



Salud periodontal en pacientes portadores de dispositivos ortopédicos fijos. Revisión de la literatura

Periodontal health in patients with fixed orthopedic devices. Literature Review

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Palabras claves:

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Resumen

Introducción: El uso de dispositivos ortopédicos maxilomandibulares presenta desafíos significativos para la higiene oral de cada paciente, afectando estructuras duras como el diente y blandas como es el periodonto, la acumulación de placa bacteriana en las estructuras retentivas puede producir inflamación de los tejidos que rodean al diente, elevando el riesgo de enfermedades periodontales y comprometiendo el bienestar oral. **Objetivo:** Identificar en bases de datos digitales información relevante sobre la salud periodontal en pacientes portadores de dispositivos ortopédicos fijos. **Metodología:** Estudio de revisión bibliográfica narrativa, mediante la selección de 31 artículos de investigación obtenidos de un universo de 1.719 publicaciones. Se aplicaron criterios de inclusión y exclusión, así como la búsqueda avanzada en repositorios de indexación tales como: PubMed, Science Direct y Google académico. Se consideraron publicaciones que aportaran información valiosa para el cumplimiento del objetivo de investigación y se seleccionaron estudios publicados durante el período 2018–2023. **Resultados:** Existe variabilidad en la definición y clasificación de la salud periodontal, enfatizando la necesidad de estandarización en la medición de la profundidad del surco periodontal. Se presenta una influencia significativa de los dispositivos ortopédicos fijos en la acumulación de placa y la salud de las encías, destacando la importancia de una selección adecuada del dispositivo, una higiene bucal rigurosa y un seguimiento regular para preservar la salud periodontal. **Conclusión:** La estandarización en la clasificación de la salud periodontal y una gestión cuidadosa de dispositivos ortopédicos son importantes para preservar la salud bucal. **Área de estudio general:** Odontología. **Área de estudio específica:** Ortodoncia. **Tipo de estudio:** Artículos originales / Original articles.

Abstract

Introduction: The use of maxillomandibular orthopedic devices presents significant challenges for the oral hygiene of each patient, affecting hard structures such as the tooth and soft structures such as the periodontium, the accumulation of

periodontics, oral hygiene.

bacterial plaque in the retentive structures can produce inflammation of the tissues that surround them. the tooth, increasing the risk of periodontal diseases and compromising oral well-being. Objective: Identify relevant information on periodontal health in patients wearing fixed orthopedic devices in digital databases. Methodology: Narrative bibliographic review study, through the selection of 31 research articles obtained from a universe of 1,719 publications. Inclusion and exclusion criteria were applied, as well as advanced search in indexing repositories such as: PubMed, Science Direct and Google Scholar. Publications that provided valuable information to fulfill the research objective were considered and studies published during the period 2018–2023 were selected. Results: There is variability in the definition and classification of periodontal health, emphasizing the need for standardization in the measurement of periodontal sulcus depth. A significant influence of fixed orthopedic devices on plaque accumulation and gum health is presented, highlighting the importance of appropriate device selection, rigorous oral hygiene, and regular follow-up to preserve periodontal health. Conclusion: Standardization in the classification of periodontal health and careful management of orthopedic devices are important to preserve oral health.

Introduction

The World Health Organization (WHO) mentions that oral health is "a state free of chronic pain in the mouth and face, free of oral and throat cancer, oral infection and sores, free of periodontal (gum) disease, free of caries, free of tooth loss and other diseases and free of disorders that limit an individual's ability to bite, chew, smile, speak and psychosocial well-being."(1).

Furthermore, periodontal disease is a condition that affects the tissues surrounding the teeth and has always been recognized as a long-term disease that has significant consequences for people's quality of life, in addition to constituting a major challenge for public health.(1).

However, lack of proper oral cavity care leads to periodontal disease, which is ranked as the eleventh most common condition globally. More than 10% of adults worldwide are affected by periodontitis, and this estimate suggests an even higher prevalence than that of heart disease.(2).

