GOOD MORNING

FURCATION INVOLVEMENT

PRESENTED BY

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INTRODUCTION

- The treatment of multirooted teeth offer a challenge to all practitioners because the posterior position of these teeth in the dental arch limits access for diagnostics, therapy and cleansing by the patient.

- The loss of periodontium in interradicular areas, referred to as *Furcation invasion,* occurs with remarkable frequency.

- Once exposed to oral cavity, these areas are difficult to clean and frequently demonstrate continued deterioration.

Definition

- The term Furcation involvement refers to the invasion of the bifurcation and trifurcation of multi-rooted teeth by periodontal disease.

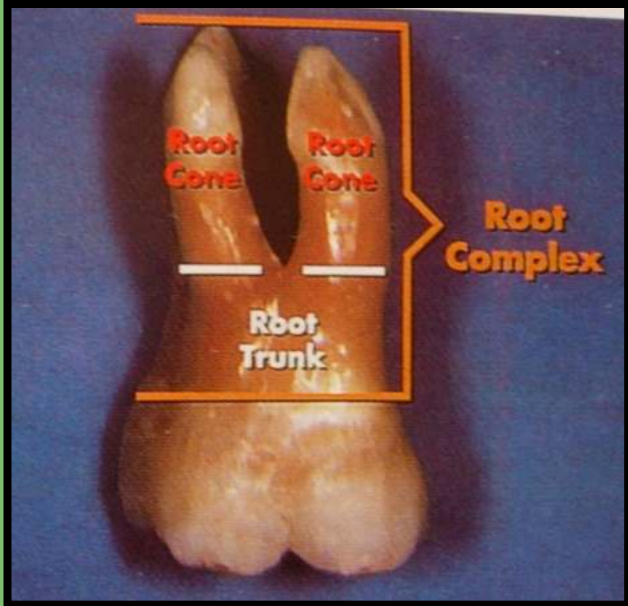
Glossary of periodontal terms (AAP 1992) defines

- *Furcation* as "the area of a multi-rooted tooth where the roots diverge".

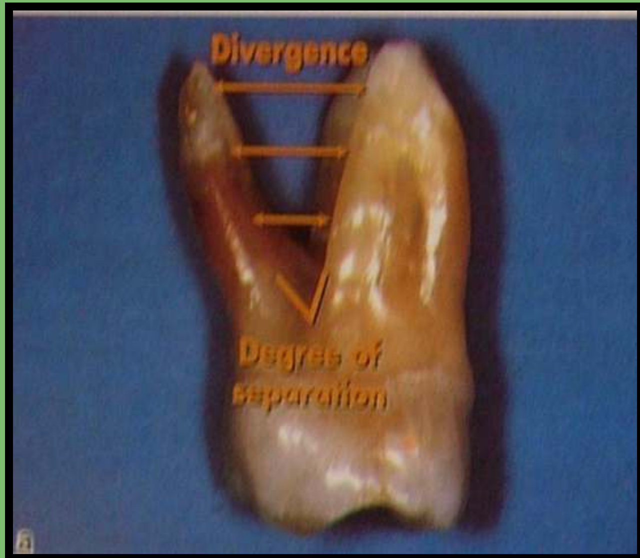
- *Furcation invasion* as the "pathologic resorption of bone within a Furcation”.

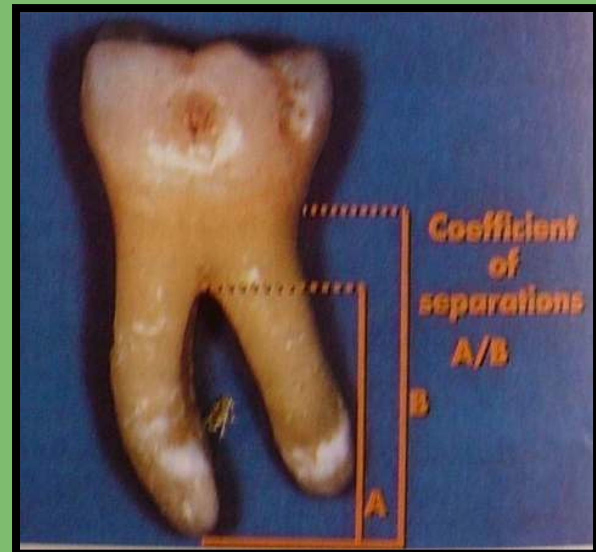
TERMINOLOGIES

- ***Root complex***
- ***Root trunk***
- ***Root cone***
- ***Furcation***
- ***Furcation fornix (roof)***
- ***Flute***
- ***Furcation entrance***
- ***Furcation chamber or the area of the root separation or inter-radicular area***
- ***Degree of separation***
- ***Divergence***
- ***Coefficient of separation***


