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Literature Review

Biological Space: Key Concept for Esthetics and Gingival Health in Restorative Procedures

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Abstract

The violation of the biological space can be caused by several factors such as subgingival caries, restorations that extend into the gingival sulcus, root fractures, and cervical root resorptions. Clinically, changes in the biological space can be observed as gingival recession and inflammation, the formation of a periodontal pocket. This condition is diagnosed by interproximal radiography methods using the parallelism technique, and by clinical evaluation through transcellular or transperiodontal probing, measuring the distance between the bone and the margin of the restoration with the aid of a periodontal probe. The clinical crown increase is a periodontal surgical procedure that aims to remove the periodontal support structure to expose healthy tooth structure region above the alveolar bone crest.

Keywords: *Periodontium; Junctional Epithelium; Dentistry*

Introduction

The healthy coexistence between the tooth and the periodontal biological structures is of fundamental importance when performing a satisfactory restoration, in the sense of adapting to the anatomical, physiological, and aesthetic needs. Unquestionably, the health of the periodontium must be restored before any restorative procedure [2].

The biological space of the periodontium has the function of protecting the supporting tissues of the dental element from bacterial aggressions and their toxic products. The body fights to defend its physical integrity. When this space is violated there is a compromise of the periodontal physiological process, in the sense that there is a more apical migration and reorganization of these structures [2].

In the presence of transgressions of the biological space of the periodontium, there is almost unanimity among the authors that there would be a need to recover this space through surgical procedures or orthodontic traction [2]. The treatment of these teeth is a challenge for dentistry, especially when they are located in the anterior region of the upper arch [10].

Faced with these problems, surgical enlargement of the clinical crown or dental traction can be performed. The teeth normally indicated for extrusion are the incisors, canines, and premolars. Clinical crown lengthening surgery sacrifices the bone of adjacent teeth and leads to excessive crown length with an unsatisfactory aesthetic result and an unfavorable crown-root ratio [10].

The choice of method will depend on the number of teeth involved, the need or not for complete orthodontic treatment, and the necessary anchorage [10]. Therefore, given this compilation of information, the present study aims to describe, through a literature review, the biological space and its main characteristics.

Literature Review

Biological space

The biological space of the periodontium must be understood in its nature as a biological barrier, whose function is to protect the supporting tissues (cementum, periodontal ligament, and alveolar bone), preventing the passage of irritating substances, bacteria, and their toxic products [2].

The integrity of the "biological space" is of paramount importance for the maintenance of gingival health since its existence is essential for the adhesion of the junctional epithelium and the conjunctiva insertion to the tooth structure [1].

The oral sulcular epithelium and the junctional epithelium are the first lines of defense against bacterial plaque activity. When this barrier is invaded, gingival inflammation and disorganization of the supporting structures occur. The supra-alveolar connective tissue is considered the second line of defense against inflammation, the more organized it remains, the greater the integrity of the underlying alveolar bone tissue. The pre-established physiological dimensional space relation must be maintained, assuring the periodontal health of the dental element, mainly in the presence of restorations [9].

Dimensions and components

Analyzing historically in the four phases of tooth eruption, they found a proportional dimensional relationship between the cementoenamel junction (CEJ) and the other supporting tissues of the tooth. These findings showed that on average the dimensions of the constituents of the dentogingival union were: Depth of the gingival sulcus - 0.69 or 0.67 mm, length of the junctional epithelium - 0.97 or 1.02 mm, and length of the conjunctiva insertion - 1.07 or 1.09 mm [1]. Of these distances, the conjunctival attachment was the most constant, while the most variable part was the length of the junctional epithelium. Therefore, the space located coronally to the alveolar bone crest can be rounded to approximately 3 mm.

Violation of biological space

The most common causes of biological space invasion are root fractures, and their predisposing factors are tooth resorption, root perforations, iatrogenic prosthetic preparations, and caries. Faced with situations like these, the recovery of this distance is necessary, either through surgery to increase the clinical crown with osteotomy or orthodontic traction. Such conduct must be carried out before restorative procedures [4].

Diagnostic methods

Proximal dental caries still represents one of the main challenges in clinical dentistry, with the early diagnosis of these lesions being the main difficulty encountered, due to their location, usually below the contact point, which makes it difficult and/or prevents an adequate clinical examination [2].

The invasion of biological space by caries, fractures, and restorative procedures, among others, can be diagnosed through clinical procedures such as transulcular or transperiodontal probing and radiographic examinations [2].

In one study, they concluded that the clinical method of transperiodontal probing was more reliable for the diagnosis of invasion of the biological space of the periodontium when compared to the radiographic analysis. The overlapping of images, the obtained image being two-dimensional instead of three-dimensional and not allowing the analysis of the free faces of the teeth, limits the use of radiographs a lot [2].

Radiographically, the biological space can be measured, verifying the distance from the enamel-cement junction to the alveolar bone crest. The main advantage of this method is that it provides us with direct visualization. The radiograph should be interproximal, using the technique of parallelism [2]. The transperiodontal probing takes place with a sterile probe, from the gingiva to the bone crest or a direct measurement of the cervical wall of the cavity to the bone crest [2].

