PERIODONTAL DISEASES

Dr.Farzane Ostovar Rad

EMAGING MODALITIES FOR THE ASSESSMENT OF PERIODONTAL DISEASE

complete diagnosis of periodontal disease requires a thorough clinical examination of the patient, combined with evidence identified on diagnostic images.

Intraoral Imaging

panoramic Imaging

Cone Beam Computed Tomography

BOX 20.1 Radiographic Assessment of Periodontal Conditions

Radiographs are especially helpful in the evaluation of the following features:

- Amount of bone present
- Condition of the alveolar crests
- Bone loss in the furcation areas
- Width of the periodontal ligament space
- Local irritating factors that increase the risk of periodontal disease
- Calculus
- Poorly contoured or overextended restorations
- Root length and morphology and crown-to-root ratio
- Open interproximal contacts, which may be sites for food impaction
- Anatomic considerations
- Position of the maxillary sinus in relation to a periodontal deformity
- Missing, supernumerary, impacted, and tipped teeth
- Pathologic considerations
- Caries
- Periapical lesions
- Root resorption

Bitewing images should be considered the primary imaging choice for characterizing the periodontal diseases.

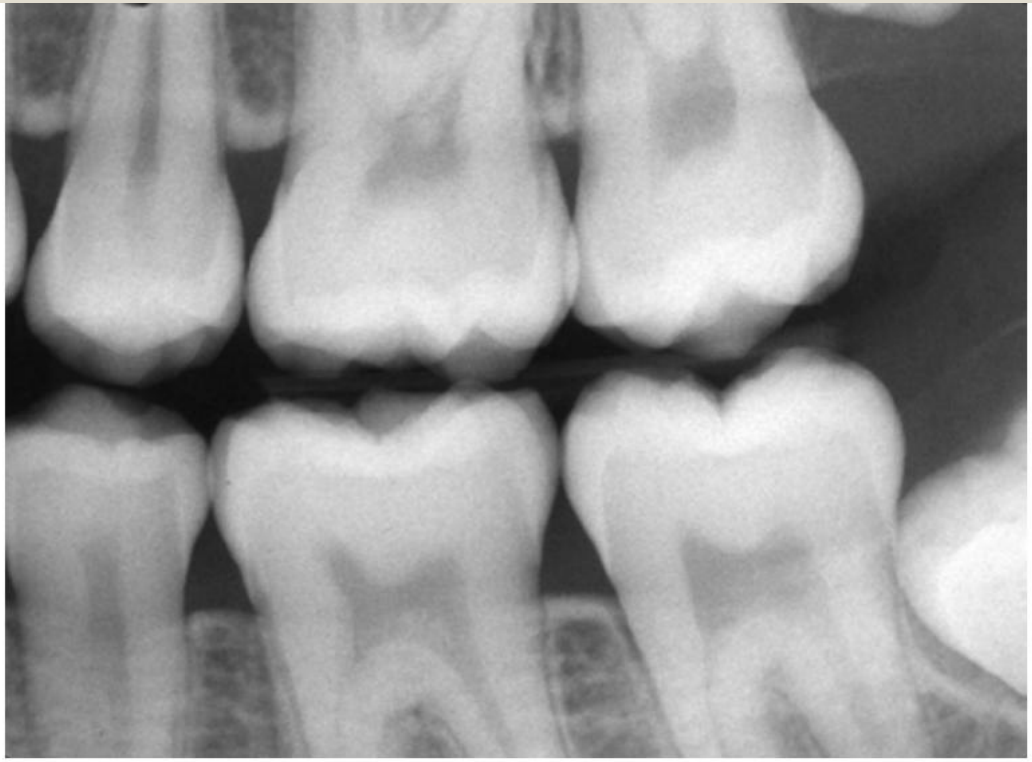


Fig. 20.3 The normal alveolar crest lies 0.5 to 2.0 mm apical to the adjacent cementoenamel junctions and forms a sharp angle with the lamina dura of the adjacent tooth. The crests may not always appear with a well-defined outer cortex.

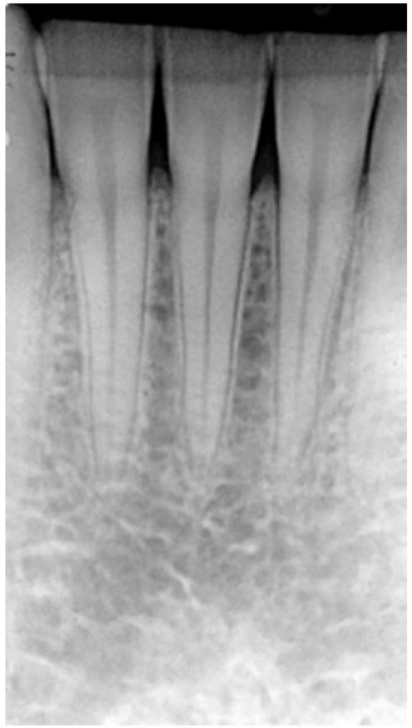


Fig. 20.4 Between the anterior teeth, the normal alveolar crest is pointed and well corticated, and is located within 0.5 to 2.0 mm of the adjacent cementoenamel junctions.

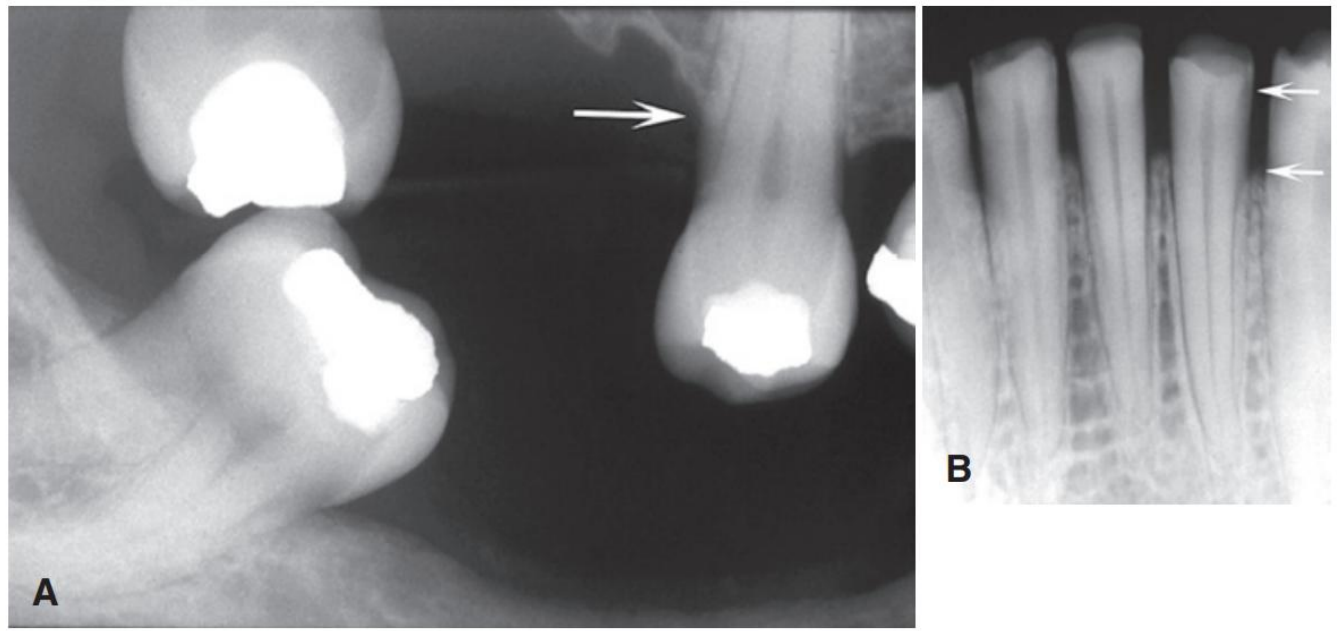


Fig. 20.8 (A) This maxillary second premolar is supraerupted; the etiology of the low bone level *(arrow)* relative to the cementoenamel junction (CEJ) is not necessarily the result of periodontal disease. (B) An example of passive eruption related to severe attrition resulting in the apparent increase in the distance from the CEJ to the bone height *(arrows)* cannot be attributed to periodontal disease. However, the resultant change in bone level relative to the CEJ still may be clinically significant.

IMAGING FEATURES OF PERIODONTAL DISEASES

- These changes can be divided into changes in the **morphology** of the supporting bone, and changes to the **trabecular density and pattern**.

Changes in Morphology of Alveolar Processes

Early Bone Changes:

localized erosion of the interproximal alveolar crest

- In the **anterior** regions : blunting of the alveolar crests and slight loss of alveolar crestal bone height.
- In the **posterior** regions of the jaws: loss of the normally acute angle between the lamina dura and alveolar crest.