Root
Cone
Root
Cone
Root
Complex
Root
Trunk

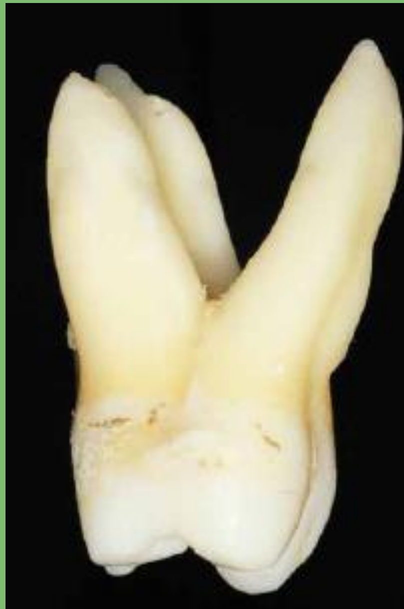
Fornix
Entrance

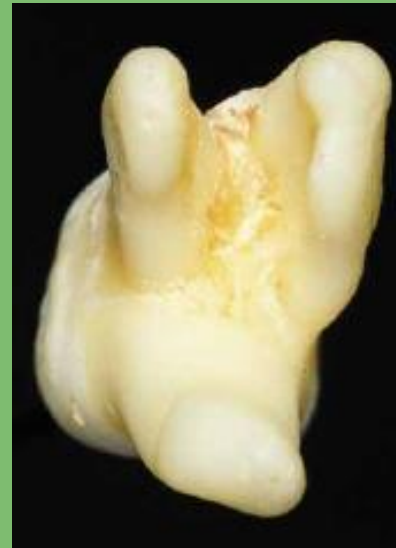

Divergence
Degree of
separation

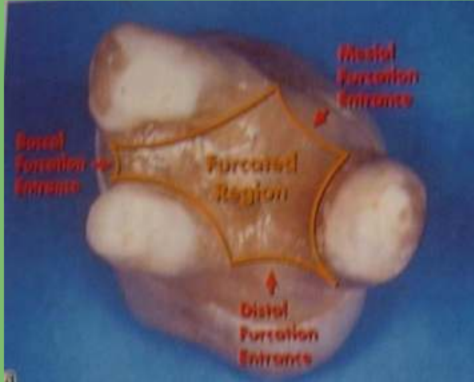

Coefficient
of
separations
A/B
B
A

MORPHOLOGY OF THE ROOT COMPLEX OF MULTIROOTED TEETH

Maxillary molars

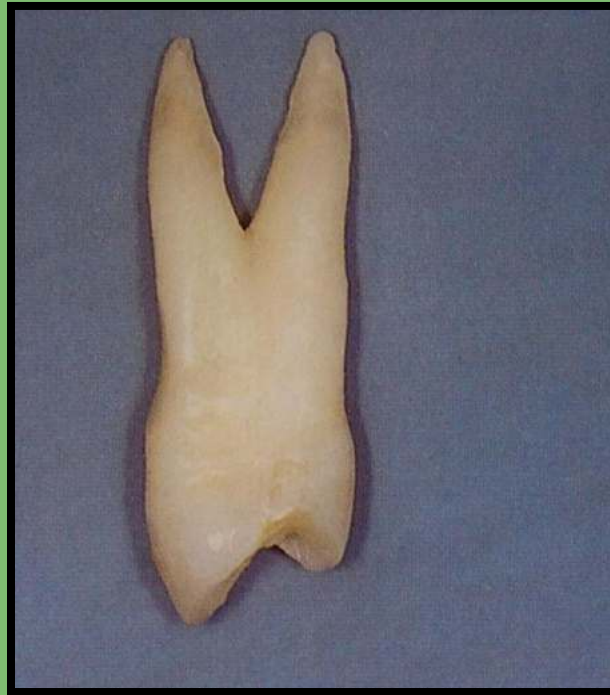




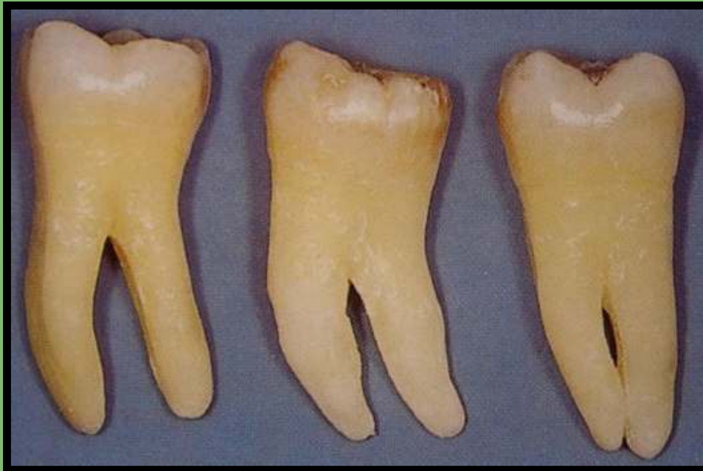

Furcated
Region
Distal
Furcation
Entrance

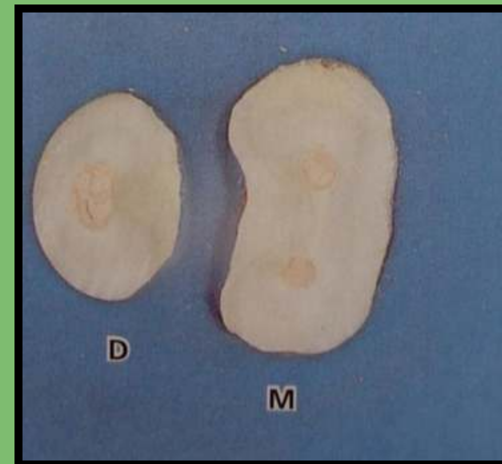
MB
DB
P

Maxillary premolars



Mandibular molars





Other teeth

- Two rooted incisors, canines and mandibular premolars

- Three rooted maxillary premolars and three rooted mandibular molars

CLASSIFICATION

Glickman (1953)

