Pulpul and periodontal relationship :

Soft pink tissue of the pulp is dependent on its normal hard dentine shell for protection. As

price of this protection, the pulp contributes to closed symbiosis with its immediate environment with which it’s confluent and mainly periodontal ligament and alveolar bone. So pulp and periodontal tissues consist of two interdependent anatomical and functional

entities which means response of the pulp to different stimuli does not necessarily end at the “magical” border of the apical foramen so it can extend following the continuity of the connective tissue toward periodontal ligament and alveolar bone.

Periapical inflammation is the extension of pulpal inflammatory process into the periapex

and periapical areas are regions of reaction to what has occurred within the root canal system.

When bacteria and their toxins make their exit through the apical foramen then periapical

inflammation or infection is established the first tissue affected is the periodontal ligament in the radiograph it shows thickening and widening of lamina dura around the apex of

the root. This first tissue affected is also the last tissue that returns to its original architecture

and function following healing of root canal treatment.

So when the pulp becomes necrotic by ability of tooth the function and durability of the tooth in the arch will depend on the help of its attachment apparatus...so the attachment apparatus will become the vital organ of the tooth. It's destruction will impair the ultimate retention of the tooth.

The tooth can survive without pulp but it can't survive without the attachment apparatus specially when the pulp becomes necrotic or infected.

The root canal treatment involves working within the tooth...the periapical tissues and their response determines the outcome of the treatment and the fate of the tooth..with the battle is joined outside the tooth full resources of the body are utilized because the hostological makeup and special environmental conditions within the periodontal ligament will permit tolerance of edema and will conclusively lead to healing of inflammatory process in the lesion .

Canal anatomic and physiologic characteristics that contribute to this biological interdependence of pulp and periodontal tissues includes embryologic origination,

vascular circulation, innervations, lymphatic system, anatomic defense, and repair

mechanism.

As we know from histology the dental papilla forms the pulp and the dental sac forms cementum...about the 8 week of fetal life the first beginning of the dental papilla which will become the future dental pulp is seen, concurrently outside the dental papilla the mesenchyme will form the dental sac which will give the tissues of periodontium– PDL, cementum,

and alveolar bone.

The dental artery provide the pulp with blood, before passing into apical foramen arterioles of the pulp will course through the periodontal ligament where they rarify. A plethora of arterio-venous anastomosis is usually observed between the puplal and periodontal vessels in this region. And the most important before passing upward through the apical foramen nerve fibers will send branches to the periodontal ligament region therefore any inflammatory reaction in the periodontal ligament will affect the pulp tissue and vice versa – their circulation and innervation are the same.

Multiple foramina are the rule rather than the exception!

Main blood supply of the pulp enters through these foramina and usually they are filled with periodontal tissue which is later replaced with cementum and dentine.

Communication between the pulp and periodontal tissues is not limited to the apical region, occasionally during the formation of the root sheath a break might develop in the

continuity of the root sheath producing a small gap..with this occurs then dentinogenesis does

not take place opposing to that defect and the result will be a small accessory canal between the dental sac and the pulp, usually the accessory canals are not seen or not visible on the radiograph and in the majority of cases they become visible following obturation of the root canal system ..but their presence can be suspected if a lesion appears on the lateral, middle, or furcation aspects of the tooth. Phsyologically these lateral canals are covered with tissues of periodontium. As for their distribution, they are present at every level; in anterior teeth they are more frequently noted in the apical lesion around 70% while in posterior teeth a great many accessory canals are seen in the furcation area and account for the frequent presence of furcation radiolucencies in molar teeth.

Following a periodontal disease lateral canals are exposed to the septic environment of the

periodontal pocket and oral cavity … when the periodontal lesions are deep resorption can

be seen within the root canal system opposite to the lateral canals

The floor of an infected molar is more permeable than that of a non-infected tooth this means that there is a constant flow of material directly through the puplal floor between the pulp and adjacent tissues … This means that the inflammation of severe intensity in the region will indicate thinnest bone of the furca and also the normal presence of marrow spaces which are susceptible to invasion in this area ,,, the radiographic appearance (radiolucency) of the furcation is usually due to an auxiliary or lateral canal in the region or inflammatory products extending through the pulpal floor

This communication between pulp and periodontal tissues occur through dentinal tubules;

despite their very small diameter, bacteria and their products can penetrate these tubules toward the pulp and cause damage.