Likewise, bacterial plaque has been consistently identified as a key contributor to the prevalence of periodontal disease, the accumulation of this and the subsequent inflammatory response are favored by the presence of retentive surfaces within the oral cavity which allow the formation of bacterial niches. In this sense, fixed orthopedic devices refer to elements that, when placed in the oral cavity, seek to correct, maintain or improve the position of the teeth and maxillofacial structures. These devices are generally used to treat malocclusions of skeletal or dentoalveolar origin.(3).

Thus, it represents a challenge to maintain optimal hygiene, since these structures can make it difficult for the patient to clean them properly.(2) On the other hand, Yáñez-Vico et al. found that performing orthopedic treatments with such devices can be uncomfortable and difficult in the cleaning process for the patient, considerably increasing the complexity in maintaining adequate oral hygiene, this generates multiple areas prone to plaque accumulation, which could lead to the development of white spots, cavities and periodontal disease.(4).

The essential elements of fixed orthodontics have the ability to reduce the physiological self-cleaning process of the tongue or cheeks, increase the retention of bacterial plaque and alter the composition and quantity of the bacterial population.(5). Numerous studies have examined the relationship between the use of fixed orthopedic appliances and the development of periodontal disease, however, to date, only a few systematic reviews have provided a detailed analysis of these results, which is why the purpose of this study is to carry out an updated literature review in order to assess the association between fixed orthopedic treatment and the periodontal health status of patients with periodontal disease.(5).

Materials and methods

A literary review has been carried out with an exploratory approach based on the synthesis of information obtained from different digital databases.

General objective

- To identify relevant information on periodontal health in patients with fixed orthopedic devices in digital databases.

Specific objectives

- Classify the status of periodontal health.
- Classify fixed orthopedic devices.
- Relate periodontal health status to fixed orthopedic devices.

Search strategy

The literature review was carried out through an exhaustive electronic search of the last 5 years in Spanish and English, in different digital databases such as: Pubmed, Google Scholar, SienceDirect, using the keywords obtained from the Medical Subject Heading (MeSH) and the Health Sciences Descriptors (DeCs), which were: periodontal, orthopedic fixation, periodontal diseases, orthopedic fixation devices, conjugated with the Boolean operators AND, OR and NOT. (Table 1)

Table 1. Search strategy

Engine	Search tree
PubMed	(periodontal) AND (device, orthopedic fixation)
PubMed	(periodontal) AND (device, orthopedic fixation) Filters: in the last 5 years, English, Spanish
PubMed	((periodontal) AND (device, orthopedic fixation)) NOT (screw) Filters: in the last 5 years, English, Spanish
PubMed	((((periodontal) OR (periodontal disease)) AND (device, orthopedic fixation)) NOT (screw) Filters: in the last 5 years, English, Spanish
Google Scholar	allintitle: periodontal device OR orthopedic OR fixation
Google Scholar	allintitle: periodontal device OR orthopedic OR fixation 2018-2023
Science Direct	periodontal and device orthodontics 2018-2023
Science Direct	Periodontal and screwless orthopedic devices Year: 2018-2023
Science Direct	periodontal and device orthodontics - oral hygiene Year:2018-2023

For the selection of the studies, the following inclusion and exclusion criteria were used:

Inclusion criteria:

- Randomized clinical trials.
- Literature review studies.

- Systematic reviews with and without meta-analysis.
- Articles reporting the quality of periodontal health with the use of fixed orthopedic devices.

Exclusion criteria:

- Book chapters.
- Expert opinion.
- Letters to the editor.
- Theses and dissertations.
- Articles reporting the use of fixed orthodontic devices.

Ethical Aspects

This research is considered to be risk-free from a bioethical point of view, since the information was obtained through documentary sources. Therefore, it did not involve the taking of biological samples, personal information or any other type of data that could affect any human being.