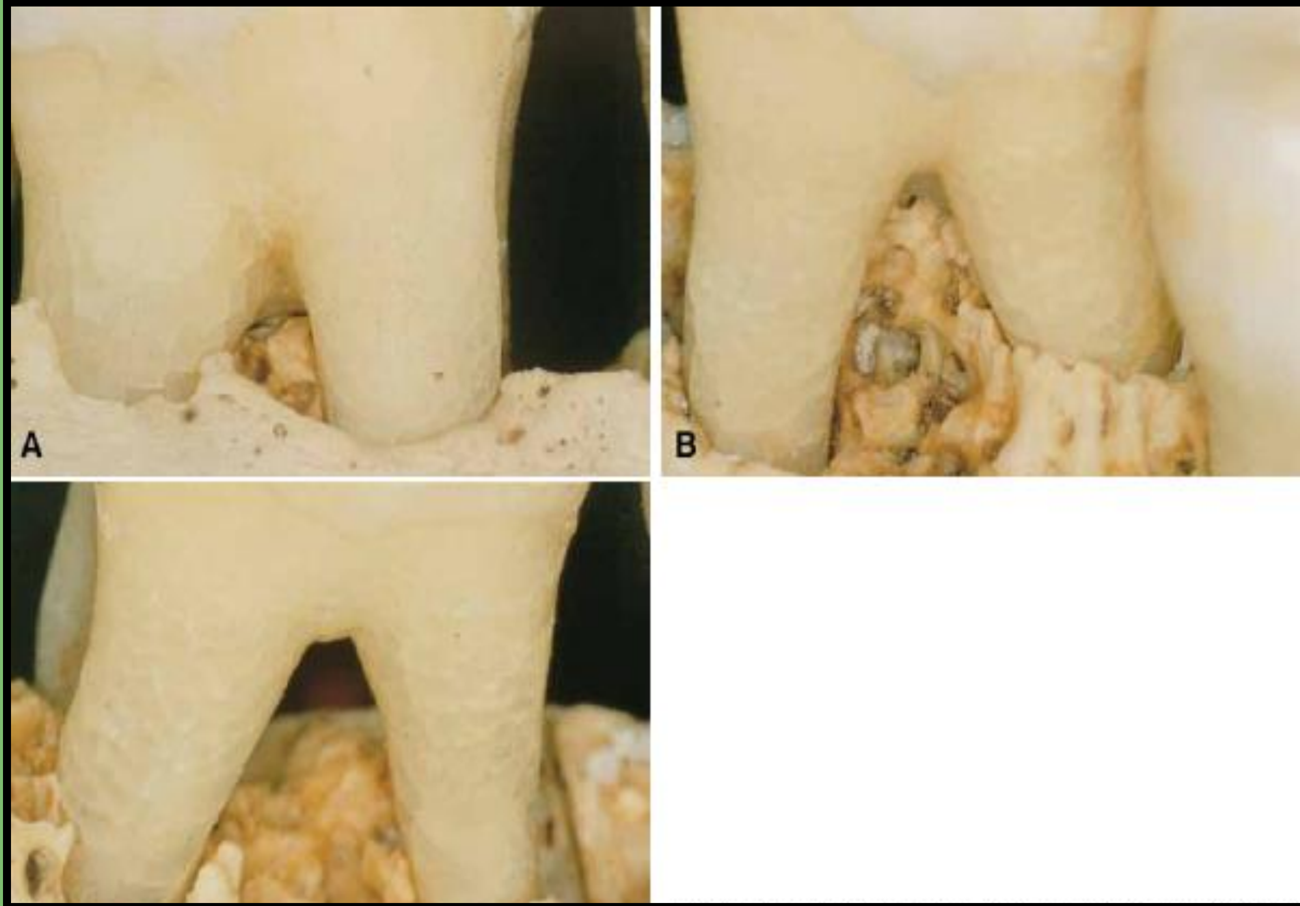
Grade-I: When there is soft-tissue lesion or pocket extending into the flute of the furcation, but the inter-radicular bone is intact. The pocket is suprabony. This involvement of the periodontium in the furcation area is without manifested radiographic evidence of bone loss.

Grade-II: Loss of inter-radicular bone & pocket formation of varying depths into the furcation but not completely through the opposite side of the tooth. This is radiographic evidence of involvement.

Grade-III: Complete loss of inter-radicular bone with radiographic evidence presenting a small triangular radiolucency at the furcation area. There is a pocket formation that is completely probable to the opposite side of the tooth. However, the furcation is not visible clinically.

Grade-lV: Same features as those of Grade III except that loss of periodontal attachment & gingival recession has made the furcation clearly visible to a clinical examination.

Glickman (1953)



Hamp, Nyman and Lindhe (1975) described a classification which defined the *horizontal extent* of the furcation involvement.

Class I: represents horizontal attachment loss of less than 3 mm within the furcation involvement.

Class II: represents horizontal loss greater than 3 mm but not encompassing the total width of the furcation.

Class III: denotes horizontal through and through destruction.

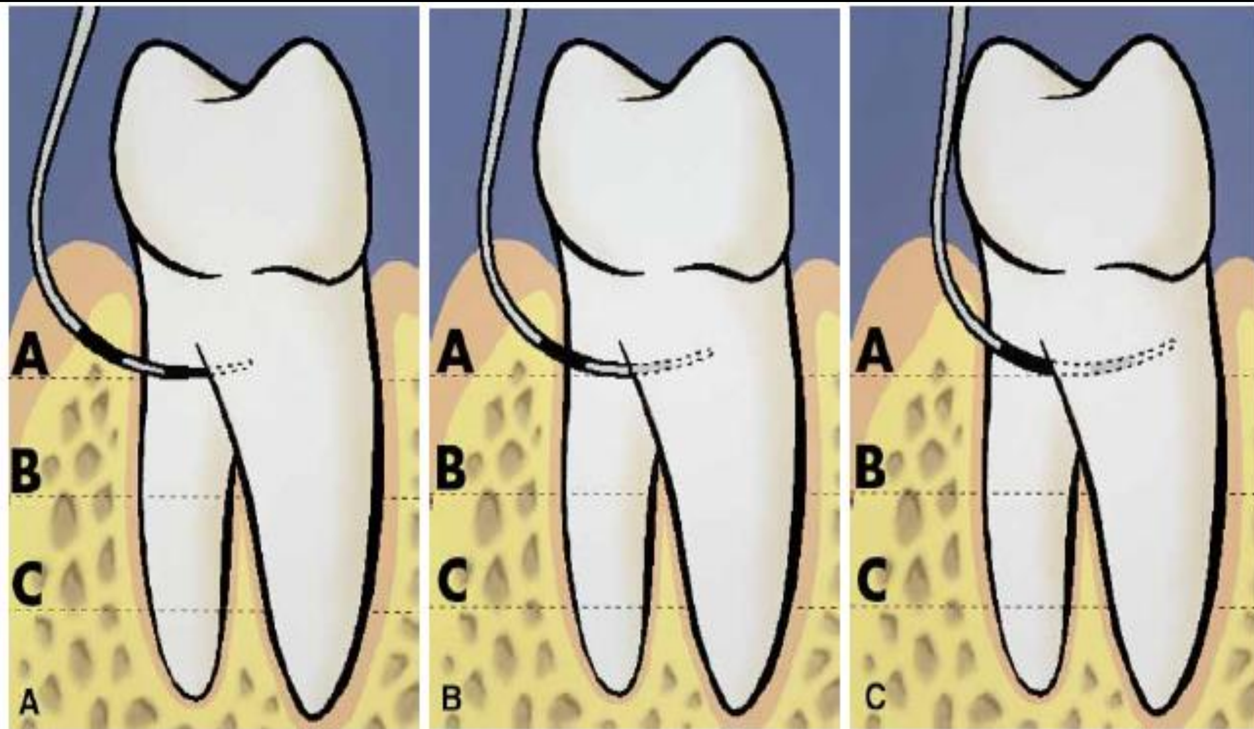


Fig. 3. Horizontal classification of furcation involvements. **A.** Class I, less than 3 mm of horizontal attachment loss. **B.** Class II, more than 3 mm of horizontal attachment loss but not through and through. **C.** Class III, through and through furcation involvement.

