

Literature Review Article

How to diagnose and treat periodontal-endodontic lesions?

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Abstract

Objective: This literature review aims to assess the causes and consequences of periodontal-endodontic lesions, as well as its clinical, radiographic and microbiological aspects. **Literature review:** Periodontal-endodontic lesions are often changes that affect all teeth due to the close relationship between pulp and periodontium. Many authors researched about this, but there are many disagreements on the subject, starting with the different types of classification, in which many are based on the origin of the disease, the other forms of treatment, degree of pulp involvement, among others, with the purpose of helping in the correct diagnosis. The knowledge of the etiology of the disease is extremely important, because the success of the treatment depends on the rapidity of its onset, the treatment protocol adopted and medication use. **Conclusion:** It is necessary that the dentists know the morphology and structure of the oral cavity, as well as the knowledge of all factors that can cause the same damage, so that they differentiate the types of periodontal-endodontic lesions regarding to its origin, defining the best treatment to be followed.

Introduction

The periodontal-endodontic lesions have been characterized by the association of the pulp and periodontal disease in a same tooth, which makes complex its diagnosis because a single lesion

may present signs of endodontic and periodontal involvement. This suggests that one disease may be the result or cause of the other or even originated from two different and independent processes which are associated by their advancement [5]. There is a strict relationship between the pulp and the periodontium. The communication between these

two structures is observed just at the beginning of the odontogenesis, because they derived from the same mesodermic source, being reduced as the root and their structures are formed [3].

The apical foramen is the main access route between the pulp and the periodontium, with the participation of all root canal system: accessory, lateral, and secondary canals as well as the dentinal tubules through which the bacteria and its products contaminate the medium.

It is known that the main cause of the periodontal lesions is the presence of the bacterial plaque, formed by aerobic and anaerobic microorganisms which may originate an infectious process. Pulp exposures, periodontitis and caries lesions are of significant importance in the development of periodontal-endodontic lesions. If the lesions are not well treated and the canals are not correctly disinfected and sealed, they will house bacterial necrotic rests, which account for the progression of the lesion or even for the endodontic reinfection [19]. Other form of the inter-relationship is because of the iatrogenic perforations due to either rotary instruments or improper handling of the endodontic instruments [22].

Vertical root fractures and cracks may serve as a "bridge" for pulp contamination. If this periodontium shows a previous inflammation, it may have the dissemination of the inflammation which can result in pulp necrosis [13].

Several authors, through their studies, diverge on the contamination routes. Rubach and Mitchell [29] suggested that the periodontal disease may affect the pulp health when the accessory canal exposure occurs, allowing that the periodontopathogenic bacteria cause inflammatory reactions followed by pulp necrosis.

Lindhe [18] also reported that bacterial infiltrates of the inflammatory process may reach the pulp when there is the accessory canal exposure, through apical foramina and canaliculi of the furcation area. Adriaens *et al.* [2] demonstrated that bacteria coming from the periodontal pockets has the capacity of crossing the root canals towards the pulp, suggesting that the dentinal tubules may serve as a reservoir for these microorganisms and that a recolonization of the treated root surface may occur.

It is highlighted that the root planing and scaling may determine the rupture of the vessels and destruction of the neurovascular bundle in the lateral canals, provoking the reduction of the blood support and consequently leading to pulp alterations.

Notwithstanding, Langeland *et al.* [16] affirmed that the pulp would only be affected by the periodontal disease if the apical foramen was involved.

A histological evaluation performed by Czarnecki and Schilder [4], comparing the pulp of teeth with periodontal involvement with that of healthy teeth, observed that regardless of the severity of the periodontal disease the pulp of all teeth was histologically normal. These authors concluded that the pulp alterations occur only in teeth with deep caries and extensive restorations, that is, these evidences pointed out that the periodontal disease alone does not affect the pulp.

The aim of this literature review was to search for the information on the diagnosis and treatment of the periodontal-endodontic lesions, which are of extreme importance in the Dentistry because of its severity and involvement in many patients. It will be reported the aspects related to the microbiota within the infections and classification regarding to its origin.