Results

For this bibliographic review, a record of 31 articles was established, selected after the search strategy summarized in the PRISMA 2020 type flowchart, which is described below:

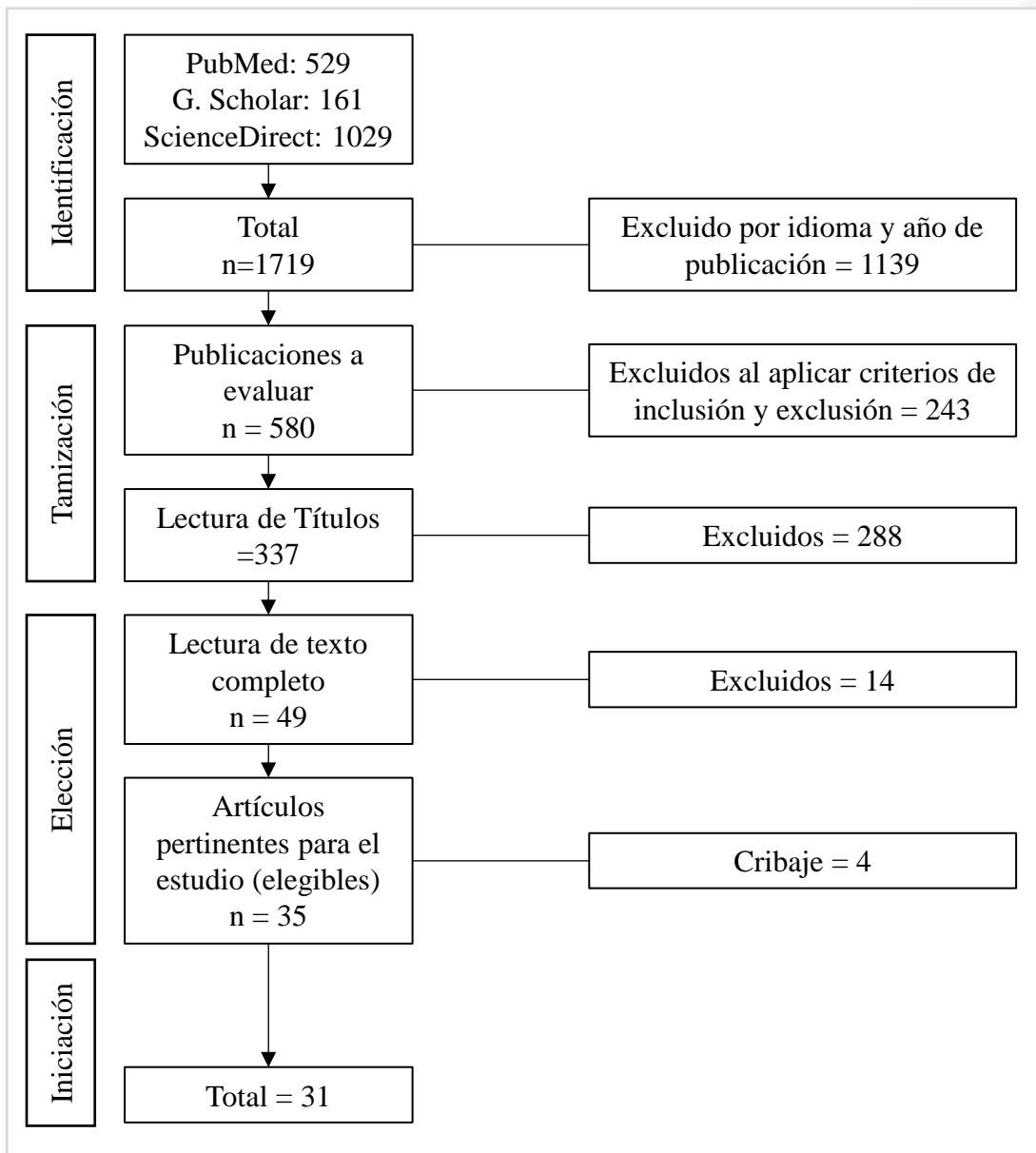


Figure 1. Flowchart for searching and selecting studies

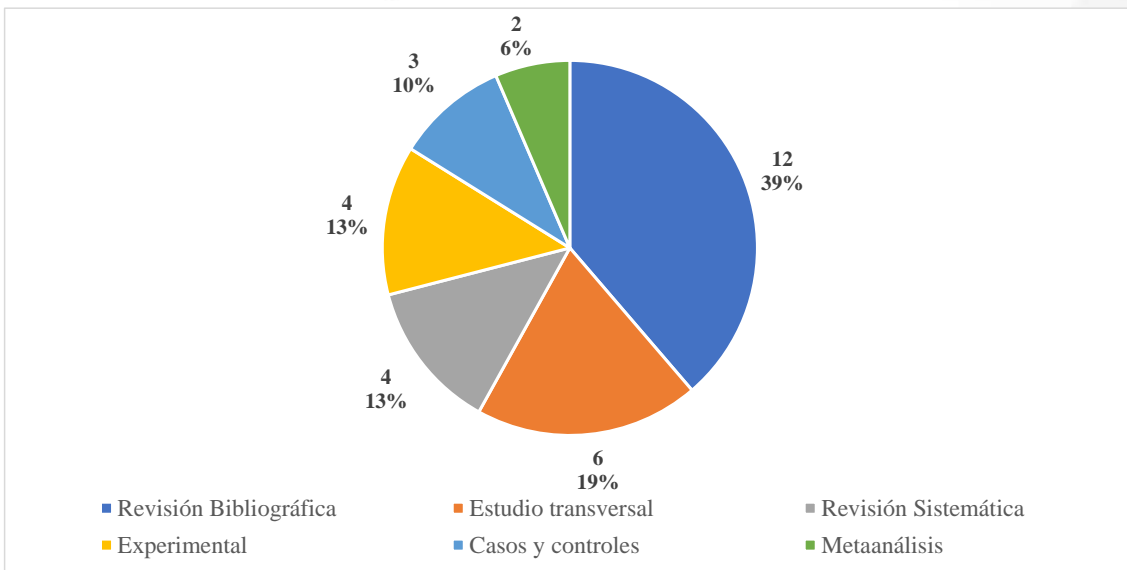


Figure 2. Distribution by type of study

The definition of periodontal health is a topic of considerable debate in the current scientific literature. Although periodontal health generally refers to the state of the tissue surrounding and supporting the teeth, exact definitions vary significantly between studies. The periodontal sulcus depth is the most commonly used parameter to define periodontal health. This parameter measures the depth of the space between the tooth and the surrounding gingiva, a key indicator of the health of the periodontal tissues.(6).

The classification of periodontal diseases was updated in 2018 by the American Academy of Periodontology (AAP) and the European Federation of Periodontology (EFP), replacing the 1999 Armitage classification. This new classification introduced a multidimensional staging and grading system, an inaugural classification for peri-implant diseases and conditions, and a recategorization of various forms of periodontitis. Periodontal health was recognized for the first time, allowing for better communication and a point of comparison if the patient develops periodontal diseases in the future. In addition, the updated classification included changes to the definition of disease extent and the reintroduction of the molar/incisor pattern, replacing the previously used terms “chronic” and “aggressive”(7,8).

Diagnosis of periodontal diseases in pediatric patients

Diagnosing periodontal disease in pediatric patients requires specific risk assessment and clinical decision making. Consideration is given to risk assessment, diagnosis of periodontal disease, and therapies applicable to pediatric patients. Special attention is also paid to care coordination, collaboration, and referral to specialists. In cases where published information on periodontal disease and pathology in children and adolescents

is limited, recommendations are extrapolated from the evidence-based literature on adult patients and the consensus opinions of the working group.(9).

The diagnosis of periodontal diseases in pediatric patients is a complex process that involves the evaluation of several factors and requires a specific approach for this population.(10)Key aspects in the diagnosis of periodontal diseases in children and adolescents include:

1. Determinants of periodontal health:

- The main determinants of periodontal health in pediatric patients include microbiological factors (such as plaque and biofilm), host factors, and environmental determinants (such as medications, stress, and nutrition).(10).

2. Categorization of gingival and periodontal diseases:

- Gingival diseases are categorized into plaque biofilm-induced gingivitis and non-plaque-induced gingival diseases. Periodontal diseases are grouped into periodontitis, necrotizing periodontitis, and periodontitis as a manifestation of systemic conditions.(10).