Lindhe (1983), Hamp andNyman (1989), Nyman & Lindhe (1997)

Degree I / Grade I (Initial): Loss of inter radicular bone less than or equal to one third.

Degree II / Grade-II (Partial): Loss of inter radicular bone greater than one third but not through and through.

Degree III / Grade-III (Total): Through& through loss of interradicular bone.

Ramjford & Ash (1979) :

Class I: probe penetrates horizontally between the roots upto 2mm

Class II: cul-de-sac >2mm but not through and through.

Class III: through and through involvement.

Glickman's (1958*)* Grade I, II and III is similar to

- the class 1, 2 and 3 of **Staffileno (1969)** and
- corresponds to **Goldman and Cohen's (1980)** classifications

Grade- I: incipient,

Grade- II: cul-de-sac and

Grade- III: through & through furcation involvement.

- **Heins & Canter (1968)** devised a more complex classification based on *surface location, number of bony walls & degree of furcal exposure.*

- **Fedi (1985)** merged these two systems into one in which the *Glickman* classification of grade I, II, III & IV is used, but for grade II furcation involvement, degree I & II are added to indicate horizontal depth less than or greater than 3 mm.

Easley & Drennan's classification (1969)

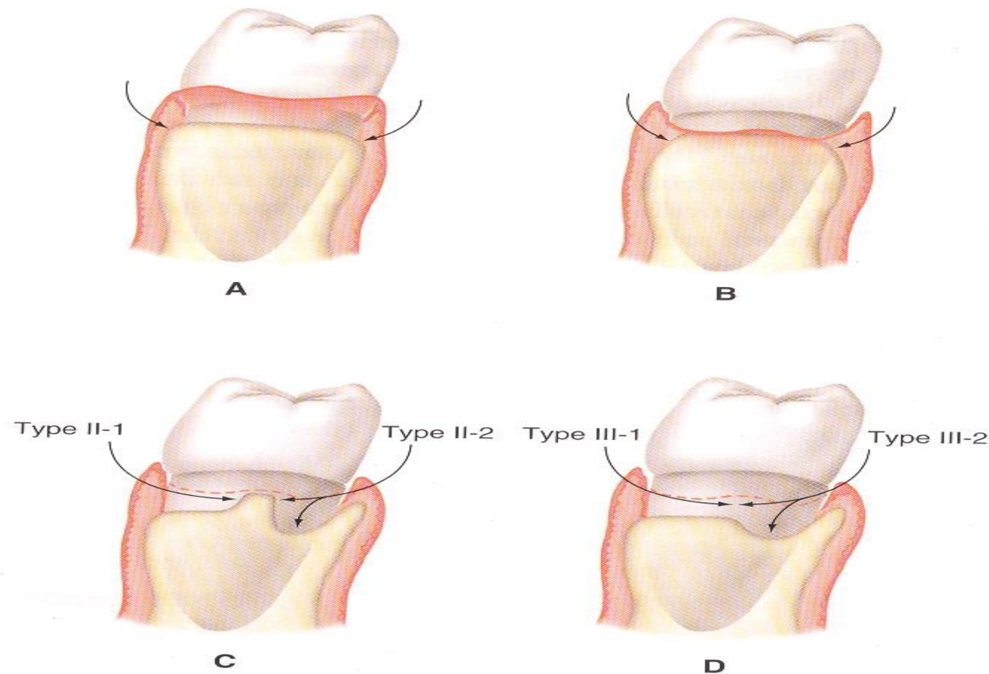


Figure 24-2. Easley and Drennan's classification of furcation involvement. **A,** Normal anatomy. No furcation involvement. **B,** Class I: Incipient involvement in which the fluting coronal to the furcation entrance is affected but there is no definite horizontal component to the furca. **C,** Class II: Type 1—A definite horizontal loss of attachment into the furcation, but the pattern of bone loss is essentially horizontal. There is no definite buccal or lingual ledge of bone. Type 2—There is a buccal or lingual bony ledge and a definite vertical component to the attachment loss. **D,** Class III: A through and through loss of attachment in the furcation. As with Class II furcation defects, the pattern of attachment loss may be horizontal (1) or there may be a vertical component (2) of varying depth.

Riccheti (1982) proposed a classification that establishes a meaningful clinical tool to determine a treatment approach.

