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Condition requiring endodontic treatment to maintain the integrity of periodontium

Yasser Khaled,[1] Bindiya K Pahuja[2]

[1]Department of General Dental Sciences, Oral Pathology, Oral Medicine and TMD/Orofacial Pain, Marquette University - School of Dentistry, USA

[2]Periodontology and Implantology, Senior Resident, AIIMS, India

Correspondence: Yasser Khaled, BDS, MDSc, MMSc, Vice-President, Marquette University Academic Senate, Member, Canadian Oral Health research Group, Assistant Professor, Department of General Dental Sciences, Oral Pathology, Oral Medicine and TMD/Orofacial Pain, Marquette University - School of Dentistry, USA, Email yasser.khaled@marquette.edu

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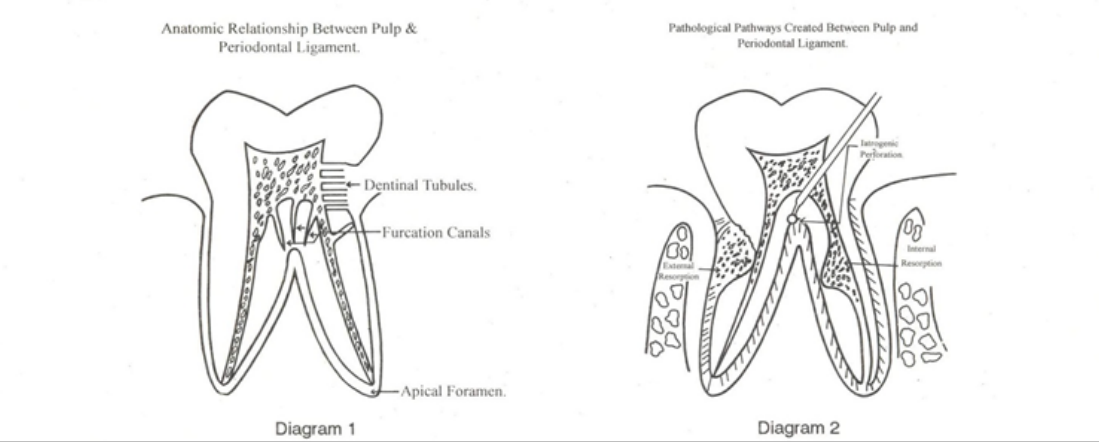
Introduction

The pulp and periodontium have common embryonic connections as well as anatomic and functional interrelationships. The two entities are so well connected that we can consider them as a single continuous system. (1) There are various pathways for the exchange of infectious elements and irritants from the pulp to periodontium or vice versa, leading to the development of endodontic periodontal lesions.[1] The pulp periodontal complex always presents challenges to the clinician as far as diagnosis and prognosis of the involved teeth are concerned as it is difficult to catch the source of infection in many clinical pictures. It is very essential to make a correct diagnosis so that the appropriate treatment can be provided.[2] In this article we are trying to simply the diagnosis of endo-perio lesions and also trying to focus on the need elective endodontic treatments prior to periodontal treatment (Diagram 1 & 2).

Diagram 1 and 2 showing various anatomical and pathological connections between pulp and periodontium.



Pulp and periodontal tissue can communicate through various natural or pathologic pathways. These could be as follows:

(1) Pathways of developmental origin (anatomical pathways)

- Apical foramen, accessory canals/lateral canals
- Congenital absence of cementum exposing dentinal tubules
- And Developmental grooves[3]

(2) Pathways of pathological origin

- Spaces on root surface created by insertion of Sharpey's fibers
- Root fracture following trauma
- Idiopathic root resorption (internal and external)
- Loss of cementum due to external irritants

(3) Pathways of iatrogenic origin

- Exposure of dentinal tubules while performing SRP(scaling and root planning)
- Lateral root perforation during endodontic procedures
- Root fractures during endodontic procedures