3. Routine evaluation and monitoring of gingival health:

- The evaluation of the periodontal status of pediatric patients should be part of a routine dental visit and oral examination. Bleeding on probing remains the best parameter to monitor gingival health or inflammation over time. It should be noted that probing can be performed from the time the patient has mixed dentition and only on permanent teeth. The patient's cooperation is also required.(10).

4. Prevalence and development of periodontal diseases in children and adolescents:

- Although destructive periodontal disease may be rare among children and adolescents, nearly half of all children will experience gingivitis in their later preschool years and nearly all will do so by the time they reach puberty.(10).

Due to the presence of intraoral devices used in braces, retention zones are created where bacterial plaque accumulates, which can lead to periodontal disease.

In the context of the study of periodontal health in patients wearing fixed orthopedic devices, it is crucial to address how these devices affect oral health, especially in the pediatric context. Orthopedic appliances, designed to correct malocclusions, can have a

significant impact on periodontal health.(11)This impact is due to several factors, including the difficulty in maintaining adequate oral hygiene due to the presence of fixed components in the mouth, which can facilitate the accumulation of plaque and food debris.(12). In addition, the materials used in these devices, as well as their design and placement, can influence the health of the gums and underlying periodontal tissue.(13). Therefore, the relationship between the use of fixed orthopedic appliances and periodontal health is an important dimension of study, which requires a detailed assessment of the risks, the challenges in maintaining oral hygiene and strategies to minimize adverse effects in pediatric patients.

Structure of a fixed orthopedic device

Fixed orthodontic devices are complex and consist of several components that work together to move teeth or jaws in a gradual and controlled manner.(14)The typical structure of a fixed orthopedic device is detailed below:

1. Bands: These are metal rings that are placed around the teeth, providing a stronger anchor for the appliance. Bands are cemented to the teeth and are usually soldered to attached steel wires or tubes.(15).
2. Steel wires: are metal elongations which are welded to the bands depending on the treatment; they exhibit diverse mechanical properties, which has contributed to enriching the versatility in the field of orthopedic treatment.(16).
3. Auxiliary accessories: depending on the treatment, other components such as springs, elastic bands (intermaxillary bands), acrylic, among others, may be included.(17).
4. Cements and adhesives: used to fix the bands to the teeth, these materials must be biocompatible and able to resist masticatory forces, glass ionomer cements are generally used which prevent cavities by releasing fluoride, they also have an excellent chemical bond to tooth enamel.(18).

It is important to note that the design and materials of fixed braces can vary depending on the specific needs of the patient and the preferences of the orthodontist. The effectiveness of the treatment depends not only on the structure and quality of the appliance, but also on the patient's commitment to oral hygiene and regular visits to the orthodontist for necessary adjustments.

Orthopedic appliances, both fixed and removable, act by transmitting forces through the teeth to the underlying bone, which could induce morphological and growth changes in the maxillomandibular structure.(14).

In the context of periodontal health, it is important to note that the type of brace used can influence the ease of maintaining oral hygiene and therefore the health of periodontal tissues. For example, fixed braces can complicate dental cleaning, increase the risk of plaque buildup and periodontal disease if proper oral hygiene is not maintained, suggesting that the choice of appliance type can have significant implications on treatment outcome.(19).

Selecting the appropriate type of brace depends on several factors, including the patient's specific needs, the complexity of the case, and the patient's preferences. It is essential to thoroughly evaluate the patient's oral and general condition, such as periodontal health status and tooth structures, to determine the most effective device.(20). In addition, the patient's ability to maintain proper oral hygiene with the appliance in place, as well as any aesthetic or functional considerations, are also important factors in the decision. Finally, the orthodontist's experience and ability to work with different types of appliances also plays a crucial role in selecting the most appropriate treatment and achieving the desired results efficiently and effectively.(21).

Dynamics of dental plaque formation and accumulation

Dental plaque formation is a dynamic and complex process, dental plaque is a complex biofilm that accumulates on hard tissues (teeth) in the oral cavity, although more than 500 bacterial species compose plaque, colonization follows a regimented pattern with adhesion of initial colonizers to the enamel salivary film followed by secondary colonization through interbacterial adhesion.(22).