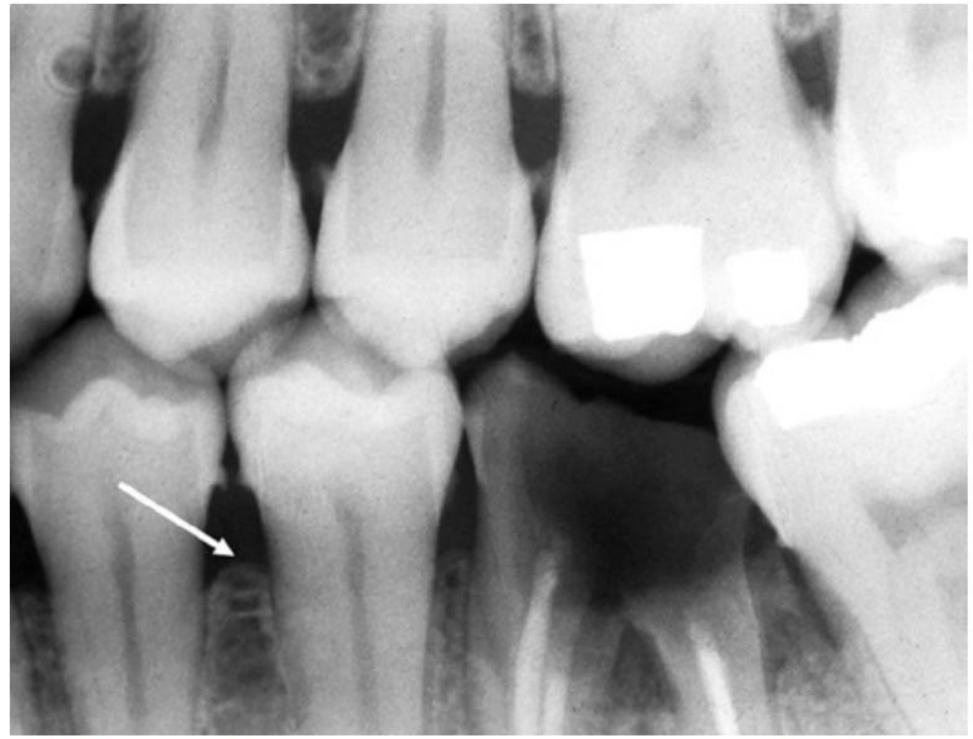


Fig. 20.5 Initial periodontal disease is seen as a loss of cortical density and a rounding of the junction between the alveolar crest and the lamina dura *(arrow)*. Note also the more pronounced bone loss around the mandibular first molar and the generalized interproximal calculus.

Horizontal Bone Loss

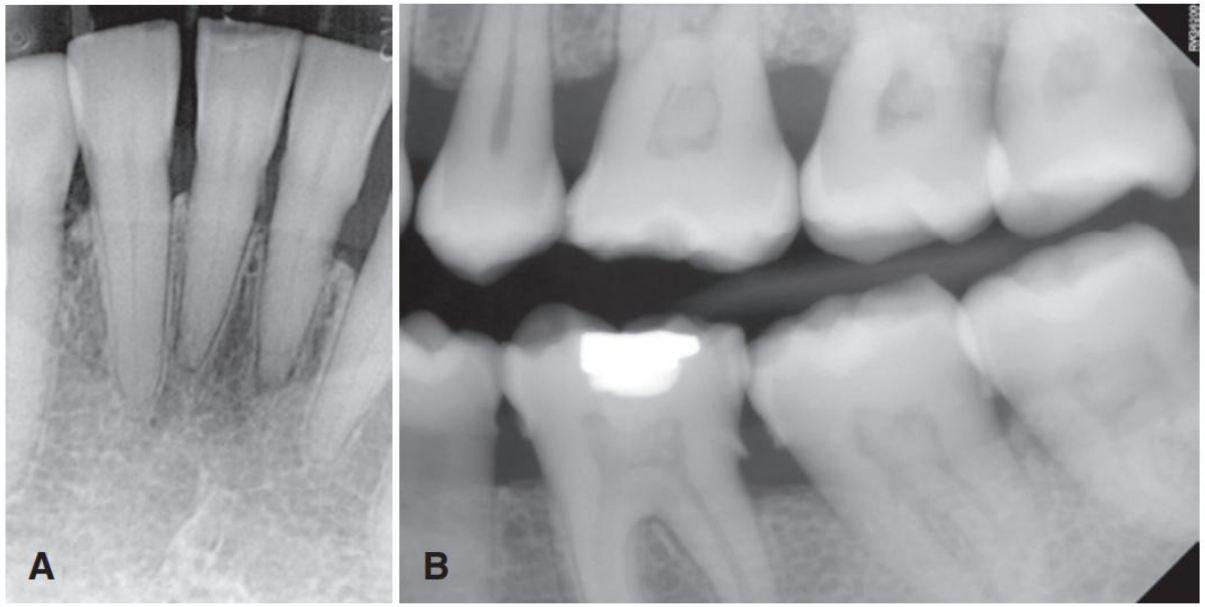


Fig. 20.6 Horizontal bone loss is seen in the anterior region (A) and the posterior region (B) as a loss of the buccal and lingual cortical plates and interdental alveolar bone.

Vertical Bone Defects

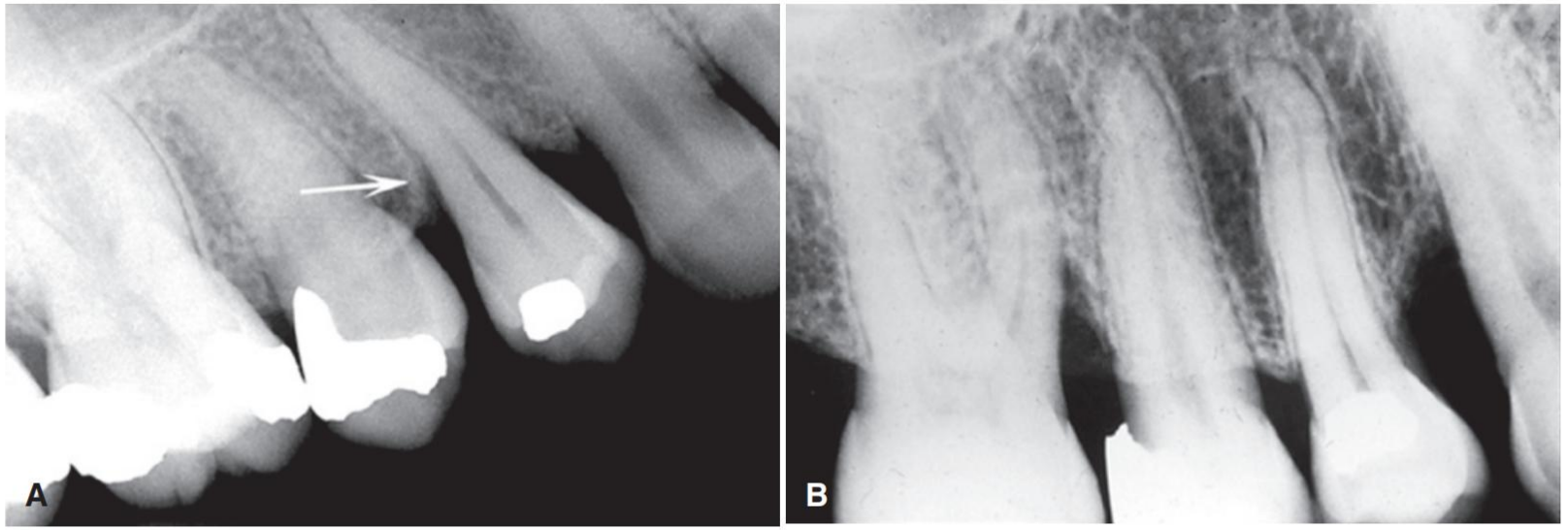


Fig. 20.9 (A) A developing vertical defect. Note the abnormal widening of the periodontal ligament space close to the crest *(arrow)*. (B) Maxillary periapical image reveals two examples of more severe vertical defects affecting the mesial surface of the first molar and the distal surface of the canine.

The **vertical defect :**

- **three-walled** (surrounded by three bony walls) when both the buccal and lingual cortical plates remain intact.
- **two-walled** when one of these plates has been resorbed
- **one-walled** when both plates have been lost

The distinctions among these groups are important in designing the treatment plan.

The number of walls associated with a vertical defect is difficult or impossible to recognize on intraoral images, because one or both of the cortical bony plates may remain superimposed over the defect.

