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Review Article

PERIODONTAL DEFECTS- A REVIEW

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ABSTRACT
Periodontal disease alters the morphologic features of the bone in addition to reducing bone height. The extent and the severity of alveolar bone loss in the dentition are usually assessed by a combination of radiographic and clinical means and are important adjuncts to the clinician in the diagnosis, treatment planning, and assessment of prognosis of the periodontal patient.

Key words:- Lamina dura, Furcation involvement, bone destruction.

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INTRODUCTION

One of the areas of chief interest in the periodontal examination is the interdental septum. The interdental septum, or septal bone, is located between the roots of adjacent teeth. It is therefore more clearly visualized than bone that is located on the buccal or lingual aspect of the tooth.

Interdental Septum and Crestal Lamina Dura

The shape of the interdental septum is a function of the morphology of the contiguous teeth. Teeth that are quite convex on the approximating surfaces (i.e., "cup-shaped") will give rise to a wider interdental space in the mesiodistal dimension. This will result in flatter, broader septa of larger mesiodistal width. Teeth that present with a flatter, less convex interproximal profile will tend to produce narrower interdental spaces. This results in formation of a "septal peak" and is most commonly seen in the anterior regions.

Loss of the architecture results in "blunting" or loss of septal height and may indicate early periodontitis (although evidence of clinical attachment loss will precede radiographically evident bone loss**)**. Figure-1 shows early and more advanced blunting of the septal crests.

The normal shape of the crowns of the posterior teeth gives rise to a relatively flat alveolar crest and this, in turn, results in a rather flat interdental image on the bitewing radiograph. The thin, radiopaque line at the top of the crest, which is continuous with the lamina dura adjacent to the PDL, is known as the crestal lamina dura. It has been suggested that loss of the crestal lamina dura may correspond to periodontal disease activity [1].

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However, failure to visualize the crestal lamina dura with conventional imaging may occur in a high percentage of interproximal sites, and thus may be regarded as within normal limits.[92] While the absence of the crestal lamina dura is not indicative of current or impending disease activity, there is evidence to suggest that the presence of a crestal lamina dura may be associated with clinical stability. Increased density of the crestal lamina dura has been reported after successful periodontal therapy.

Normally, the alveolar crest meets the lamina dura at a right angle. However, when teeth are tipped, the appearance of the crestal lamina may mimic a vertical bone defect. Because of the improper vertical angulation or orientation of the tipped tooth, the CEJ is positioned inferiorly relative to the adjacent tooth. This creates the impression of a vertical bony defect when in reality there is no bony defect.

A similar "CEJ discrepancy" may occur as a simple anatomic variation from normal. Some people have a mesial tilt to the posterior teeth that can result in the appearance of the vertical defects adjacent to the mesial surfaces of multiple teeth. Ritchey and Orban (1953) report that lines drawn between the adjacent CEJs should parallel the crestal lamina dura, and this simple test will readily distinguish true vertical defects from "pseudo-defects" caused by tooth angulation.[2]

Radiographic Evidence of Bone Loss:

A number of investigators, using dried jaw specimens, have determined that significant amounts of bone must be removed before bone loss is visible on conventional radiographs. Ortman et al. (1982) used dried specimens with artificially created bone defects and reported that radiographic examination tends to underestimate the artificial bone loss when 30% or less of the bone was removed. Bender & Seltzer (1961) found that mandibular lesions created with a bur were not visible until some cortical bone was removed. Ramadan & Mitchell (1962) determined that significant amounts of bone removal in their dried specimens did not consistently produce changes in the radiographic images.

One of the primary problems in radiographic examination is the lack of consistency among serial radiographs taken under normal conditions. Relatively small changes in film positioning can result in large changes in bone appearance. Lesions can appear or disappear. Generally, changes in bone height have been determined by comparing the distance from the CEJ to the alveolar crest at two different time points (e.g., before and after some type of treatment). If a certain amount loss is detected, then the label of "bone loss" can be affixed. Several investigators have analysed the distance from the CEJ to the alveolar crest.[3]

Most studies have been conducted in adolescents and the general consensus seems to be a distance of 2 mm; this distance may be greater in older patients.

The distribution of bone loss is an important diagnostic sign. It points to the location of destructive local factors in different areas of the mouth and in relation to different areas of the mouth and in relation to different surfaces of the same tooth.