The study by Vincent-Bugnas et al. (2021), offers crucial insights into gingival ingrowth during treatment with fixed braces, highlighting that the prevalence of this phenomenon is considerable, affecting 49.7% of patients. Factors such as the use of intraoral devices, mouth breathing, male gender, a thick periodontal phenotype, elastomeric ligatures, and treatment duration were identified as predisposing factors for gingival ingrowth. Notably, the amount of dental plaque was not found to be directly related to the development of gingival ingrowth, suggesting that other factors play a more significant role in this process during orthodontic treatment. This finding is important to better understand how fixed braces influence periodontal health and underlines the need to consider a variety of factors, beyond oral hygiene, in managing the periodontal health of patients undergoing orthodontic treatment.(23).

Periodontal health in patients with fixed orthopedic devices is an area of growing interest in dentistry, given the prevalence of orthodontic and orthopedic treatments in diverse populations. This research work has revealed that while fixed orthopedic devices are essential tools in the correction of malocclusions and in dental alignment, their presence can significantly influence the periodontal health of patients. Factors such as the difficulty

in maintaining optimal oral hygiene due to orthopedic treatment devices, as well as the type and duration of treatment, are key elements in the incidence of periodontal problems.(24).

Discussion

The study by Vincent-Bugnas et al. (23), suggests that other aspects such as individual patient characteristics, periodontal phenotype, are significant determinants of gum health during orthopedic treatment. These findings highlight the importance of a holistic approach in managing oral health in patients with fixed braces.(23).

The review identified that both the definition and classification of periodontal health are topics of considerable debate in the current scientific literature. Periodontal health is commonly recognized as referring to the state of the tissue surrounding and supporting the teeth, but specific definitions and assessment methods vary significantly between studies. A key aspect is that periodontal sulcus depth is frequently used as a fundamental parameter for assessing periodontal health, serving as an important indicator of the health of periodontal tissues.(6)This finding highlights the need for a clear and uniform understanding of what constitutes periodontal health, especially in the context of patients with fixed orthotic devices, where periodontal tissue integrity may be compromised.

Furthermore, the 2018 update of the classification of periodontal diseases by the American Academy of Periodontology (AAP) and the European Federation of Periodontology (EFP) introduced a multidimensional approach including staging and grading. This system considers several aspects of periodontitis and recognises periodontal health as a clear entity for the first time. This advanced classification is particularly relevant in the context of patients using fixed orthopaedic devices, as it comprehensively addresses the complexity of their periodontal situation. Difficulty in maintaining adequate oral hygiene and the specific characteristics of orthopaedic treatment can significantly influence the health of periodontal tissues. Therefore, a detailed and accurate classification of periodontal status is essential for the effective prevention and management of problems such as gingival ingrowth and plaque accumulation in these patients.(7,8).

Variability in definitions is mainly due to differences in measurement methods and threshold values used to determine what is considered healthy. For example, different studies may use different cut-off points for periodontal sulcus depth to classify periodontal health or disease. This diversity in definitions and measurement methods results in difficulty in making direct comparisons between studies, as there is no clear consensus on what exactly constitutes a healthy periodontium. This diversity highlights the importance of standardizing the definition of periodontal health to improve comparability and interpretation of studies in this field.(7).

According to Salimov (24), he mentions that challenges persist in planning orthopedic treatment with artificial supports in patients suffering from periodontal diseases. Salimov (24) emphasizes the importance of continuing to search for ways to improve implantation methods and select the most appropriate orthopedic design to improve the efficiency of rehabilitation in these patients, highlighting the need for innovations in treatment strategies.

Regarding the classification of fixed orthopedic devices, the present research indicates a significant diversity in the types and structures of these devices, each designed to meet specific orthopedic treatment needs. Fixed orthopedic devices are used to correct malocclusions, control habits or align teeth and can be made up of various components including bands, steel wires, auxiliary accessories, cements and adhesives. Each of these components constitute important aspects in the functionality and in the controlled and gradual movement of teeth and dentoalveolar processes.(14).