Clinical and radiographic signs of invasion

Clinically, changes in biological space can be observed as inflammation, gingival recession, and periodontal pocket formation. In the radiographic image, a darkening of the lamina dura and alveolar bone crest can also be noted, indicating bone loss [6].

Tissue inflammation, bone loss of unforeseen dimensions, and tissue retraction are results of the body's attempt to recreate the space between the alveolar bone and the margin, to allow new insertion of tissue [7]. The first sign of caries is whitish or brownish spots, and if left untreated, caries can advance towards the deepest and most pain-sensitive dentin; later it advances to the region of the dental pulp, causing inflammation (pulpitis) and intense pain; If the proper treatment is not carried out, dental abscesses or more serious conditions such as Ludwig's angina or cavernous sinus thrombosis may arise, which can lead to death if not treated [3].

The radiographic method is capable of detecting small proximal lesions confined to the enamel, identifying large hidden occlusal lesions, accompanying the evolution of carious lesions, and providing additional information, such as the condition of the inter-dental septum and restoration margins. suitable for diagnosis of occlusal, posterior proximal caries and secondary lesions; moderate for inspection of root surfaces and deficient for smooth free surfaces, small occlusal caries, and secondary occlusal caries [3].

Forms of treatment

Faced with situations like these, the recovery of the biological distance is necessary, either through surgery to increase the clinical crown with osteotomy or orthodontic traction. Such conduct must be carried out before restorative procedures [5].

Orthodontic traction

Dental traction is the orthodontic movement of a tooth in the occlusal direction, which leads to the exposure of healthy dental tissue coronal to the bone crest, allowing restoration without aesthetic or periodontal compromise. The use of fixed appliances can be through cantilevers, elastics, orthodontic wire, and binding wire to exert the traction force. For the use of mobile devices, elastic bands, cantilevers, and magnets can be used. The choice of method will depend on the number of teeth involved, the need or not for complete orthodontic treatment, and the necessary anchorage [10].

The option for extrusive treatment is very advantageous because it is extremely conservative, providing dental restoration without the need for preparations on adjacent teeth, and because it restores the patient's function and aesthetics. The treatment period is relatively short and presents minimal discomfort. Furthermore, extrusion does not involve bone loss or periodontal support, as commonly occurs during clinical crown lengthening surgery [9].

Clinical crown augmentation

Clinical crown lengthening is a periodontal surgical procedure that aims to remove the supporting periodontal structure to expose a region of healthy tooth structure above the alveolar bone crest, delimiting and conditioning a new biological space, thus enabling better performance. of dental interventions inherent to this type of procedure [2].

Clinical situations in which crown lengthening is indicated as an adaptation and/or treatment option are common and frequent, such as invasion of the biological space due to extensive destruction of the crown and/or part of the root, tooth remnant that will receive direct

restorative treatment or indirect and that is to whom of the biological space, cases in which extreme coronal destruction is heard where it is not possible to retain the absolute isolation clamp, elimination of periodontal pockets, orthodontic extrusions when it is necessary to remove bone tissue that accompanied the additional eruption of the dental element and in aesthetic cases [8].

During surgery, a detailed assessment of the patient's health status is necessary, where correct infection control must be carried out by the professional and the patient, promoting the decrease or elimination of the inflammatory infiltrate, and improving the surgical and postoperative conditions. It should be noted that a correct control of bacterial plaque favors any dental procedure, because, in the case of performing a surgical procedure, a good state of gingival health is necessary, to obtain success in the pre, trans and postoperative periods. Often, what is treated as a contraindication must be understood as a temporary limitation, as in the case of gingival inflammation due to lack or poor hygiene.

Dental rehabilitation

The tooth structure damaged by caries, trauma, parafunction, or iatrogenic needs restorative treatment that can be performed through direct or indirect confection, depending on the type and extent of the lesion [8-13].

When choosing to carry out a direct restoration, the characteristics of the restorative material must be taken into account, as well as the area to be restored, providing for better adaptation and durability of the restoration [8-14]. Carious lesions in cervical regions require greater care regarding the conditioning of the preparation and choice of restorative material, due to the proximity and intimate contact with tissue and gingival fluids [8-16].

Silver amalgam offers a less sensitive technique and a surface smoothness compatible with this type of clinical situation. Cervical restorations in which there is some contact with periodontal tissues, require extreme adaptation and surface smoothness, establishing marginal sealing and non-retention of plaque, not compromising periodontal health close to the restoration [8].

When choosing composite resins, the most suitable for direct contact with the periodontium is microparticulate resins, as they provide surface smoothness and satisfactory polishing, reducing the accumulation of bacterial plaque, and being considered biocompatible after correct polymerization, with minimal solubility [8-20].

Conclusion

The biological space constituted by the sulcus, junctional epithelium, and connective insertion must be understood as a biological barrier, where its function is to protect the supporting tissues. The most common causes of biological space invasion are root fractures, tooth resorption, root perforations, iatrogenic prosthetic preparations, and caries. Damage caused by invasion is irreversible, with periodontal pocket formation and attachment loss related to apical migration of the junctional epithelium. Its treatment can be carried out through orthodontic traction, which aims at orthodontic extrusion and formation of periodontal support tissue and the increase of the clinical crown, a periodontal surgical procedure that aims to remove the periodontal structure of support.

Conflict of Interests

The authors declare they do not have any conflict of interest.

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