Pattern of Bone Destruction:

In periodontal disease the interdental septa undergo changes that affect the lamina dura, crestal radiodensity, size and shape of the medullary spaces, and height and contour of the bone. The interdental septa may be reduced in height, with the crest horizontal and perpendicular to the long axis of the adjacent teeth (*horizontal bone loss*, *Figure-2*), or the septa may have angular or arcuate defects (angular, or vertical bone loss, Figure-3). [4]

Radiographs do not indicate the internal morphology or depth of the craterlike interdental defects, which appear as angular or vertical defects. Also, radiographs do not reveal the extent of involvement on the facial and lingual surfaces. Bone destruction of facial and lingual surfaces is obscured by the dense root structure, and bone destruction on the mesial and distal root surfaces may be partially hidden by a dense mylohyoid ridge. In most cases it can be assumed that bone losses seen interdentally continue in either the facial or the lingual aspect, creating a troughlike lesion. The true lesion can be detected only by clinically probing the defect.

Dense cortical plates on the facial and lingual surfaces of the interdental septa obscure destruction that occurs in the intervening cancellous bone. Thus is possible to have a deep crater in the bone between the facial and lingual plates without radiographic indications of its presence.

To record destruction of interproximal cancellous bone radiographically, the cortical bone must be involved. A reduction of only 0.5 to 1.0 mm in the thickness of the cortical plate is sufficient to permit radiographic visualization of destruction of the inner cancellous trabeculae.

Interdental vertical lesions in the posterior areas with thick facial or lingual bone may not be isolated in the interdental area but may continue facially and/or lingually to form a troughlike defect that cannot be seen radiographically. These lesions may terminate on the radicular surface or may communicate with the adjacent interdental area to form one continuous lesion.[5]

Gutta percha packed around the teeth increases the usefulness of the radiograph for the detecting the morphologic changes of osseous craters and involvement of the facial and lingual surfaces. However this is a cumbersome technique and is seldom performed. Surgical exposure and visual examination provide the most definitive information regarding the bone architecture produced by periodontal destruction.

Radiographic Appearance of Periodontal Disease

Periodontitis

The sequence of radiographic changes in periodontitis and the causative tissue changes are as follows:

1. Fuzziness and a break in the continuity of the lamina dura at the mesial or distal aspect of the crest of the interdental septum have been considered as the earliest radiographic changes in periodontitis. These result from the extension of gingival inflammation into the bone, causing widening of the vessel channels and a reduction in calcified tissue at the septal margin.
2. A wedge-shaped radiolucent area is formed at the mesial or distal aspect of the crest of the septal bone. The apex of the area is pointed in the direction of the root. This is produced by resorption of the bone of the lateral aspect of the interdental septum, with an associated widening of the periodontal space.
3. The destructive process extends across the crest of the interdental septum, and the height is reduced. Fingerlike radiolucent projections extend from the crest into the septum. The radiolucent projections into the interdental septum are the result of the deeper extension of the inflammation into the bone. Inflammatory cells and fluid, proliferation of connective tissue cells, and increased osteoclasis cause increased bone resorption along the endosteal margins of the medullary spaces. The radiopaque projections separating the radiolucent spaces are the composite images of the partially eroded bony trabeculae.
4. The height of the interdental septum is progressively reduced by the extension of inflammation and the resorption of bone.[6]

Interdental Craters

Interdental craters are seen as irregular areas of reduced radiopacity on the alveolar bone crests. Craters are generally nor sharply demarcated from the rest of the bone, with which they blend gradually. Radiographs do not accurately depict the morphology or the depth of the interdental craters, which sometimes appear as vertical defects.

Furcation Involvement

Definitive diagnosis of furcation involvement of furcation involvement is made by clinical examination, which includes careful probing with a specially designed probe (e.g., Nabers). Radiographs are helpful but show artifacts that allow furcation involvement to be present without detectable radiographic changes.

As a general rule, bone loss is always greater than it appears in the radiograph. Variations in the radiographic technique may obscure the presence and extent of furcation involvement. A tooth may present marked bifurcation involvement in one film but appear to be involved in another. Radiographs should be taken at different angles to reduce the risk of missing furcation involvement.