Visualization of the depth of pockets :

- by inserting a **gutta-percha** point before making the intraoral image
- Clinical and surgical inspections are the best means of determining the number of remaining bony walls
- . **CBCT** imaging can also help characterize a defect more clearly, although this should not be routinely used for this purpose

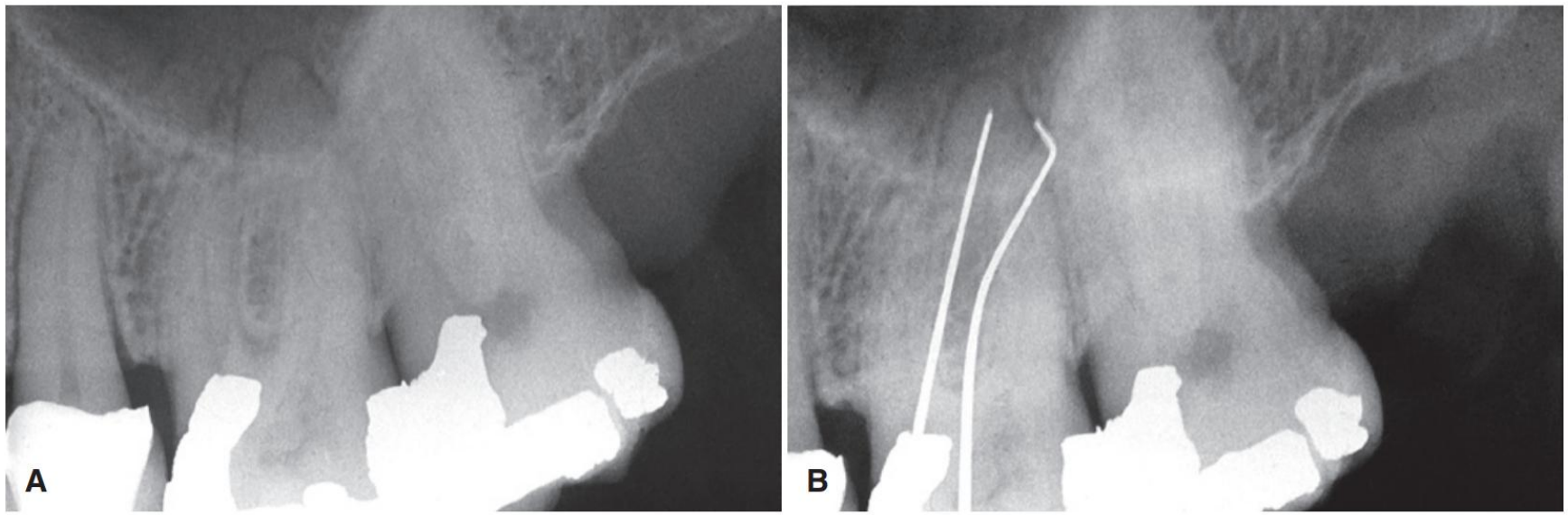
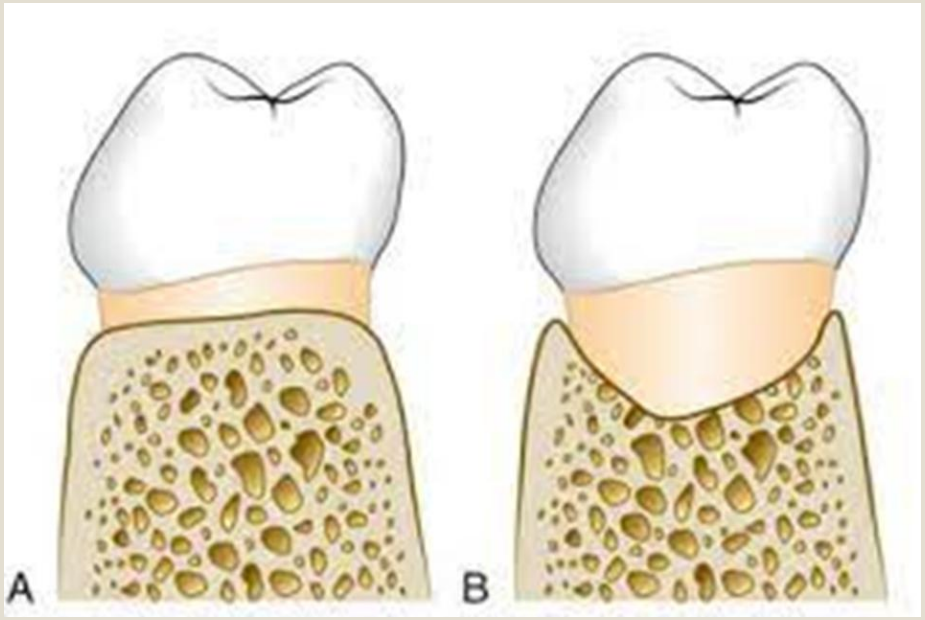


Fig. 20.11 Gutta-Percha May Be Used to Visualize the Depth of Infrabony Defects. (A) The image fails to show the osseous defect without the use of the gutta-percha points. (B) The image reveals an osseous defect extending to the region of the apex. (Courtesy Dr. H. Takei, Los Angeles, California.)

Interdental Craters

. In an image, this appears as a **band-like or irregular region** of bone **with less density at the crest**, immediately adjacent to the moredense normal bone apical to the base of the crater more common in the posterior segments



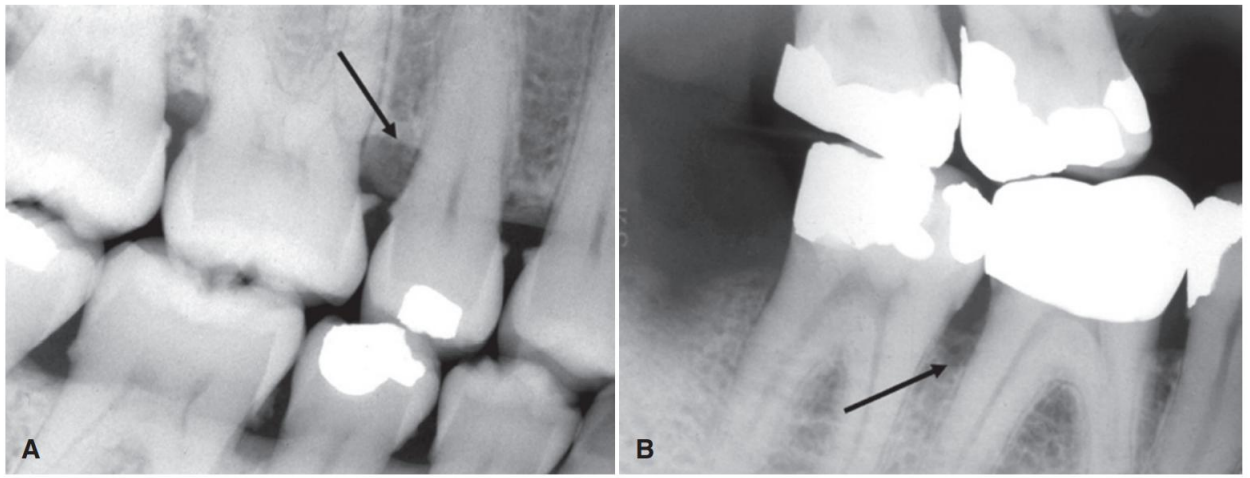
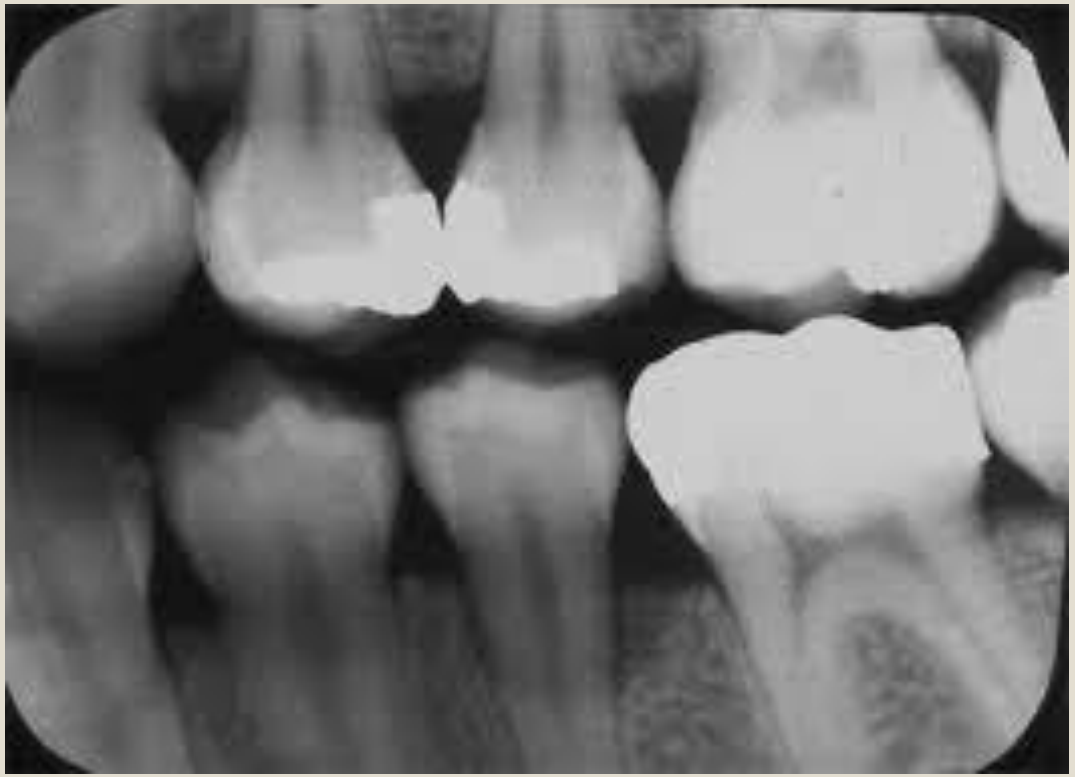


Fig. 20.13 Interproximal craters, existing as defects between the buccal and lingual cortical plates, seen as a radiolucent band (A) or trough (B) apical to the level of the crestal edges. The *arrows* indicate the base of the craters.