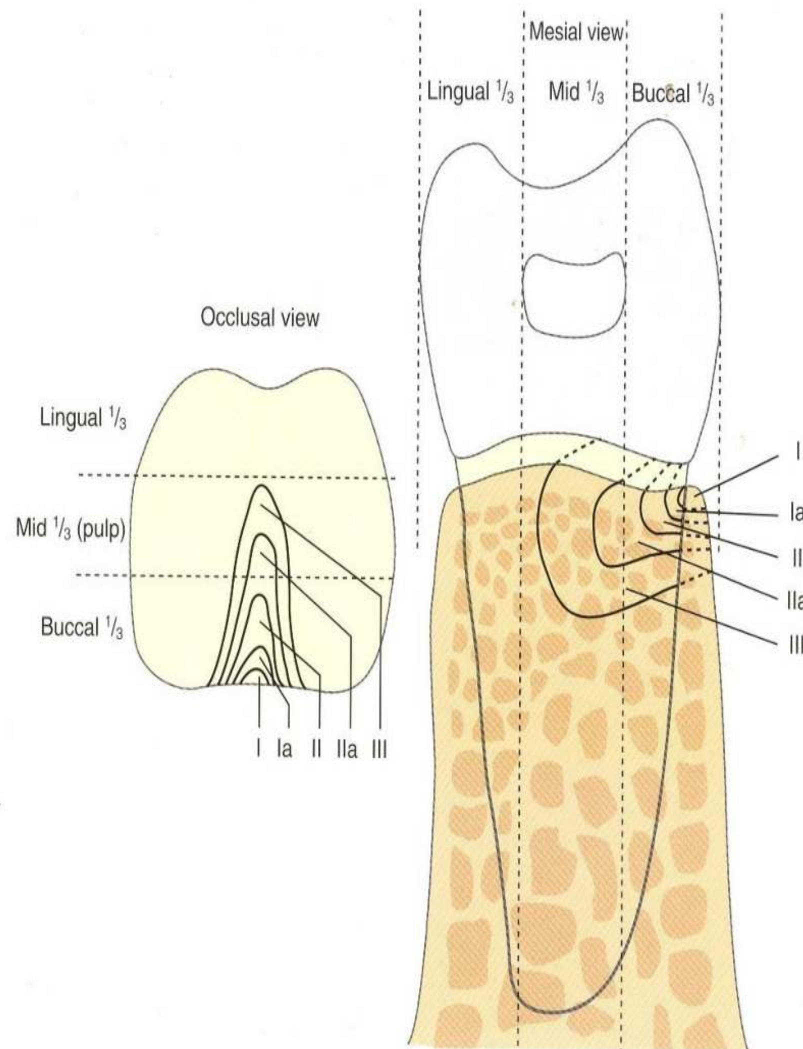


Fig 13-10 Mandibular molar demonstrating the pocket configuration and bone loss generally found with furcation invasion:

Class I: 1 mm of horizontal measurement–the root furrow.

Class Ia: 1 to 2 mm of horizontal invasion–earliest damage.

Class II: 2 to 4 mm of horizontal invasion–observe or perform odontoplasty.

Class IIa: 4 to 6 mm of horizontal invasion–observe, section, or attempt regeneration.

Class III: more than 6 mm of horizontal invasion–must section.

(left) Occlusal view of mandibular molar. *(right)* Mesial view of distal half of mandibular molar section through the interradicular septum after section of mesial root.

This furcation classification is most useful when the clinician is considering the treatment of early and intermediate furcation invasions. (From Ricchetti.[32] Reprinted with permission.)

Eskow and Kapin (1984) classified vertical loss in thirds of inter radicular loss

Tarnow & Fletcher (1984) classified vertical attachment loss in millimeters as follows:

Subclass A: Vertical destruction to one third of the total inter radicular height (1 to 3 mm).

Subclass B: Vertical destruction reaching two thirds of the inter radicular height (4 to 6 mm).

Subclass C: Inter radicular osseous destruction into or beyond the apical third (> 7 mm).

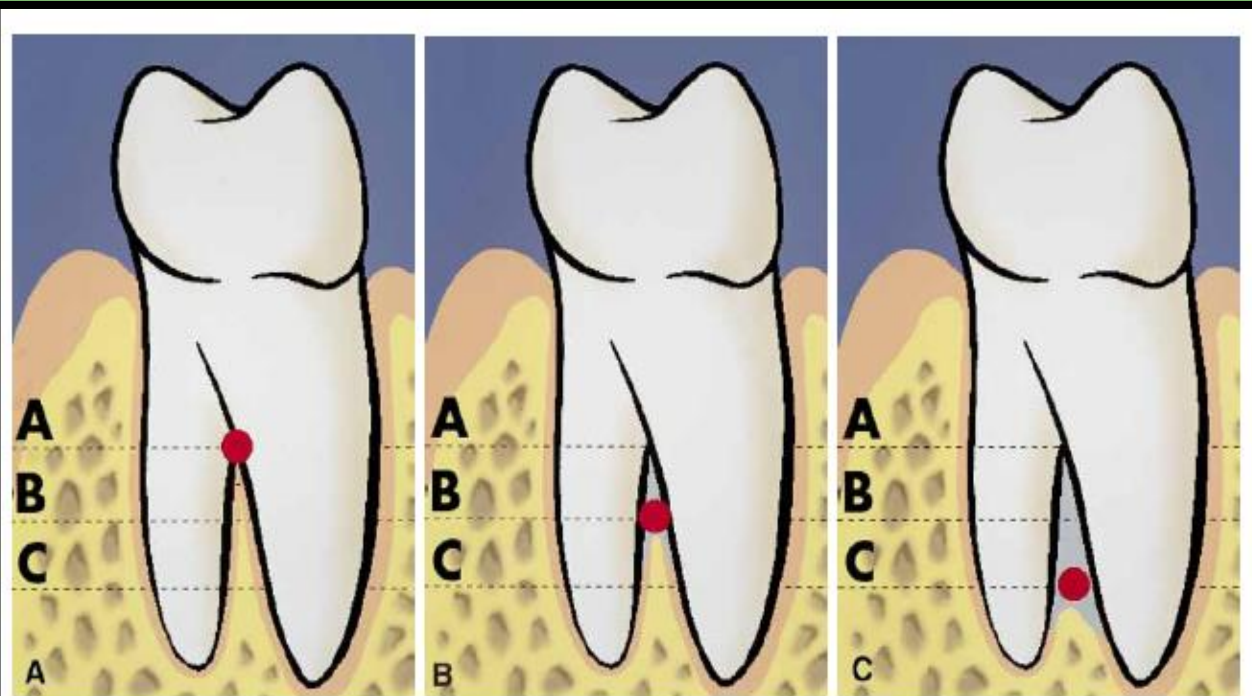


Fig. 4. Vertical classification of furcation involvements. **A.** Subclass A denotes furcation involvements with vertical bone loss of 3 mm or less. **B.** Subclass B denotes furcation involvements with vertical bone loss of 4 to 6 mm. **C.** Subclass C denotes furcation involvements with vertical bone loss from the fornix of 7 mm or more.

Basaraba (I990) gave a classification as ;

Class I (incipient lesion): a site where the probe will sink into the shallow V-shaped notch in the crestal outline. There is no intrabony lesion.

Class II (patent furcal invasion) : This type of invasion creates deep pockets and varying degree of bone destruction extending into the region of the furca. The defect may occur on any surface of the tooth or on more than one. There is no through and through communication.

Class III (Communicating furcal invasion) : It is a patent invasion that communicates with a second or third furcal opening.

Hou and Tsai (1997) proposed a classification of molar furcation involvement based on the root trunk and horizontal and vertical probing attachment levels.