Simring and Goldberg[1] were the first to describe the relationship between pulpal and periodontal disease as "endo-perio lesion." The

most common classifications of endodontic-periodontal lesions was given by Simon et al.[4] depending on the cause of the lesion as primary endodontic disease, primary periodontal disease, and as combined disease. In 2014, Al-Fouzan suggested a new endodontic-periodontal interrelationship classification, based on the primary disease and its secondary effect. This rational classification increases the understanding of the disease process and its origin. The classification is as follows.[5]

1) Retrograde periodontal disease

a) Primary endodontic lesion with drainage through the periodontal ligament,

b) Primary endodontic lesion with secondary periodontal involvement;

2) Primary periodontal lesion

3) Primary periodontal lesion with secondary endodontic involvement;

4) Combined endodontic-periodontal lesion;

5) Iatrogenic periodontal lesions

A. Retrograde Periodontal Disease: It could be of two subcategories.

i. Primary Endodontic Lesion with Drainage through the Periodontal Ligament. Only a deep narrow probing defect is noted on any one aspect of the tooth root. Acute exacerbation of a chronic apical lesion on a tooth with a necrotic pulp may drain coronally through the periodontal ligament into the gingival sulcus. The condition may mimic periodontal abscess in clinical picture. In reality, it is a sinus tract from pulpal origin that opens through the periodontal ligament area. For diagnostic purposes, it is imperative for the clinician to insert a gutta-percha cone into the sinus tract and to take one or more radiographs to determine the origin of the lesion. When the pocket is probed, it is narrow and lacks width. Primary endodontic diseases usually heal following root canal treatment.

ii. Primary Endodontic Lesion with Secondary Periodontal Involvement. There is a more extensive periodontal pocket which has occurred as a result of the drainage from noxious agents present in an infected root canal system. Long-term existence of the defect has resulted in deposits of plaque and calculus in the pocket with subsequent advancement of the periodontal disease. The integrity of the periodontium will be reestablished if root canal treatment is done properly. If a draining sinus tract through the periodontal ligament is present before root canal treatment, resolution of the probing defect is expected. Tooth may require periodontal intervention as a part of the treatment.

B. Primary Periodontal Lesion. This part of the classification can be further modified and can again be divided into two categories. 1) Where the periodontal disease has gradually spread along the root surface towards the apex but may not damage the periapical area and pulp may remain vital and may show some degenerative changes over time. In such cases, it is advisable to treat the periodontal tissues only. 2) Where as in second condition deep instrumentation is needed which may compromise the integrity of apical foramen and where the tooth is significantly mobile a prior endodontic treatment may be needed. The pulp is vital in this condition.

C. Primary Periodontal Lesion with Secondary Endodontic Involvement. Progression of the periodontal disease and the pocket leads to pulpal involvement via either a lateral canal foramen or the main apical foramen. Pulp subsequently becomes necrotic and infected. In such cases, it is advisable to treat both tissues but endodontic treatment has to done before periodontal intervention.[6]

D. Combined Endodontic-Periodontal Lesion. Tooth has a pulpless, infected root canal system and a coexisting periodontal defect. An attempt should be made to identify the primary cause of a combined lesion but this may not always be possible. In such cases, it is not essential to determine which disease entity occurred first as the treatment will involve both endodontic and periodontal management. Any one of the treatment modality would not help and the tissue will not heal adequately. It is generally advisable to treat both tissues concurrently in order to create the most favorable environment for healing.[7]

E. Iatrogenic periodontal lesion. Root perforations, root fracture, coronal leakage and chemical injuries to the periodontium due to endodontic or conservative procedures may lead to they are likely to cause necrosis of the cementum, in ammation of the periodontal ligament, and subsequently root resorption.[8]