Buccal or Lingual Cortical Plate Loss



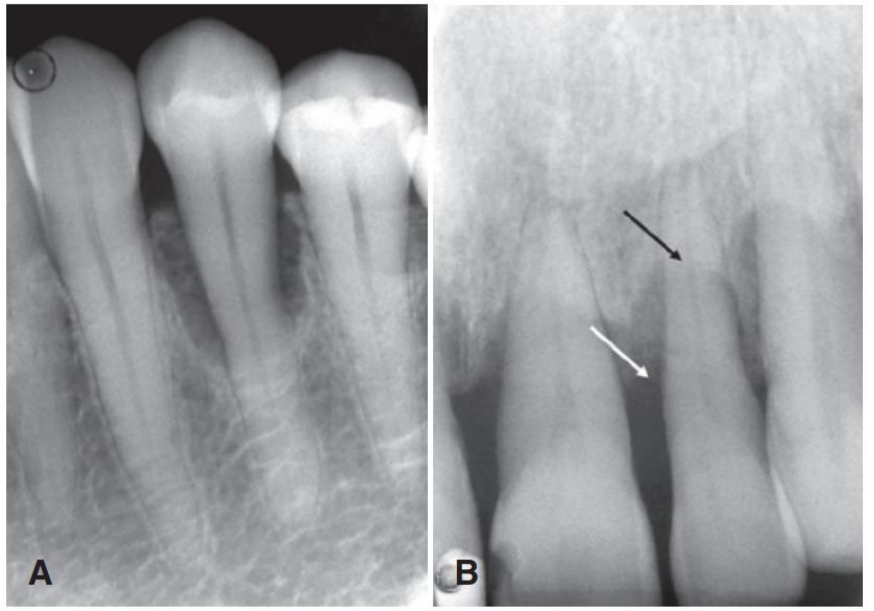
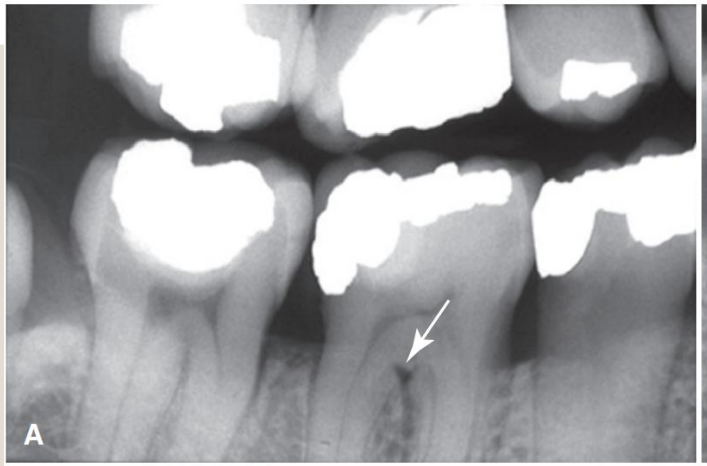


Fig. 20.14 (A) Loss of the lingual alveolar crest adjacent to this mandibular first premolar without associated interproximal bone loss. (B) Loss of the buccal cortical bone adjacent to the maxillary central and lateral incisors. The *black arrow* indicates the level of the buccal alveolar crest, which demonstrates more profound loss relative to the lingual alveolar crest *(white arrow)*.

Osseous Deformities in the Furcations of Multirooted Teeth

- **Widening of the PDL space** at the apex of the interradicular bony crest of the furcation is strong evidence that the periodontal disease process involves the furcation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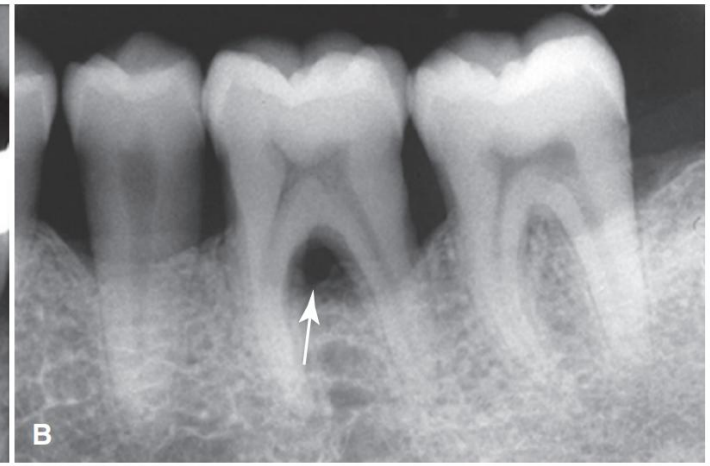
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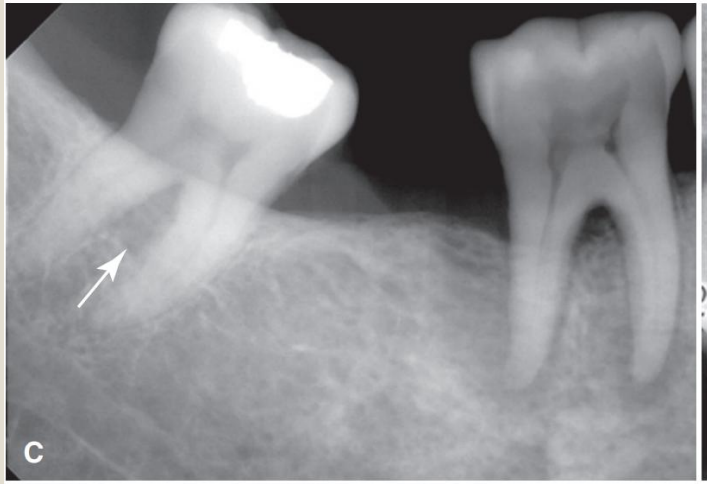
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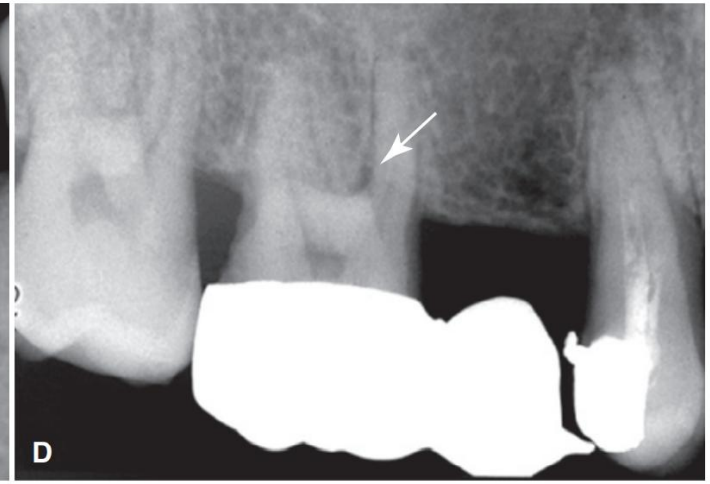
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E

- A definitive diagnosis of complex furcation deformities requires

Careful clinical examination and sometimes surgical exploration

- Intraoral images are an important tool in identifying potentially involved sites as well as providing information about root morphology and length, which is of significance to treatment planning and prognosis.
- CBCT imaging can also be used to confirm involvement of a tooth and allow more detailed characterization of osseous furcation defects in cases where this information is necessary for treatment planning purposes