Subclass A : short root trunk of less than 1/3 of the root complex (corresponding to a separation degree of more than 2/3)

Subclasses B : medium-sized root trunk of 50% of the root complex (separation degree 1/2) and

Subclasses C : root trunk 2/3 of the root complex (separation degree 1/3)

PREVALENCE OF FURCATION INVOLVEMENT

- Tal (1982) - 85.4% of mandibular molars
- Tal and Lemmer (1982) – manbibular first molars are more affected than second molars.
- Bjorn & Hjort (1982) - maxillary & mandibular molars range from 25% to 52% and from 16% to 35% respectively
- Svadstrom and Wennstrm (1996) - Furcation lesions were more prevalent in the maxilla than in the mandible and Periodontal destruction was most frequently observed at the distal aspect of the first and second maxillary molars (53% and 35% respectively).
- Furcation involvement is more frequently detected in smokers (72%) than in nonsmokers (36%).
- Molars with crowns or proximal restorations have significantly higher percentage of FI (52-63%) compared with molars without restorations (39%).

ANATOMIC FACTORS :

Local anatomic factors are important to be identified because they not only affect the development and treatment of furcation involvement (FI), but also the prognosis of the therapy.

1. ***Root trunk length***
2. **Interradicular dimension**
3. **Anatomy of furcation :**

a. Root concavities

b. Bifurcation ridges

c. Accessory pulp canals

d. Cervical Enamel pearls and projection

e. Location and diameter of furcation entrance

f. Root form

Root trunk length

- Short or long
- Invasion of periodontal disease and access to therapy
- First molars generally have shorter root trunks than second molars.

  This may account for their having a higher prevalence of furcation involvements than second molars.

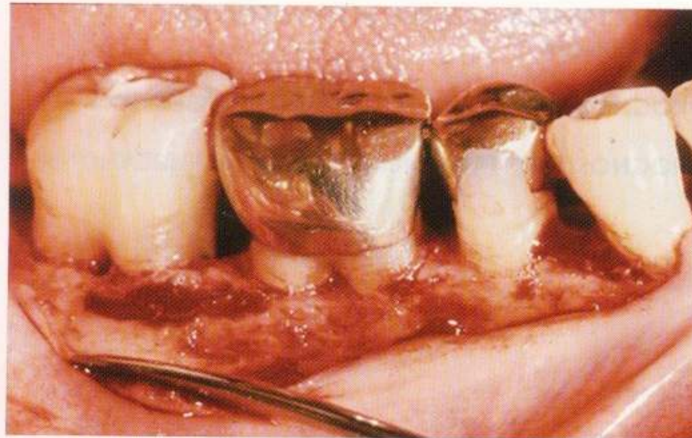


Figure 24-1. Root trunk dimension. The length of the root trunks may be highly variable. In very short root trunks, like these mandibular molars, the attachment level even with health may be near or at the entrance into the furca. The shorter the root trunk, the less attachment that has to be lost before involvement of the furcation.

Interradicular dimension

- Roots – widely separated or closely approximated or fused

- Ease or difficulty in instrumentation
- Also provide niche for microbial colonization

- First molar furcations are frequently wider than those of second molars because of greater spread of their roots and hence allow for better access during treatment.

Root concavities

Bower (1979) found that all the root surfaces facing the furcation exhibit some degree of concavity or depression in an occluso-apical direction

- Mandibular molars had deeper concavity in relation to the mesial root (mean concavity 0.7 mm) than in the distal root (mean concavity 0.5 mm).
- The maxillary first molar had deepest concavity in the furcal aspect of the mesiobuccal root (mean concavity 0.3 mm); 94% of mesiobuccal roots; 31% of distobuccal roots & 17%) of palatal roots.
- Furcation concavities are covered by more cementum than the adjacent convexities. This may have clinical significance due to cementum's ability to absorb and/or adsorb toxic bacterial products such as endotoxins when altered by the inflammatory process.

Bifurcation ridges

- Everett (1958) described a ridge on mandibular molars that originated from the mesial surface of the distal root, ran across the bifurcation and ended high up on the mesial root, where it blended into the commonly occurring concavity of the distal surface of the mesial root. He called it an "intermediate bifurcation ridge" and found an overall incidence of 73%
- Burch & Hulen (1974) found an incidence of 76%.

- Histologic examination revealed that the ridge is formed mostly of cementum.
- This anatomical structure creates niches where plaque can accumulate undisturbed when the furcation is exposed to the oral environment.
- Buccal and lingual ridges were found in 63% of the mandibular molars.
- These ridges resulted in the roof of the furcation being located more coronally than the entrances.

Accessory pulp canals

- may extend pulpal inflammation to the furcation.

- could be an initiating cofactor in the development of furcation involvement.

- Accessory canals connecting the pulp chamber to the floor to the furcation have been found in

    36% maxillary first molars,

    12% of maxillary second molars,

    32% of mandibular first molars and

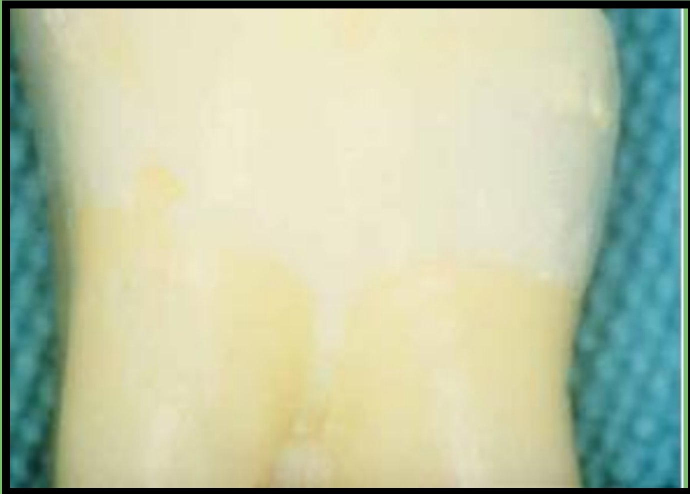
    24% of mandibular second molars.