Literature review

Microbiota

The periodontal lesion has as main cause the presence of bacterial plaque which will initiate an infectious process. It is known that in the oral cavity there was more than 600 species of microorganisms, and the anaerobic bacteria have been directly related to both the apical and periodontal lesion.

It is known, however, that the endodontic is less complex than periodontal bacteria [21]. In periodontal disease the following bacterial species may be found: *Porphyromonas gingivalis*, *Tannerella forsythia*, *Treponema denticola*, *Aggregatibacter actinomycetemcomitans* (Aa) and *Prevotella intermedia*, among others [17].

Most of the endodontic infections is mixed and polymicrobial, with the predominance of strict anaerobic microorganisms. Trope *et al.* [36] found that in the root canal there is the predominance of anaerobic microorganisms, such as some species of *Porphyromonas* and *Prevotella*.

Kobayashi *et al.* [14] reported that microorganisms common to root canals and periodontal pockets were detected in 15 devitalized teeth, without caries and with periodontal advancement. Among them there were: *Eubacterium* and *Fusobacterium* spp, *Porphyromonas gingivalis*, *Prevotella intermedia*, *Peptostreptococcus* spp, *Capnocytophaga* spp, *Actinomyces* spp and *Streptococcus* spp [8].

According to Siqueira Jr. and Lopes [34], the bacteria that are part of the red complex are of the species *P. gingivalis*, *Treponema denticola* and *Tannerella forsythia*, being related to severe and isolated forms of periodontitis; they were not found in the root canal system.

The similarity between the endodontic and periodontal microbiota indicates the strong probability of the occurrence of cross infection between the root canal and periodontal pocket.

Diagnosis

The correct diagnosis of the periodontal-endodontic lesions is of fundamental importance to determine the treatment and prognosis of each case. According to Schmitz *et al.* [30], some factors that are used to differentiate the symptomatology should be taken into account, therefore helping in the diagnosis.

The presence of severe pain associated with a periodontal lesion is probably the result of acute dentoalveolar abscess or pulp degeneration [24].

Tal *et al.* [35] affirmed that if there is a positive response to the test, it can be indicated that the lesion is primarily periodontal without endodontic involvement, because in a true combined lesion the pulp does not answer to the test. However, it is highlighted that there may be cases in which there would be a false positive response.

When the lesion is of endodontic origin, its drainage occurs by the mucosa, gingiva or gingival sulcus; when it is of periodontal origin, the drainage is through the periodontal pocket [09]. Thus, the path of the fistula should be tracked to determine the lesion origin.

Through radiographic examinations, the presence of bone loss, presence and deepness of the restorations and endodontic treatments can be evaluated. Presence of bone rarefaction at the furcation region showing the proximal bone crests preserved indicates that the lesion is of endodontic not of periodontal origin, as well as marginal bone loss with apical rarefaction which had or had not undergone to endodontic treatment. If there is a deeper and more angulated marginal bone loss in isolated teeth with normal apical contour of the periodontal ligament without presenting aggression factors to the pulp, the periodontal disease may happen over the pulp [13].

The presence of tooth mobility helps in the differential diagnosis because the periapical destruction associated with the periodontium collapse jeopardizes the insertion apparatus, facilitating the onset of the periodontal disease; however, in cases of acute dentoalveolar abscess at developed stage there is little mobility. Therefore, the degree of tooth mobility will determine the lesion origin [32].

According to Gold and Moskow [9] and Rossman [28], in the true periodontal-endodontic lesion, the clinical probing deepness is irregular mainly at the labial/buccal surface because there is an abrupt probing along with the tooth axis.

Among the parameters for the diagnosis elaboration, the clinical history of the patient brings important information. According to the studies of Goldman and Schildert [10], cases of caries, traumas, defective restorations and severe abrasions which can develop into a pulp necrosis indicate the endodontic origin of the lesion. In cases of the absence of these factors and presence of calculus, plaque, gingival inflammation and periodontitis, there is the probability of the lesion to be of periodontal lesion [5].