Changes to the Internal Density and Trabecular Pattern of Bone

- As with all other inflammatory lesions

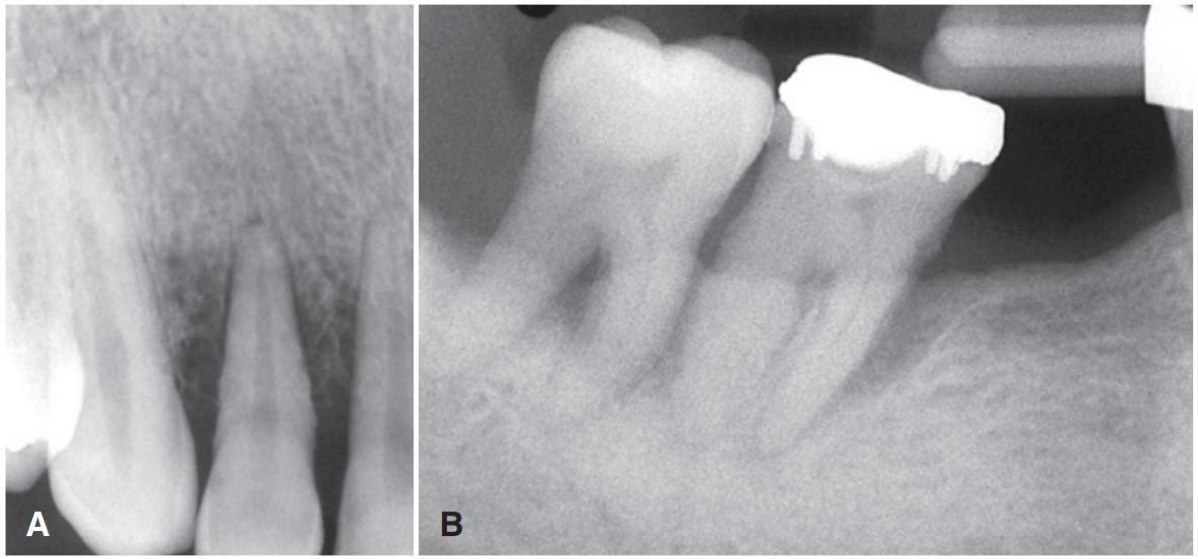
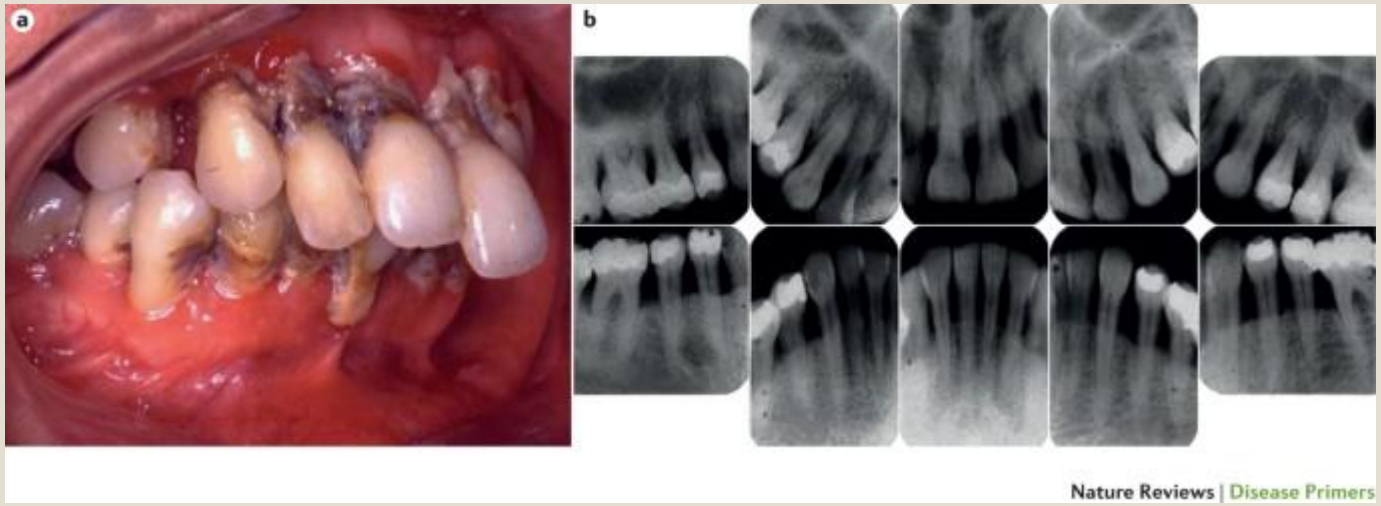


Fig. 20.16 (A) Example of a primarily radiolucent reaction around this maxillary lateral incisor. The trabeculae toward the alveolar crest on the mesial and distal aspect of the tooth are barely perceptible, and the marrow spaces are enlarged. (B) Periapical image revealing a predominantly sclerotic bone reaction resulting from the periodontal disease involving the mandibular molars. The trabeculae are thickened, and the marrow spaces are barely perceptible.

- **Necrotizing Periodontal Diseases**

Fig 1 The necrosis divides the papilla into a facial and a lin-



- **Periodontitis as a Manifestation of Systemic Disease**

Leukemic gingival enlargement

OTHER CONDITIONS AFFECTING THE PERIODONTIUM

Periodontal Abscess:

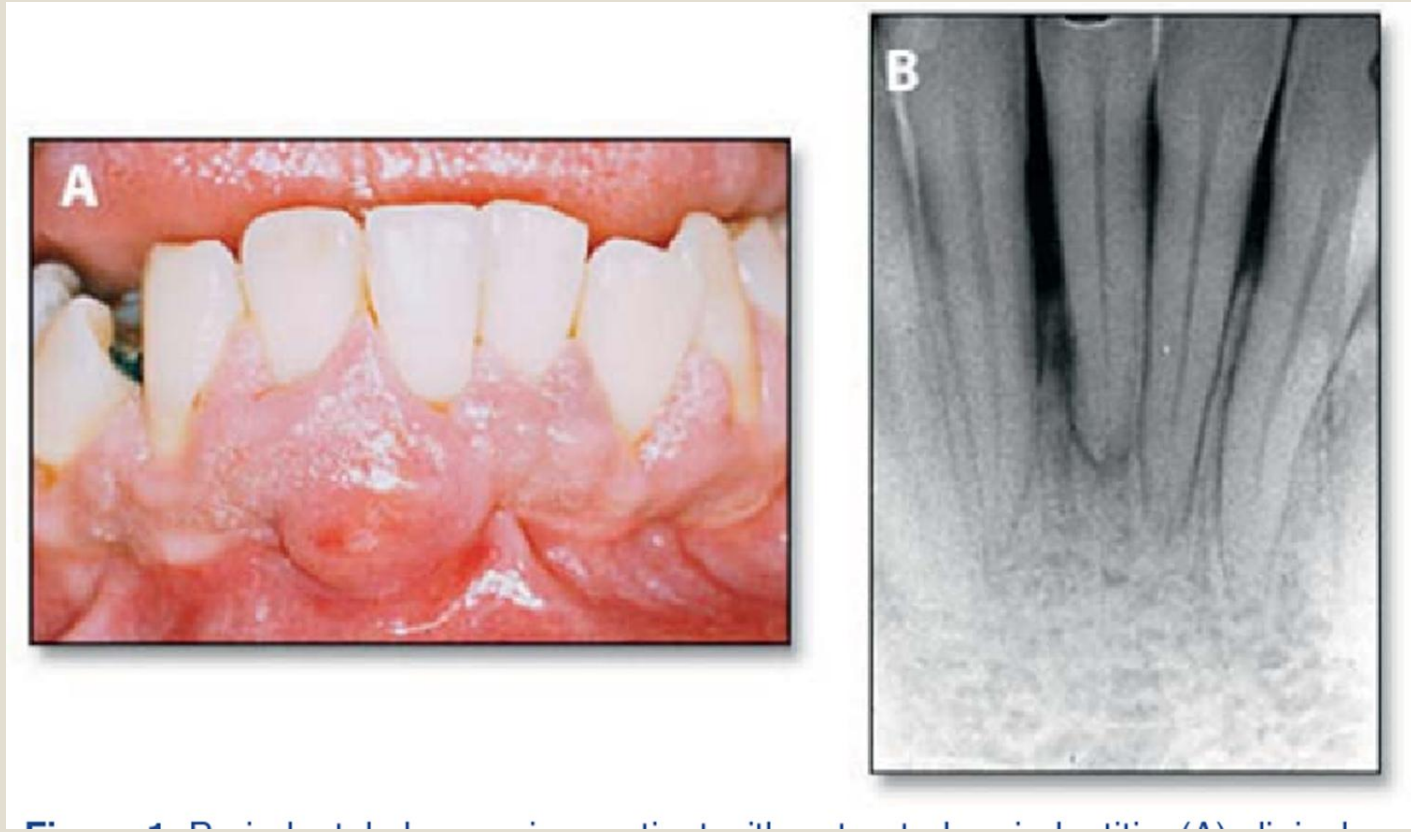
It occurs when the coronal portion of the pocket becomes occluded or when foreign material becomes lodged between a tooth and the gingiva

- if the lesion **is acute, there may be no visible changes** in the image.
- If the lesion **persists, a radiolucent region** appears, often superimposed over the root of a tooth.

The radiolucency may be a focal, round area of rarefaction, with **loss of the lamina dura** on the involved root surface,

and a bridge of bone may be present over the coronal aspect of the lesion, separating it from the crest of the alveolar ridge