There are also other factors that can affect the establishment of the endo-perio lesions through anatomical anomalies such as the enamel pearls which are small enamel droplets formed on the surfaces of or between the roots and they contain many opening through which pulps of these teeth could be affected, also there is vertical developmental radicular groove in the crown of upper central and lateral teeth can also results in untreatable periodontal disease that can affect the pulp hemostasis and also iatrogenic factors such as perforation that can results in combined endo-perio disease.

As for the effect of pulpal inflammation on the periodontium..pulpal inflammation does not

always lead to extensive periodontal damage but bacteria or their toxins making their exit through the apical foramen toward the periodontium can cause periodontal changes even through accessory and multiple foramina in the region and also through the Crestal extension of the periapical granulmatous lesion .

So the exit of bacteria and their toxins through the apical foramen toward the periodontium can resualt in the establishment of the periapical inflammation that may develop into periodontal pocket draining via the gingival sulcus of the tooth .

As for the effect of periodontal lesions on the pulp ..pulpal response to mild periodontal disease can demonstrate fibrosis , calcification and debris in number of blood vessels.

The periodontal pockets extending to the apex of the tooth can affect the vitality of the pulp

causing damage ranging from hyperemia to necrosis.

Just as products from inflamed pulpal tissue can cause periapical inflammation, periodontal

disease can cause pulpitis what we call retrograde or secondary pulpitis usually associated with periodontal disease and a vicious circle can establish >> periodontal disease results in inflamed pulp and the inflamed or necrotic pulp will perpetuate through lateral canals the periodontal disease …

Also the effect of periodontal treatment should be considered... deep root planing can cause removal or loss of cementum in addition of sensitivity this also can lead to inflammatory changes or hemorrhages.

this process is similar to the induction of acute inflammation of the pulp following cavity preparation ...so deep scaling can cause pulpal inflammation and hemorrhages in the pulp that can produce pain spasms and ultimate death of pulpal cells; a phenomenon similar to cardiac angina attack... So what happens practically is that we will have a small area of infarction in the body of the pulp followed by coagulation necrosis.

But not all periodontal curettements of teeth will terminate with pulpal inflammation and necrosis.

Attachment apparatus could be affected variety of diseases; endodontic, periodontal or occlusal origin.

As for the classification of endo perio diseases , they are classified on

the basis of their etiology, clinical symptomatology, or primary location of the

lesion, and therapeutic treatment of the lesion.

According to that we have:

- Class I Endo-Perio lesion >> that is primarily or pure endodontic

(pulpal/periapical) – due to inflammation or necrosis of the pulp. In

other words, the primary cause of that lesion is pulpal (endodontic) in origin,

but Symptoms clinically and radiographically simulate periodontal disease.

- Class II Endo-Perio lesion >> the primary or pure periodontal in origin, but Symptoms clinically and radiographically simulate endodontic disease.

- Class III (true or combined) Endo-Perio lesion >> both endo and perio diseases exist in the same tooth; and here we have two subcategories; (i) the lesion is pure or primary periodontal but treatment requires endodontic therapy, or (ii) the lesion is pulpal or primary endodontic but treatment requires surgical periodontal therapy.

In ‘Class I’ which is pure or primary endodontic lesion ...the most significant sign is isolated pocket in a clean mouth it means that there is no other periodontal disease in other areas of the mouth... it is very rare to have severe periodontal disease around one tooth only while all other teeth are relatively normal. Basis for diagnosis; is loss of vitality ...the electric pulp test shows negative response usually obtained by electric pulp tester.

In case of pulpotomy, pulp capping, large restorations, deep carious lesion, or considerable diminishing of the pulp canal space; all these are strong signs or indications that an endodontic lesion is present.

