM.
- Cases in which the periodontal control by the patient will be severely impacted considering the planning of incorporation of invasive, extensive, rough, intragingival, mucosupported or excessively limiting orthodontic braces, which may be impaired due to relative impediment. access to retentive areas.The orthodontist should have good communication with the patient's physician, so that if the patient does not have well-controlled DM, he or she can assist him in achieving adequate glycemic levels for dental treatment, as a well-controlled patient can perform orthodontic treatment without special precautions, thus having a lower risk of complications

Conclusion

There is a lack of studies addressing orthodontic treatment in patients with DM, the vast majority are animal studies and single case reports that do not allow extrapolating the results to clinical practice. Biofilm control is essential and can avoid major tissue and bone complications, which would interfere with orthodontic therapy.

REFERENCES

Almadiha A, Al-Zayera M , Dabela S , Alkhalafa A , Al Mayyada A, Bardisib W, Alshammaric S, Alsihatid Z. Orthodontic Treatment Consideration in Diabetic Patients. *J Clin Med Res*. 2018;10:77-81.

Arita K, Hotokezaka H, Hashimoto M, Nakano-Tajima T, Kurohama T, Kondo T, Darendeliler MA, Yoshida N. Effects of diabetes on tooth movement and root resorption after orthodontic force application in rats. *Orthod Craniofac Res.* 2016;19:83-92.

Bensch L, Braem M, Van Acker K, Willems G. Orthodontic treatment considerations in patients with diabetes mellitus. *Am J Orthod Dentofacial Orthop* 2003;123:74-8.

Braga SMG, Albuquerque Taddei SR, Andrade I Jr, Queiroz-Junior CM, Garlet GP,Repeke CE, Teixeira MM, da Silva TA. Effect of diabetes on orthodontic tooth movement in a mouse model. *Eur J Oral Sci.* 2011;119:7-14.

Cervino G, Terranova A, Briguglio F, Stefano R, Famà F, D'Amico C, et al. Diabetes: Oral Health Related Quality of Life and Oral Alterations, *BioMed Research International.* 2019;1-14.

Colombo APV, Tanner ACR. The Role of Bacterial Biofilms in Dental Caries and Periodontal and Peri-implant Diseases: A Historical Perspective. *J Dent Res.* 2019;98:373-385.

Ferreira CL, Da Rocha VC, da Silva Ursi WJ, De Marco AC, Santamaria Jr M, Santamaria MP, Neves Jardini MA. Periodontal response to orthodontic tooth movement in diabetes-induced rats with or without periodontal disease. *J Periodontol.* 2018;89;4.

IDF Diabetes Atlas 8 th Ed. International Diabetes Federation 2017, in: www.diabetesatlas.org

Mena Laura EE, Cestari TM, Almeida R, Pereira DS, Taga R, Garlet GP, Assis GF. Metformin as an add-on to insulin improves periodontal response during orthodontic

tooth movement in type 1 diabetic rats. *J Periodontol.* 2019; 90:920-931.

Najeeb S, Siddiqui F, Qasim SB, Khurshid Z, Zohaib S, Zafar MS. Influence of uncontrolled diabetes mellitus on periodontal tissues during orthodontic tooth movement: a systematic review of animal studies. *Prog Orthod*. 2017; 18: 5.

Raman R., Taiyeb-Ali T., Chan S., Chinna K., Vaithilingam R. Effect of nonsurgical periodontal therapy verses oral hygiene instructions on Type 2 diabetes subjects with chronic periodontitis: a randomised clinical trial. BMC Oral Health. 2014;14:79.

Reichert C, Deschner J, Jäger A. Influence of Diabetes Mellitus on the Development and Treatment of Malocclusions – A Case Report with Literature Review. *Am J Orofac Orthop* 2009; 70:160-175.

Rhodus NL, Vibeto BM, Hamamoto DT. Glycemic control in patients with diabetes mellitus upon admission to a dental clinic: considerations for dental management. Quintessence. 2005; 36:474-82.

Rizvi SO, Pattabiraman V, Pai S, Sabrish S. Diabetes mellitus, A Dilemma in Orthodontics. J Orthod Res 2014;2:113-7.

Sun J, Du J, Feng W, Lu B, Liu H, Guo J, Amizuka N, Li M. Histological evidence that metformin reverses the adverse effects of diabetes on orthodontic tooth movement in rats. *J Mol Histol.* 2017;48:73-81.

Toda K, Mizutani K, Minami I, Ye M, Arakawa T, Mitsubayashi K, Ogawa Y, Araki K, Shinada K. Effects of oral health instructions on glycemic control and oral health status of periodontitis patients with type 2 diabetes mellitus: A preliminary observation. *J Dent Sci.* 2019;14:171–177.

Villarino ME, Lewicki M, Ubios AM. Bone response to orthodontic forces in diabetic Wistar rats. *Am J Orthod Dentofacial Orthop.* 2011;139:S76-82

****