The recognition of a large, clearly defined radiolucency in the furcation area presents no problem (Figure-4), but less clearly defined radiographic changes produced by furcation involvement are often overlooked. To assist in the radiographic detection of the furcation involvement, the following diagnostic criteria are suggested:

1. The slightest radiographic change in the furcation area should be investigated clinically, especially if there is bone loss on adjacent roots.
2. Diminished radiodensity in the furcation area in which outlines of bony trabeculae are visible suggests furcation involvement.
3. Whenever there is marked bone loss in relation to a single molar root, it may be assumed that furcation is also involved'

Localized Aggressive Periodontitis

Localized aggressive periodontitis is characterized by a combination of the following radiographic features:

1. Bone loss may occur initially in the maxillary and mandibular incisor and/or first molar areas, usually bilaterally, and results in vertical, arclike destructive patterns *(Figure-5)*.
2. Loss of alveolar bone may become generalized as the disease progresses but remains less pronounced in the premolar areas.[7]

Trauma from Occlusion

Trauma from occlusion can produce radiographically detectable changes in the lamina dura, morphology of the alveolar crest, width of the PDL space, and density of the surrounding cancellous bone.

The injury phase of trauma from occlusion produces a loss of the lamina dura that may be noted in apices, furcations, and marginal areas. This loss of lamina dura results in widening of the PDL space.

The repair phase of trauma form occlusion results in an attempt to strengthen the periodontal structures to better support the increased loads. Radiographically, this is manifested by a widening of the PDL space, which may be generalized or localized.

More advanced traumatic lesions may result in deep angular bone loss, which, when combined with marginal inflammation, may lead to intrabony pocket formation. In terminal stages these lesions extend around the root apex, producing a wide, radiolucent periapical image (cavernous lesions).

Sounding (Transgingival probing)

Knowledge of the bone topography is useful before surgical entry is made. The buccal and lingual plates are of variable thickness, depending on location. One may assume, however, that interproximal areas have relatively more bone and that the bone coverage on root prominences is relatively less. [8]

To date, techniques of non-surgical clinical measurements of alveolar bone levels have received little attention. Goadby (1928), Hirschfeld (1953), Easley (1967) and Tibbetts (1969) described bone sounding techniques, but their work did not involve measurements or comparisons with surgical measurements of alveolar bone levels.

Various investigators have demonstrated a good correlation between clinical attachment level measurements and probing bone levels when bone levels were measured during surgery [9].

Fig. 1 – Early & advanced blunting of interdental crest

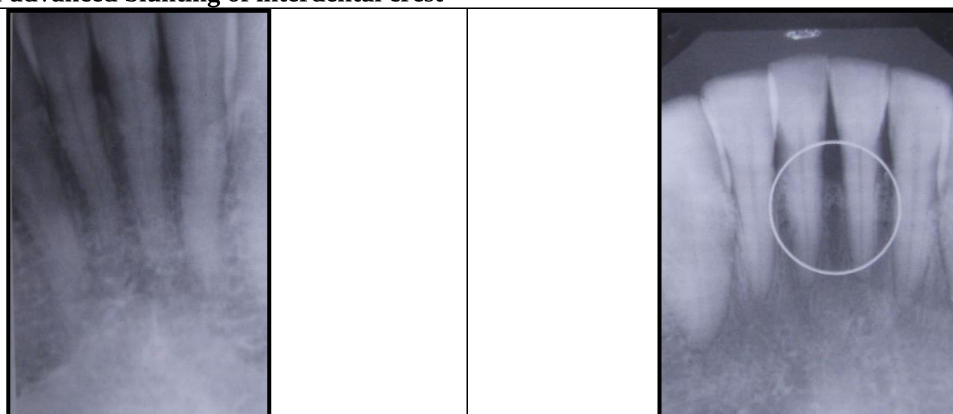

Fig. 2 – Horizontal bone loss in relation to maxillary premolars and molars

Fig. 3 – Vertical bone loss in relation to mesial aspect of first molar

Fig. 4 – Radiograph showing furcation involvement in relation to lower first mola

Fig. 5 – Radiograph of a patient with localized aggressive periodontitis showing typical molar-incisor lesions

CONCLUSION

Sites with infrabony defects have been shown to be at higher risk of disease progression in subjects who did not receive systematic periodontal therapy. On the other hand, evidence that persistence of an infrabony defect after completion of active periodontal treatment may increase the site-specific risk of progression of periodontitis is only indirect and associated with the reported increased risk of periodontal breakdown at sites with residual pockets. One of the most important features of periodontal disease is loss of bone. The variation in bone loss between individuals and between different sites in the same mouth, the rate of that bone loss and the diversity of form of loss have stimulated a great deal of interest and speculation, but little research has been carried out in this direction.

Among the various patterns of bone destruction in periodontal disease described in literature, vertical or angular bone defects and furcation involvements have received particular attention. The reason for this fact may be that these particular entities are relatively more prevalent and prone to deterioration and recurrence even after periodontal therapy.

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