Fig. 20.18 Example of a periodontal abscess related to the maxillary canine; note the well-defined area of bone loss over the midroot region of the tooth and extending in a mesial direction toward the lateral incisor. There appears to be a layer of bone *(arrow)* separating the area of bone destruction from the crest of the alveolar process.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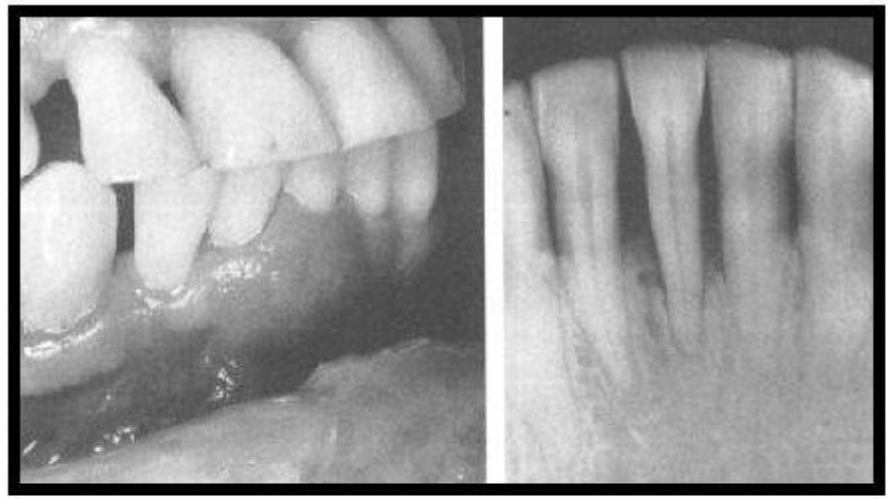
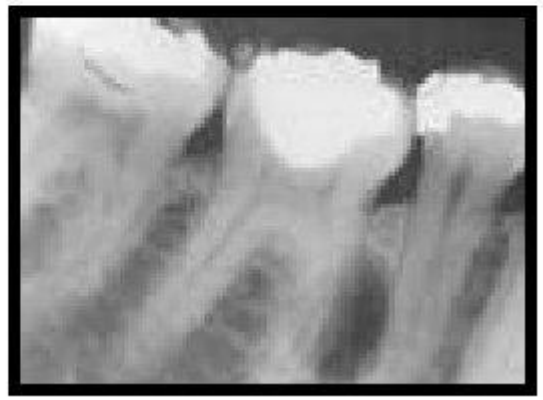
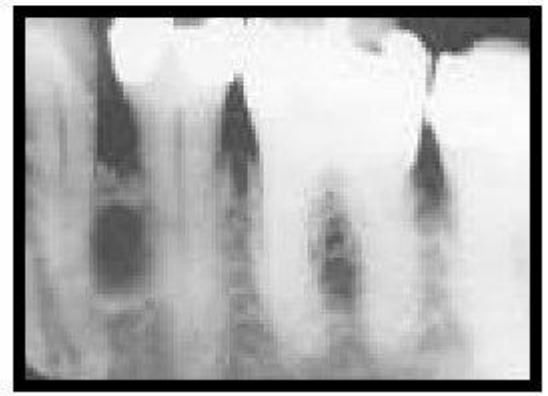






- **Occlusal Trauma**

increased mobility, wear facets, unusual response to percussion, and a history of contributing habits

there are associated **findings in the images**, including **widening of the PDL space**, thickening of the lamina dura, bone loss, and an increase in the number and size of trabeculae.

Traumatic occlusion can be definitively diagnosed only by clinical evaluation and not by the imaging findings .

may include hypercementosis and root fractures

Tooth Mobility

Widening of the PDL space

- **single root**: the socket may develop an **hourglass shape**.
- **Multirooted**: it may show widening of the PDL space at the apices and in the region of the furcation

the image of the **lamina dura may appear broad and hazy, and show increased density.**

Open Contacts

. Open contacts are associated with sites of periodontal disease more than closed contacts.

Trapped food particles may damage the soft tissue and induce an inflammatory response, and contribute to the development of localized chronic periodontal disease

Similar potential situation: discrepancies in the height of two adjacent marginal ridges/Abnormal tooth alignment

Fig. 20.20 The second molar has tipped mesially after loss of the first molar, creating an abnormal tooth alignment that was difficult for the patient to maintain, leading to localized periodontal disease. Note the calculus on the mesial surface of the second molar. The crown on the second premolar was constructed with an enlarged distal contour to stop further tipping of the molar.

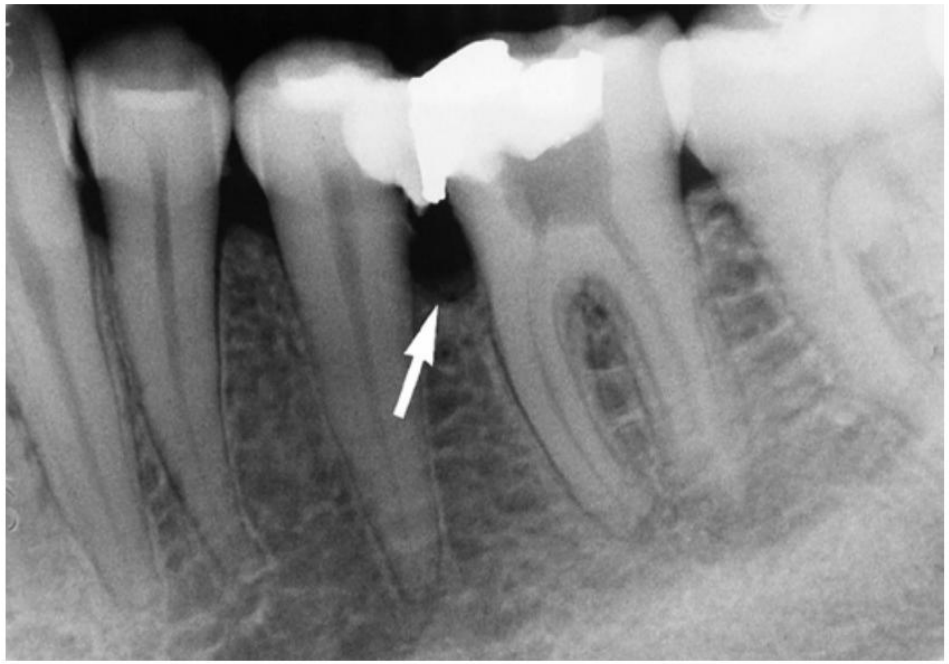


Fig. 20.22 These overhanging restorations provided an environment suitable for plaque accumulation and subsequent localized periodontal bone loss *(arrow)*.

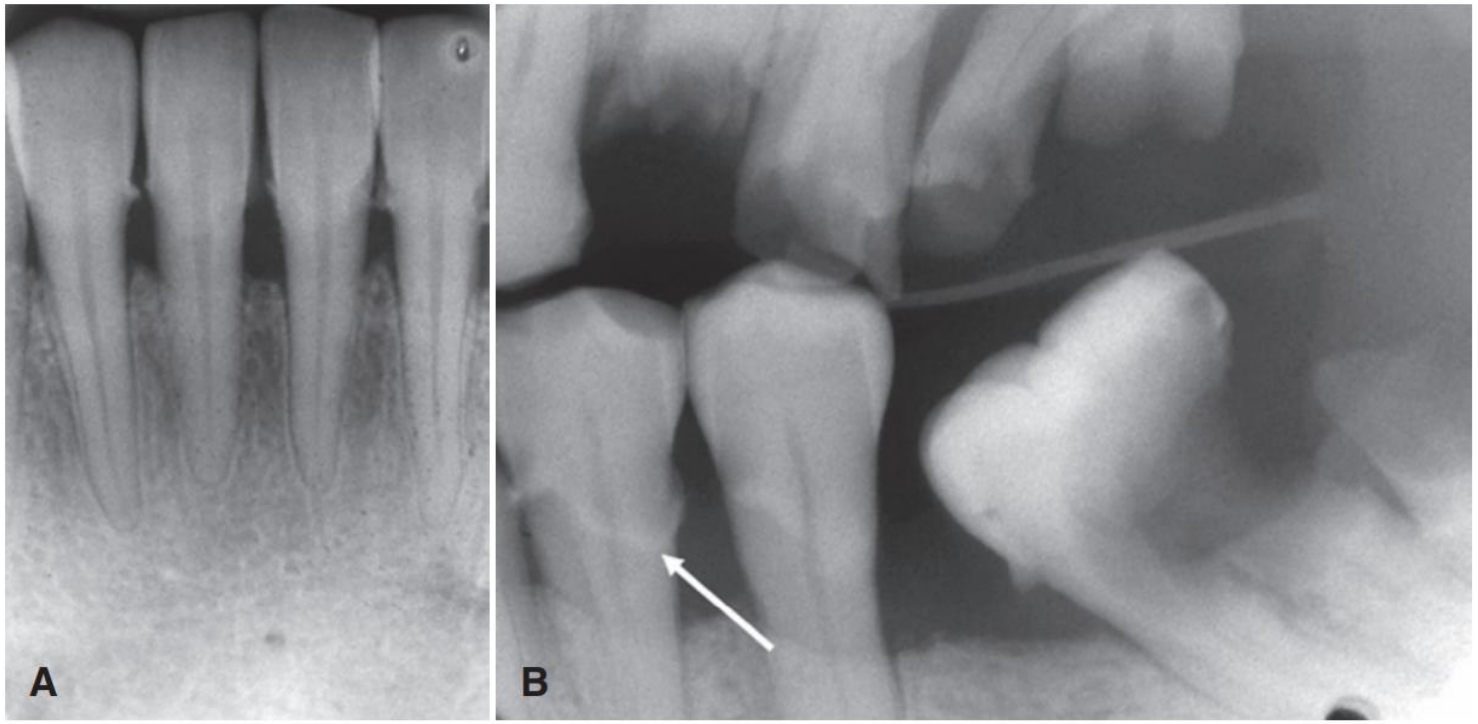


Fig. 20.21 Calculus may be seen as small angular radiopaque deposits projecting between interproximal surfaces of the teeth (A) or as radiopaque bands across the roots representing circumferential accumulation (*arrow* in B).

OTHER MODIFIERS OF PERIODONTAL DISEASE

Diabetes mellitus:

. Patients with **uncontrolled** diabetes and periodontal disease also show **more severe and rapid resorption** of the alveolar processes, and are **more prone to the development of periodontal abscesses**.