What happens is that periapical lesion can find a pathway resulting in what's appears to be a periodontal pocket ..they drain through soft tissues.. but what we see is no true furcation invasion, because there is no communication between the radiolucencies area with true periodontal pocket. This is a “sinus tract” – not a true periodontal pocket, which means that there is epithelium proliferation, but No periodontal pocket formation. We do tracing by guttapercha placed in sinus tract which helps in finding the origin of the disease and usually it will heals with only endodontic treatment alone ...no need for perio treatment. The radiolucency in the furcation area heals perfectly as well following the endodontic treatment. That means that probing Depths will back to normal from mesial, buccal, to distal (all sites); a result which is rare - if possible – to obtain when we have a periodontal disease so rapidly. Worth saying that the root surface in that so-called pocket should not be scraped or scaled because the viable periodontal tissues could be found and scaling will interfere with the healing process cause it will remove them do not want to remove them.

Class I endo-perio lesion “looks as if” periodontal therapy is needed, the primary cause is endodontic that requires endodontic therapy only, heals rapidly and has an excellent prognosis.

In Class II which is pure perio (the dominant condition is periodontal) – the primary cause is periodontal. Symptoms might simulate endodontic disease. Periodontal probing will show increased pocket depth with plaque and calculus formation and the bony lesion is usually more widespread and generalized ...mouth must be examined for the existence of periodontal disease in other areas.. this is very good indication that class II endo-perio lesion is present. Pulp testing should indicate vital pulpal response. Symptoms of pulpal disease such as draining sinus tract, loss of bone and/or soft tissue support,sensivity, tenderness to percution mobility, and swelling; all these are confused with endodontic diagnosis.. Also a tooth with severe periodontal lesion but with no Restoration, caries-free - or only minimal restoration -, no fracture, and normal response to electric pulp tester; mostly indicates class II endo-perio lesion so periodontal treatment must be performed to this tooth...cause unless perio treatment is performed the disease forces will continue and we will have more complications and also it may progress around root surface to apical region mimicking combined endo-perio lesion.

In Class III were both endo and perio disease can attack the same tissue, also called true

combined endo-perio lesion.this means any tooth with 2 thirds or more bone loss is potentially a case of combined endo perio disease of (pulpal periodontal syndrome)...a lesion that appears to be continues from the Crestal bone to the periapex when examined or viewed radiographically and clinically may in fact be two separate lesions that are joined..the lesion extending from crestal bone to the apex is a periodontal lesion due to periodontal damage while a lesion that extends from the apex toward the crestal bone is endodontic lesion due to endodontic causes ( pulpal inflammation or necrosis)... these combined lesions could be primarily pulpal in origin with secondary apposition of periodontal disease, it could be primarily periodontal disease with extension to the pulpal tissue, or it could be pulpal and periodontal lesions in which disease processes exist independently in both tissues.

Diagnosis depends on the patient does have periodontal disease in multiple areas of the

mouth. If both periodontal and endodontic diseases are present in the same patient then the treatment and prognosis will change ...although the overall prognosis in combined endo-perio disease is questionable but we notice that the endodontic component of the lesion has better prognosis because it has a better chance of resolution ... if endodontic therapy is only performed the periapical lesion will heal to the point where the periodontal lesion begins. On the other hand, if periodontal treatment is only performed the crestal lesion will heal to the point where the periapical lesion begins...so when ever we have combined lesion we must do combined treatment.

Most importantly that root canal treatment always performed first or at least at the same time of periodontal treatment because endodontic component has better chance of resolution.

Pathological components of the pulp will retard healing process of periodontal disease because it will provide it with toxins.

If the periapical lesion has healed the incidence of reccurance is negligible but if they reccur then this is not an endodontic cause.

To prevent periodontal complications we can use non-setting calcium hydroxide for treatment to prevent establishment of chronic periodontal disease and also to improve the micro environment in the lesion.

A subcategory of class III is Endodontic therapy and root amputation may be required to gain healing for a periodontal only problem. Typical indication where we have severe periodontal defect around only one root of a multi rooted teeth while the other roots have healthy support or maybe slightly inflammed here we may interfere and do hemisection .

Another subcategory is the vertical root fracture which is untreatable in these cases.

Also perforations we treat them by repair of the perforation site, root amputation, hemisection or extraction depending on the case.

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