Classification of periodontal-endodontic lesions

The periodontal-endodontic lesions have received several classifications, among which is the classification of Simon *et al.* [33]: primary endodontic lesions with secondary periodontal involvement, primary periodontal lesions, primary periodontal lesions with secondary pulp involvement and true combined lesions.

The primary endodontic lesions exhibited only alterations inside the pulp chamber without affecting the periodontium; therefore, only with the pulp chamber and root canal debridement is enough to result in the lesion repair. If there is an acute exacerbation of a chronic apical lesion, the lesion can be drained towards the coronal direction through the periodontal ligament, giving the impression that it is a periodontal abscess; however, the fistula is of pulp origin opening in an area of periodontal ligament.

In primary endodontic lesions with secondary periodontal involvement, the root canals contamination occurs because of the caries process, traumatic lesions and coronal microleakage [15]. Pulp inflammation or necrosis leads to an inflammatory response in the periodontal ligament, apical foramen, and the underlying alveolar bone. Clinically, it is presented as deep and localized periodontal pockets extending mostly up to the tooth apex, resulting in a localized diffuse swelling.

Primary periodontal lesions consist in alterations only in the periodontium caused by periodontal pathogens without the involvement of the root canal; therefore the periodontal treatment is the most indicated for the cases. Clinically, the periodontal pocket is presented with several deepness, frequently with bacterial plaque and dental calculus. In these cases, the pulp sensitivity test is within normality [26].

The primary periodontal lesions with secondary pulp involvement have been characterized by the presence of the periodontal pocket, which invades the pulp through the dentinal tubules, lateral and accessory canals or apical foramen,

resulting in pulp necrosis. Single-rooted teeth have a less favorable prognosis than multirooted teeth because the latter can undergo root resection as an alternative treatment. The prognosis for a tooth with periodontal disease is determined by the result of the periodontal therapy.

The true combined lesions take place when the pulp necrosis and periodontal disease is within a same tooth, occurring together or alone, with a more complex diagnosis than for those cases with either isolated periodontal disease or periapical lesion [2]. Procedures of endodontic treatment prior to periodontal treatment may lead to a good prognosis, but there will be cases in which surgical procedures are necessary aiming to reduce the periodontal pocket deepness. The periodontal tissues may not respond well depending on the severity of the periodontal disease. In many cases, guided tissue regeneration (GTR) has been applied in surgeries of combined lesions, mainly in molars with furcation lesion resulting in an improvement of the clinical probing [4, 20, 24, 37].

Among other classifications, there is that of Guldener and Langeland [12], who used only the lesion origin: primarily endodontic; primarily periodontal and combined periodontal-endodontic lesions.

Still there is the classification of Torinejad and Trope (*apud* Abbot [1]), who based on the origin of the existing periodontal defect: lesion of endodontic origin; lesion of periodontal origin; lesion of combined periodontal-endodontic origin, subdivided into two types: combined without communication and combined with communication [13].

Von Arx and Cochran [38] proposed a classification based on the clinical treatment with the employment of a membrane:

- Class I: lesion with bone defect in the apex which may invade the buccal/labial and lingual cortex. However, the periapical lesion cannot be measured through the gingival sulcus of the affected tooth, that is, the periodontal pocket does not reach the apex;
- Class II: apical lesion with the concomitant marginal involvement, also referred as a combined periodontal-endodontic lesion, with great periodontal pocket deepness around the affected tooth. The treatment uses the membrane for the guided tissue regeneration;
- Class III: furcation lesion, coming from the accessory canals or from iatrogenic perforation and the marginal lesion may or may not occur. Also, the use of the membrane for guided tissue regeneration can be used as treatment.

Treatment protocol

After the diagnosis elaboration, it is recommended according to Abott [1], to adopt a treatment protocol:

- If the disease is exclusively endodontic, the treatment of the root canals is performed adopting antimicrobial chemical substances as intracanal medications, e.g. calcium hydroxide, because of its mineralizing and antimicrobial action;
- If the disease involved only the periodontium, the periodontal therapy is performed comprising the root planing and scaling to control the periodontal infection. As an antimicrobial agent, 0.12% chlorhexidine solution can be associated with the periodontal treatment;
- If the two diseases are truly combined, the studies Harrington *et al.* [13] recommended primarily the treatment of the endodontic lesion, followed by the non-surgical periodontal therapy, comprising the surgical access and preparation of the root canal, placement of an intracanal medication (calcium hydroxide) at periodical changes. The periodontal evolution is evaluated after 3 or 4 weeks.