The variety in types of fixed braces means that each design can have different implications for periodontal health, as some designs can facilitate the buildup of plaque and food debris, increasing the risk of periodontal disease.(25). Furthermore, the effectiveness of the treatment depends not only on the structure and quality of the appliance, but also on the patient's commitment to oral hygiene and regular visits to the specialist dentist.(26).

In the context of the relationship between fixed orthopaedic appliances and periodontal health, the findings of this research underline the importance of choosing the right appliance based on the individual needs of the patient and the specific characteristics of his or her case. It also highlights the need for rigorous oral hygiene and regular follow-up by the orthodontist to minimise the risks of deterioration of periodontal health.(27). The choice of the type of device, together with proper management of oral hygiene, are key elements to ensure not only the success of orthopedic treatment, but also the protection of long-term periodontal health.(28).

In the present study, it was found that fixed orthopedic appliances, although essential for correcting malocclusions and aligning teeth, can present unique challenges to periodontal health. The study by Vincent-Bugnas et al. (23), brings valuable insight to this discussion by revealing that although plaque quantity was not directly related to gingival growth in patients with fixed orthopedic appliances, other factors such as appliance type, treatment duration, and individual patient characteristics did have a significant impact. This finding suggests that the relationship between fixed orthopedic appliances and periodontal health is multifactorial and not limited to plaque accumulation alone.(23).

It was also found that the presence of foreign objects in the oral cavity, such as dental braces, can have a significant impact on soft tissues, particularly the gums. According to

Sandoval-Vidal et al. (29), these devices can act as reservoirs for dental plaque accumulation and calculus formation, creating conditions conducive to the development of periodontal and gingival problems. Plaque retention around braces makes efficient removal by brushing and flossing difficult, increasing the risk of gingival inflammation and the progression of periodontal disease. This adverse effect on gum health emphasizes the importance of meticulous oral hygiene and regular check-ups by dental health professionals to minimize the negative impact of braces on periodontal health. Patient education on proper oral hygiene techniques and the use of specialized tools can be crucial to mitigate these risks.(29).

Furthermore, the updated classification of periodontal diseases by the AAP and EFP underscores the importance of assessing periodontal status in a comprehensive manner, considering not only the presence of plaque and gingivitis, but also other factors such as the type and duration of orthopedic treatment. This is especially relevant in pediatric patients, where the diagnosis of periodontal diseases involves considering additional aspects such as dental development and growth characteristics.(30).

Xia et al. (16) highlight the importance of the material selected for the manufacture of orthopedic devices, due to its interaction with periodontal tissue and maxillofacial structures.

Conclusions

- The present study reveals that the definition and classification of periodontal health are topics of considerable debate in the current scientific literature, with variability in measurement methods and threshold values used. Periodontal sulcus depth emerges as the most commonly used parameter, but the lack of standardization in its definition and measurement highlights the need for a clearer consensus to improve comparability and interpretation of studies in this field.
- Regarding fixed orthopaedic appliances, a significant diversity in their type and structure was identified, each designed for specific treatment needs. The classification of these appliances is essential since their design and use can influence periodontal health. The importance of choosing the appropriate appliance based on the patient's individual needs and specific characteristics of the case is highlighted, along with the need for rigorous oral hygiene and regular follow-up.
- The research highlights the complex interaction between dental braces and periodontal health, evidencing the critical importance of appropriate orthotic device selection based on individual patient needs and case-specific characteristics. The findings highlight that the presence of these devices can influence dental plaque accumulation and calculus formation, presenting

significant challenges to soft tissue health, especially the gums. Therefore, the need for rigorous oral hygiene and regular follow-up by dental health professionals is emphasized to prevent deterioration of periodontal health.

- The relationship between periodontal health and the use of fixed orthodontic appliances is multifactorial and complex. Although the presence of these appliances may hinder proper oral hygiene and increase the risk of periodontal diseases, other factors such as the duration of treatment and individual patient characteristics also play an important role. This research underlines the importance of personalized care and regular follow-up to prevent deterioration of periodontal health in patients undergoing orthodontic treatment.

Conflict of interest

The authors declare that there is no possible conflict of interest.

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