In patients whose diabetes is under control,periodontal disease responds normally to traditional treatment.

HIV:

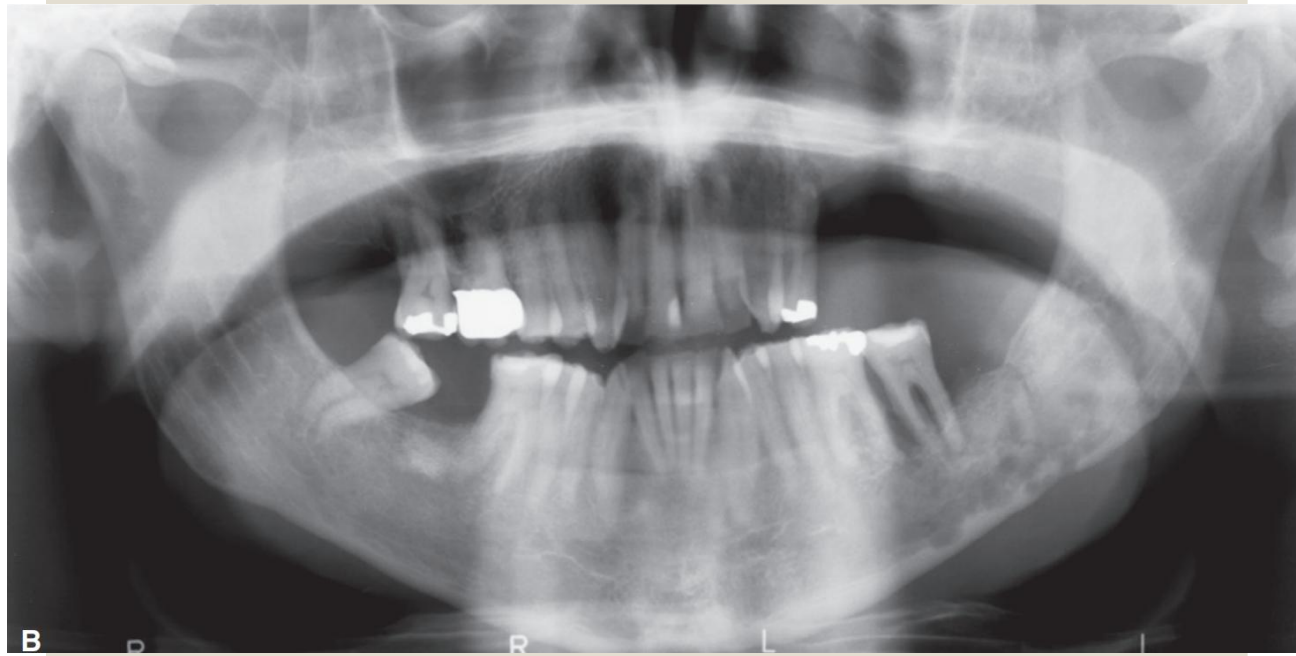
The incidence and severity of periodontal disease is high in patients with HIV/AIDS.

the disease process is characterized by a **rapid progression** that leads to bone **sequestration** and **loss of several teeth**.

These patients may not respond to standard periodontal therapy.

High-dose irradiation :

rapid bone loss that is indistinguishable from the characteristics of periodontal disease seen on imaging. **Teeth that have been exposed to high-dose radiation fields** have been shown to demonstrate greater recession, attachment loss, and mobility than teeth in the same mouth that were not within the field



Panoramic radiograph taken to evaluate the teeth and jaws in a postradiation therapy patient shows presence of mild periodontal bone loss. (B) Panoramic radiograph of same patient taken 3 years later
shows extensive bone destruction in the left posterior mandible body-angle region, extending to the inferior mandibular cortex.

EVALUATION OF PERIODONTAL THERAPY

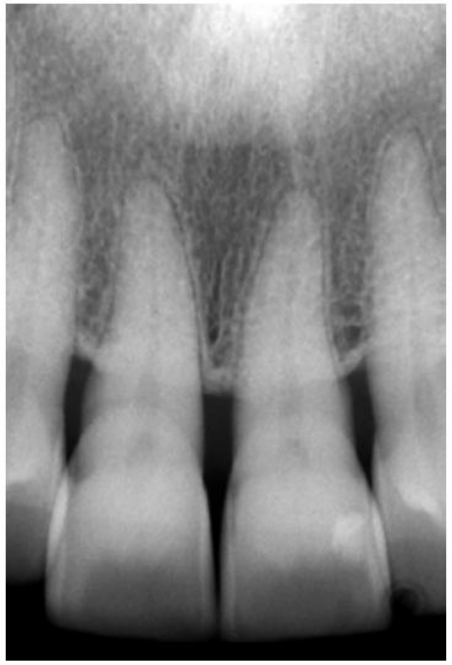


Fig. 20.23 Example of a case in which the interproximal cortex of the alveolar crest has re-formed after successful periodontal therapy.

DIFFERENTIAL INTEPRETATION

Most cases of bone loss around teeth are caused by the periodontal diseases.

Malignant neoplasms—in particular, squamous cell carcinoma—involving the alveolar process may mimic the appearance of periodontal disease

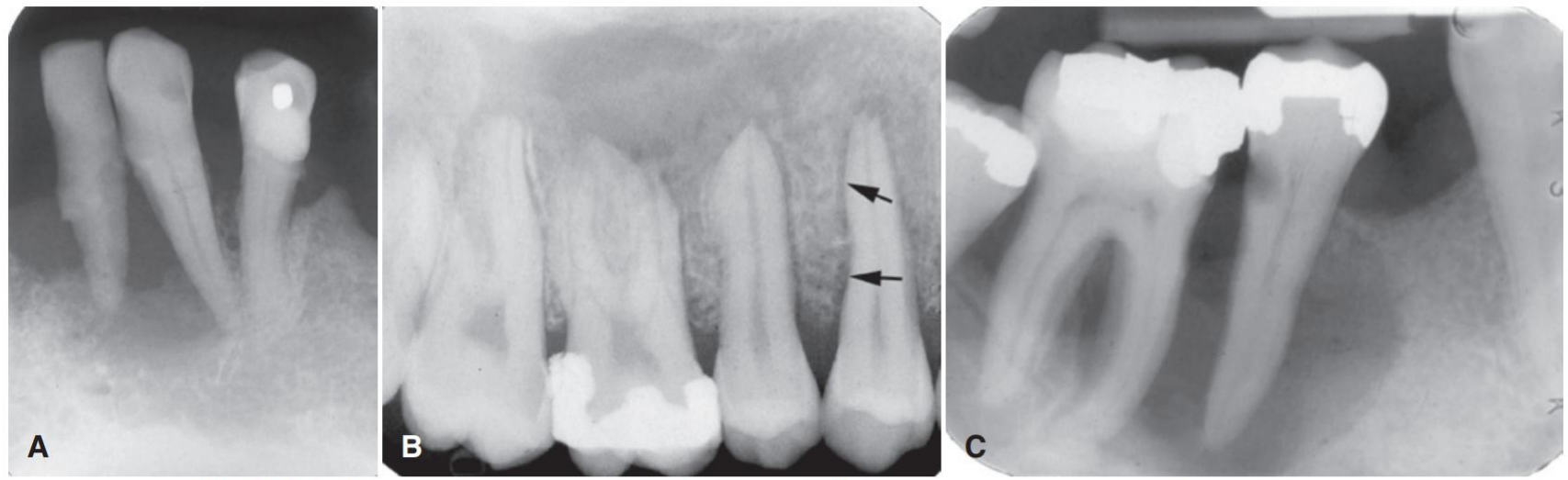


Fig. 20.24 (A) Periapical image of a case of squamous cell carcinoma involving the alveolar process of the mandible; note the irregular bone destruction. (B) Periapical image of a malignant tumor extending from the maxillary sinus into the alveolar process and invading the periodontal ligament space of the adjacent teeth. Note the irregular widening *(arrows)*. (C) Periapical image of Langerhan cell histiocytosis demonstrating a lesion with destruction of the alveolar process. Note the epicenter in the midroot region instead of the alveolar crest, as seen in periodontal disease.