If there is no improvement of the periodontal conditions, root planing and scaling is performed. According to Vanchit *et al.* [37], among some surgical approaches, the guided tissue regeneration can be used in which a membrane prevents the migration of the epithelial cells towards the defect during the healing, allowing the selection of the cells. The grafting material can be autogenous, allogeneous or alloplastic [29].

Discussion

It is known that both the pulp and the periodontium is closely linked between each other, through the apical foramen, accessory canals, and dentinal tubules of the root, and one can interfere on the integrity of the other. Although there is the existence of these communication routes, the mechanism of direct transmission of the periodontal infection to the pulp is still controversial.

Some authors such as Rubach and Mitchell [29] affirmed that the periodontal disease may affect the pulp when there is the exposure of the accessory canals through the apical foraminas and canaliculi in the furcation. Adriaens *et al.* [2] reported that the bacterias coming from the periodontal pockets may contaminate the pulp through the dentinal tubules that would be exposed due to the root planing and scaling, serving as a microorganism reservoir

resulting in the recolonization of the root surface treated. Seltzer *et al.* [31] contradicted this idea, because even with the removal of the cementum during the periodontal therapy in vital teeth, the pulp tissue will be protected against the harmful agents through forming reparative dentin. Moreover, a dentinal fluid move towards the exterior with the function of protection and cleaning therefore reducing the diffusion of the harmful products of the bacterias on the exposed dentin.

On the other hand, Langeland *et al.* [16] affirmed that the pulp would only be affected by the periodontal disease if the apical foramen is involved.

Czarnecki and Schilder [4] also affirmed that, while the lateral/accessory canals and mainly the apical foramen have not been affected by the periodontal disease, the pulp still remains unchanged.

Several other etiologic factors may also initiate the pulp reaction, such as fractures, cracks, clinical procedures, traumas; however, caries is the most important contamination route of the pulp [13, 22].

Because of that, it is highlighted the importance of performing an adequate diagnosis, by evaluating the factors such as the microbiota, symptomatology, and clinical history for the determination of the correct treatment and prognosis. And even taking into consideration all these factors, there are still divergences regarding to the origin and direction that these infections developed, therefore justifying the several classifications of these lesions.

If the pulp is only inflamed and is not necrotic, the periapical tissues are preserved. Unlikely, a necrotic and infected pulp may lead to a periapical reaction [16].

Concerning to the periodontal-endodontic lesion treatment, it must be guided for the removal of the etiologic factors accounting for the tissue destruction. Depending on the etiology, the lesion may respond to both the endodontic and periodontal therapy, because according to Dejean *et al.* [5], isolated cases of the disease may occur, or one is the result or cause of the other, being associated during their advancement, a fact that was verified by Carranza *et al.* [3] and Fachin *et al.* [7].

Harrington *et al.* [13] affirmed that the endodontic treatment should occur prior to the periodontal therapy, because it provides time for the initial periapical healing, enabling a better evaluation of the periodontal conditions, in cases of true combined lesions.

If the endodontic treatment and the non-surgical procedures of scaling do not provide an improvement, the next step will be the surgical

periodontal scaling. According to Vanchit *et al.* [37], one of the surgical approaches for the treatment of these lesions is the guided tissue regeneration.

Conclusion

Based on the literature review, it can be concluded that is of extremely importance that the dentist know to differentiate the origins of the periodontal-endodontic lesions, including all the routes of communication between the pulp and the periodontium which act as possible "bridges" for changing the microorganisms, therefore enabling the dissemination of the infection from one site to another.

Through this knowledge, the dentist will achieve the correct diagnosis and adequate treatment, resulting in greater chances of obtaining the success in the treatment of the periodontal-endodontic lesions.

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