In all the above mentioned cases an endodontic treatment is required prior to periodontal therapy. Whenever endodontic treatment is indicated along with periodontal therapy, the best sequence of treatment is that endodontic treatment should precede the periodontal therapy as it has been shown that if the toxic materials from the root canal is removed, reattachment of soft tissue is improved.[9] also by doing this the severe intraoperative sensitivity can be avoided if the pulp content is removed first. More areas where endodontic treatment is needed before periodontal interventions are where:

6) Root amputation is required to gain periodontal healing

Root amputation may be a viable treatment for a severe periodontal defect that affects one root of a multi-rooted tooth. In several cases, the pulp may appear to be normal but elective RCT is warranted. Root amputation is also indicated in a multi-rooted tooth that has an extensive external root resorption affecting a single root.[10]

7) Surgical removal of some odontogenic and non-odontogenic bone lesions approximating the root apex

Elective RCT of teeth with normal pulps prior to surgical interference of some bone lesions approximating the root apex may be indicated because of the high possibility of apical injury which in turn may compromise the vascular supply of the related vital teeth during curettage of the lesion.[11] The same principle can also be applied to teeth scheduled for extensive periodontal surgery where the root apex is certainly involved.[12]

8) In the management of juvenile periodontitis, prior to tooth hemisection Elective RCT has also been reported as an adjunct component in the management of juvenile peri-odontitis, prior to tooth hemisection,[13] and for traumatized vital teeth with discoloration resistant to external bleaching.[14]

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Clinical considerations and diagnosis of endo-perio lesions

It is easier to determine the origin of the lesion when a pulp vitality test is positive because this will rule out an endodontic etiology. However, pulp tests may not be always reliable.[15] This consideration is particularly relevant when challenges to pulpal status arise from periodontal diseases such as partial necrosis of a pulp as in multirooted tooth or when areas of pulpal necrosis are associated with areas of pulpal inflammatory involvement in the single rooted tooth.[16] Therefore, accurate diagnosis can be made by careful history taking, thorough oral hard and soft tissue examination. The following steps help in diagnosing the exact lesion (Table 1).[17]

`	Retrograde periodontal lesion	Primary periodontal lesion	Primary periodontal secondary endodontic	Combined lesions	Iatrogenic periodontal lesion
Visual (magnifying loupes and operative microscope can be effective)	Soft tissue-presence of sinus opening Tooth-presence of decay/ large restoration/ fractured restoration or tooth/ erosions/abrasions/ cracks/ discolorations/ poor RCT	Inflamed gingiva/ gingival recession around multiple teeth Accumulation of plaque and subgibgival calculus around multiple teeth Intact teeth Presence of swelling indicating periodontal abscess	Presence of plaque, subgingival calculus and swelling around multiple teeth Presence of pus, exudate Presence of localized/ generalized gingival recession and exposure of root	Plaque, calculus and periodontitis will be present in varying degrees Swelling around single or multiple teeth Presence of pus, exudate	inflammation of marginal gingiva, periodontal ligament and necrosis of cementum may occur due to iatrogenic trauma to the periodontium. Root perforation,fracture/ misplaced post coronal leakage from the restoration margins.
Pain	Sharp	Usually dull ache Sharp only in acute condition	Usually dull ache Sharp only in acute periodontal abscess	Dull ache usually Only in acute conditions it is severe	Depends on the kind of injury. Dull ache in chronic conditions
Palpation (a positive response to palpation may indicate active periradicular inflammatory process)	It does not indicate whether the inflammatory process is of endodontic or periodontal origin	Pain on palpation	Pain on palpation	Pain on palpation	Pain on palpation
Percussion (it indicates the presence of a periradicular inflammation that may be either from pulpal or PDL origin)	Normally tender on percussion	The sensitivity of the proprioceptive fibers in an inflamed periodontal ligament will help identify the location of the pain	Tender on percussion	Tender on percussion	Tender on percussion
Mobility (tooth mobility is directly proportional to the integrity of the attachment apparatus or to the extent of inflammation in the PDL ligament)	Fractured roots and recently traumatized teeth often present high mobility	Localized to generalized mobility of teeth	Generalized mobility	Generalized mobility with higher grade of mobility related to the involved tooth	Localized mobility may or may not be present.
Pulp vitality using cold test, electric test, blood flow tests, and cavity test (an abnormal response may indicate degenerative changes in the pulp)	A lingering response-irreversible pulpitis No response-necrotic pulp (non-vital)	The pulp is vital and responsive to testing	Pulp vitality may be positive in multirooted teeth	Usually negative because of non-vital pulp. Vitality tests may give a positive response in multirooted teeth	Pulp vitality tests negative