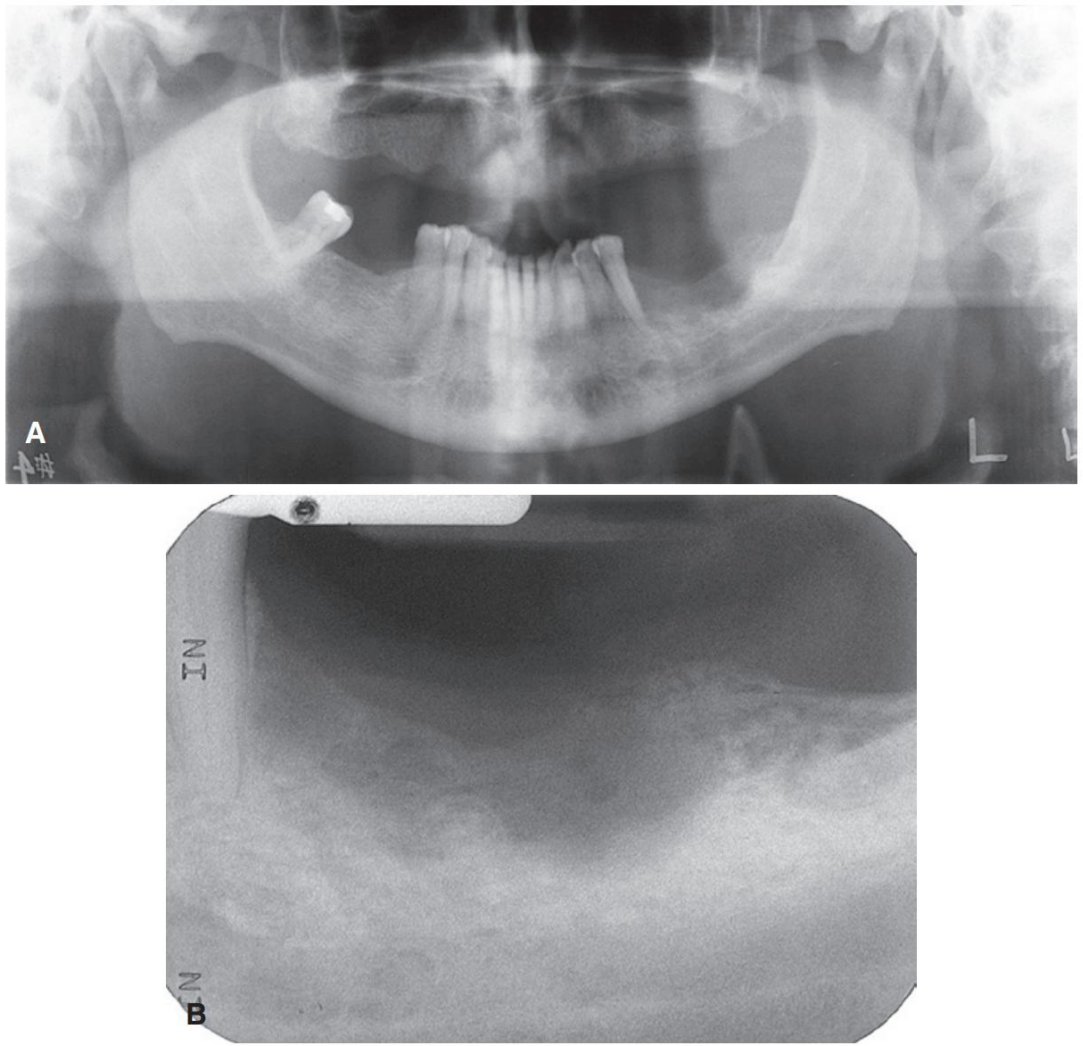
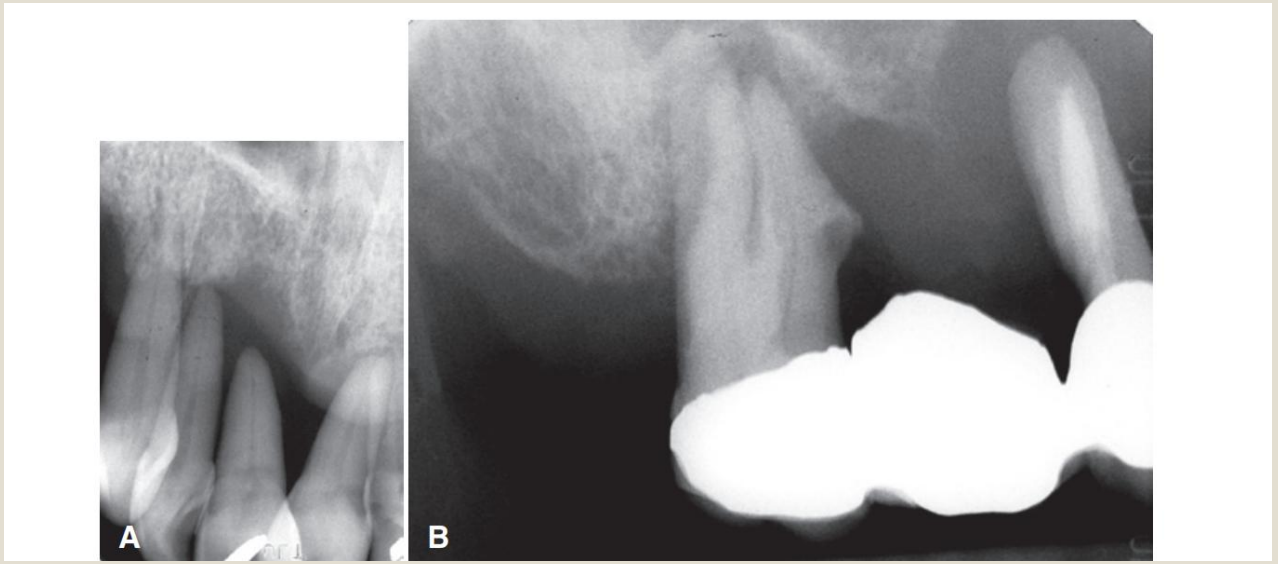


Fig. 26.2 Panoramic (A) and periapical (B) images of a squamous cell carcinoma invading the alveolar process of the left posterior mandible.

Fig. 26.5 Periapical image reveals bone destruction similar to periodontal disease around the lateral incisor from a squamous cell carcinoma originating in the soft tissues of the alveolar process (A). Note the lack of a sclerotic bone reaction at the periphery. The tooth socket from an extracted second molar has enlarged in size, and has not healed because of the presence of a squamous cell carcinoma (B). Periapical images (C and D) of a squamous cell carcinoma invading the alveolar process from the nasal cavity. In (C), note the wide transition zone from the bone destruction near the midline to the more normal bone pattern distal to the canine tooth.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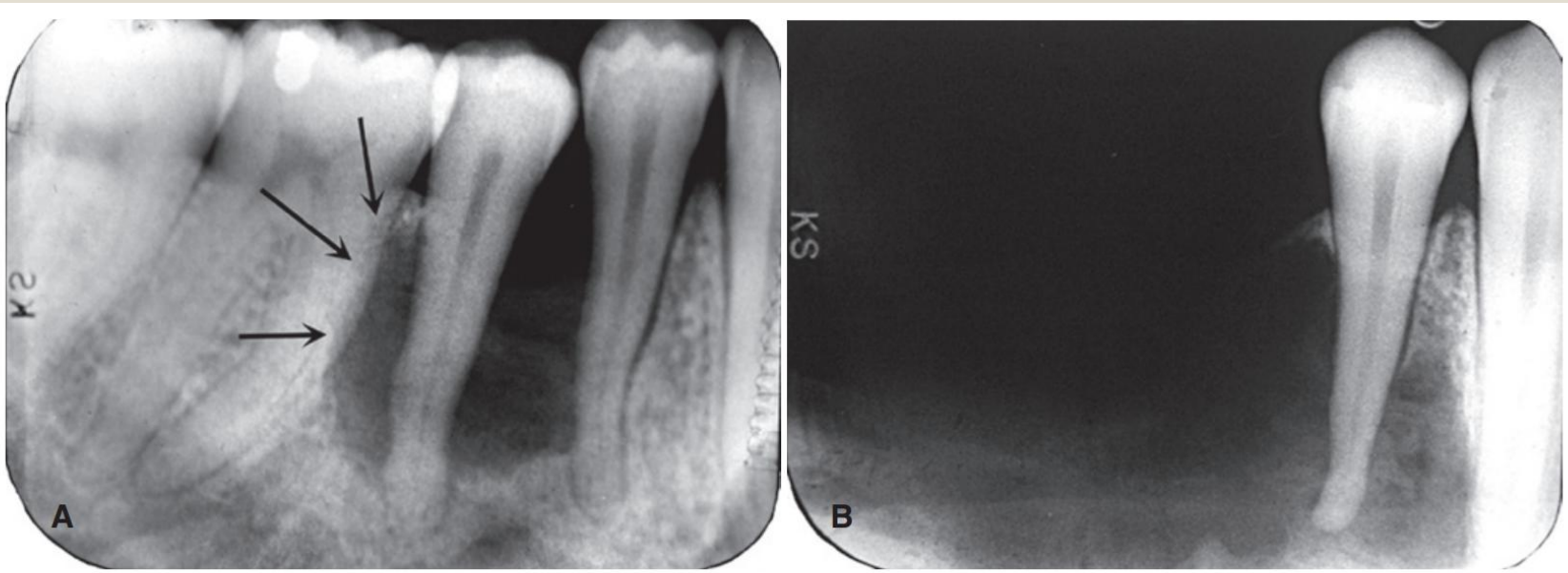

Fig. 26.24 Periapical Images of the Same Region of the Mandible Approximately 1 Year Apart. The earlier image (A) shows the scooped-out appearance of the lesion with an epicenter near the mid-root level of the involved teeth (in contrast to periodontal disease). The later image (B) shows much more extensive bone destruction, and the loss of teeth. (Courtesy Dr. D. Stoneman, Toronto, ON, Canada.)


THANKS FOR ATTENTION