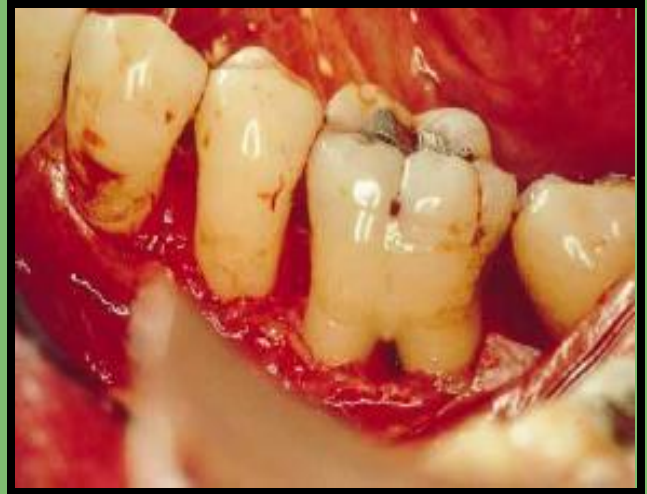
Cervical Enamel pearls and projection

(AAP) 1986 Glossary of periodontal terms, defines an ***enamel pearl*** as *"a small focal mass of enamel formed apical to the CEJ"*,

enamel projection is *"an extension of the cervical enamel margin either toward or into the root furcation area "*.

Cavanah (1965) studied molars with enamel pearls and concluded that the only situation in which enamel pearls may become contributors or predispose to periodontal breakdown occurs when the inflammatory process contacts their coronal aspect. Therefore, the closer the enamel pearl is to the CEJ, the greater is its chance of becoming a contributory factor.





Master & Hoskins (1964) classified the CEP into the following grades according to severity of the projections:

- *grade I:* The enamel projection extends from CEJ of the tooth towards the furcation entrance
- *grade II:* The enamel projection approaches the entrance to the furcation. It does not enter the furcation, and therefore no horizontal component is present.
- *grade III:* The enamel projection extends horizontally into the furcation.

- The CEP as a group was found in decreasing order of incidence on mandibular second molars (28.6%), on maxillary second molars (17%), on mandibular first molars, and finally on maxillary first molars.

- They also observed the presence of CEP in more than 90% of isolated furca lesions of mandibular teeth.

Location and diameter of furcation entrance

- Mandibular molar
- Maxillary molar – mesial, distal and buccal
- The distal maxillary furcation is the most frequently involved as corroborated by Klavan (1975).
- Bower (1979) found that 81% of furcation entrance diameters was 1.0 mm or less, and 58% of the diameter was 1.75 mm.
  Overall furcation entrance diameter was smaller than the blade face width of commonly used periodontal curettes in 58% of the furcation examined.
- ***Diameter Of Furcation Entrance***
  maxillary molar
  mandibular molar

Root form

- The mesial root of mandibular first and second molars and mesiobuccal root of maxillary first molar are typically curved on distal side.
- In addition, the distal aspect of this root is usually heavilly fluted.

ETIOLOGY OF FURCATION INVOLVEMENT

***Primary factor* – Bacterial Plaque**

Predisposing factors:

Anatomic factors –

- **i. *Root concavities***
- **ii. *Root trunk length***
- **iii. *Accessory pulp canals***
- **iv. *Cervical Enamel pearls and projection***
- **v. *Bifurcation ridges***
- **vi. *degree of separation of roots***

Iatrogenic factors –

- **i. overhanging reatorations**

Isolated molar furcation invasions

Trauma from occlusion - controversial

Pulpal periodontal disease

Iatrogenic cofactors - crowns

Root fractures involving furcations

The role of TFO as a predisposing factor in FI is controversial.

- Glickman et al (1966) have shown that when rat molars are put into hyperfunction, the PDL, bone and cementum in the furcation area are most succeptible to injury from the occlusal forces.

  The magnitude, duration, frequency or direction of the occlusal forces can readily exceed the reparative capacity of the attachment apparatus, because the quantity of bone within the most coronal aspect of the furcation is limited.

- Periodontal ligament in the furcation is aligned in a horizontal rather than a vertical plane. Thus, even slight increase in centric occlusal forces would have the same crushing effect on periodontal ligament as destructive, lateral forces on a PDL aligned in a vertical plane.

Bacterial plaque (Primary factor)

Periodontal pocket – apical migration

Predisposing factors

Extension of inflammatory changes to furcation area

Loss of attachment and Bone loss in furcation area

FURCATION INVOLVEMENT

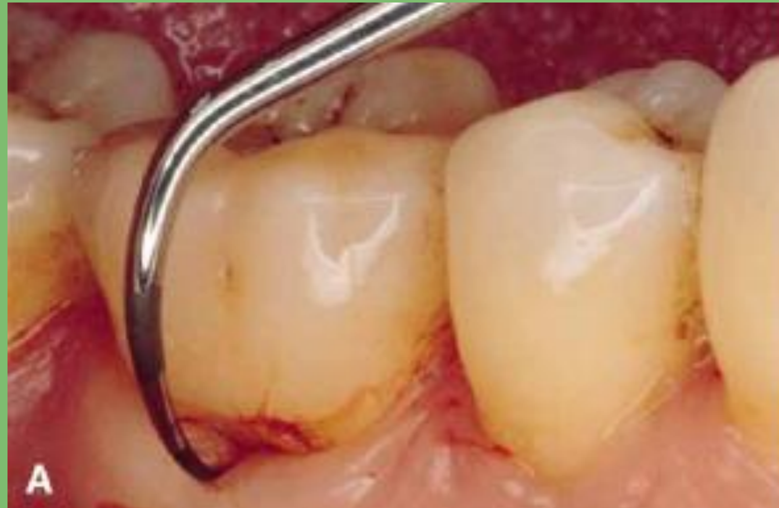
DIAGNOSIS OF FURCATION INVOLVEMENT

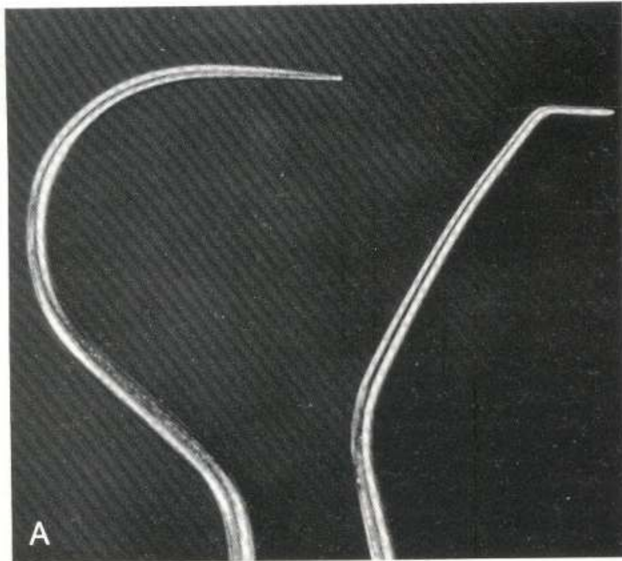
- **CLINICAL EXAMINATION**
- **RADIOGRAPHIC EXAMINATION**
- **INTRAOPERATIVE MEASUREMENTS**