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Table Contiued

`	Retrograde periodontal lesion	Primary periodontal lesion	Primary periodontal secondary endodontic	Combined lesions	Iatrogenic periodontal lesion
Pocket probing	A deep narrow solitary pocket in the absence of periodontal disease may indicate the presence of a lesion of endodontic origin or a vertical root fracture	Multiple wide and deep pockets	Presence of multiple wide and deep periodontal pockets	Probing reveals the typical conical periodontal type of probing with the exception that at the base of the periodontal lesion, the probe will abruptly drop further down the lateral root surface and may even extend to the apex of the tooth	Presence of solitary wide pocket [Figure 2a-d] but if periodontal lesion is due to fracture of root then solitary deep narrow pocket (mainly localized)
Sinus tracing (by inserting a semi rigid radiopaque material into the sinus tract until resistance is met)	A radiograph with gutta percha points to apex or furcation area in molars	Sinus tract mainly at the lateral aspect of the root	Sinus tract mainly at the lateral aspect of the root	Difficult to trace out the origin of the lesion, if a sinus tract is present, it may be necessary to raise a flap to determine the etiology of the lesion	Sinus tract mainly at the apex or furcation area
Radiographs	Presence of deep carious lesions/ extensive or defective restorations/previous poor root canal treatment/possible mishaps/root fractures/ root resorption with peripical radiolucency Often, the initial phases of periradicular bone resorption from endodontic origin is confined only to cancellous bone. Therefore it cannot be detected unless the cortical bone is also affected	Vertical bone loss and more generalized than to lesions of endodontic origin Bone loss wider coronally	Angular bone loss in multiple teeth with a wide base coronally and narrow at the apex of the root	The radiographic appearance of combined endodontic–periodontal disease may be similar to that of a vertically fractured tooth	Presence of deep carious lesions/ extensive or defective restorations/ previous poor root canal treatment/diminution of the pulp canal space/ possible mishaps/root fractures [Figure 3a and b]/root resorption with a wide base radiolucency around the apex of the root [Figure 4a-e]
Cracked tooth testing using transillumination staining	Painful while chewing and on releasing the biting pressure	No symptoms	No symptoms	Painful while chewing and on releasing the biting pressure	Painful while chewing& on releasing biting pressure

Conclusion

1) A strong co-relation has been found between periodontal disease and inflammatory and degenerative changes in the pulp. 2) The sharp shooting pain almost always requires endodontic treatment only exceptions are the cases of acute periodontal abscess which is easy to diagnose. 3) The dull aching pain may indicates only periodontal involvement or chronic pulpitis or a combination of the two. 4) The clinical symptoms of pulpitis commonly seen in periodontal patients are mostly intraoperative than pertaining to the disease itself as vigorous root planning may open some dentinal tubules leading to the persistent sensitivity and pain. 5) Pulp vitality test is of lower significant value in combined endo-perio cases as there are high chances of getting false positive results. 6) There are a large number of oral conditions where elective endodontic treatments are needed to maintain the integrity of the periodontal tissue. 7) By elective endodontic treatment we refers to RCT of either a normal pulp or a doubtful pulp prior to restorative procedures or calcified pulp canal (calcific metamorphosis) or an injured pulp following traumatic dental injuries such as avulsion and some luxation injuries.

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