CLINICAL EXAMINATION

- Signs and symptoms of periodontal inflammation may be present to varying extent, such as :
  - Redness
  - Swelling - Periodontal abscess
  - Increased temperature
  - Pain
  - Loss of function – tooth may be perceived elongated and mobile
  - Increased bleeding tendency
  - Suppuration

- Clinical probing – using a curved graduated periodontal probe (Naber's probe), an explorer or a small curette.
- Nabers #1 and 2 probe.
- Straight probes detect only vertical attachment loss and are not accessible for determining horizontal attachment loss.





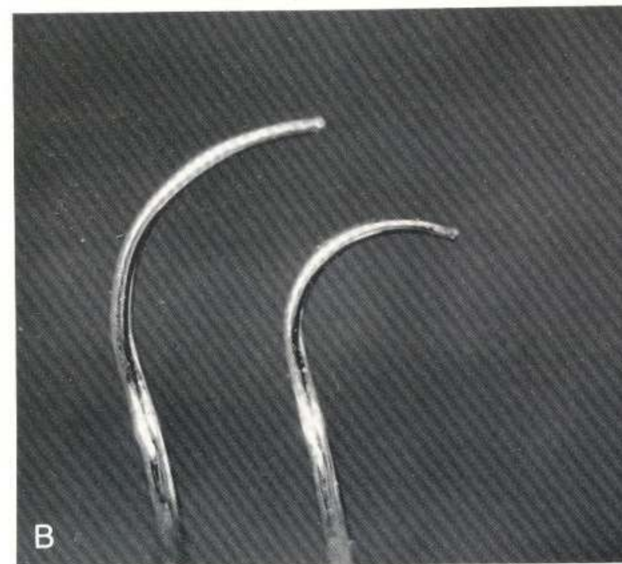


Fig. 14-1. Instruments Used for Furcation Deflection. **A,** No. 23 explorer. **B,** Nabers No. 1 and No. 2 curved probes.

- A probing depth deeper than the length of the root trunk should be immediately evaluated.

- Vertical attachment loss on the adjacent roots should be probed at the furcation line angle of each root, angling the probe somewhat into the furca.

- Horizontal attachment loss is measured from an imaginary tangent passing through or applied at both roots or root cones at the level of the furcation entrance.

- The buccal furcation of the maxillary molars and the buccal and lingual furcas of the mandibular molars are normally accessible for examination by clinical probing.

- The clinical examination of furcas on the approximal tooth surfaces may be more difficult when neighboring teeth are present, especially if the contact area between the teeth is large.
- This is particularly the case in maxillary molars.

  The mesial furcation opens about 2/3rd of the way toward the palate and is easily probed from the palatal aspect of the tooth.

  While the furcation in the distal surface, located midway bucco-lingually is probed form either the buccal or the palatal aspect.

- Since the furcation entrance lies subgingivally in most cases, the operator has to search for a concavity at the respective site and then to penetrate into the area between the roots.
  Consequently, a pressure controlled, flexible, plastic probe (Hunter et al. 1992) was shown to hamper a correct furcation assessment especially in case of a through-and-through involvement (Kim et al. 1996, Eickholz & Kim 1998).

- On the other hand, bleeding on probing, which has been shown to negatively affect the reproducibility of furcation measurements (Steinbrenner et al. 1997), is expected to be provoked more frequently with the ‘‘searching probe’’ trying to gain access to this area.

- Since the pocket has a vertical *and* horizontal component, conventional straight probes may also underestimate the severity of the furcation involvement.

RADIOGRAPHIC EXAMINATION

- In practice, ***periapical*** or ***vertical bitewing*** exposures in combination with a ***long cone*** as well as ***panoramic tomograms*** are commonly used for the diagnosis of the periodontal condition.

- An initial furcal lesion, in particular in maxillary molars (and correspondingly periapical lesions), may actually be better uncovered on a panoramic tomogram (Rohlin et al. 1989), which frequently images the central plane of the alveolar bone including the furcation area, whereas structures not in the interesting plane are blurred.

- Glickman found that clinically significant tissue changes in the furcation often are not detected by radiographs.
- X-rays are virtually the only diagnostic tool to reliably determine
  - the bone level within the root complex
  - the height of the alveolar bone crest in relation to the tooth length.
  - the anatomy and topography of the root complex,
    i.e., number and form of roots,
    separation degree,
    divergence of roots etc.,
  - the location of the interdental bone
- Radiographs may be taken with probes, explores or curettes in place and a more accurate assessment of the extent of the lesion can be determined.

- On x-ray films of maxillary molars, a small, triangular, radiolucent shadow is sometimes seen over the mesial or distal roots in the proximal furcation areas, which has been called *furcation arrow*.

- The association of this image with deep grade II or grade III FI was significant compared with uninvolved furcations, but the arrow was not seen in more than half of the sites with a deep grade II FI and in slightly less than half of grade III sites.

- However, a radiographic image of a furcation arrow should induce the periodontist to carefully further assess the severity of furcation invasions clinically and, if need, intra-operatively.

To assist in the radiographic detection of FI, the following three diagnostic criteria 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 the furcation is also involved.

Radiographs alone do not detect FI with any predictable accuracy and that probing the furcation area is necessary to confirm the presence & severity of FI.

- With the aid of high-resolution ***computed tomography*** a more detailed, *3- dimensional interpretation* of bony lesions and tooth structures especially in the furcation area seems possible (Fuhrmann et al. 1997).

- ***Direct axial scanning*** parallel to the occlusal plane has been recommended for detection of infrabony pockets, furcation involvements and buccal or lingual bone dehiscences (Fuhrmann et al. 1997).

- Evidence for healing in furcations may be provided by ***computer- assisted densitometric image analysis (CADIA)*** as well as ***qualitative and quantitative digital subtraction radiography***

INTRAOPERATIVE MEASUREMENTS

- Comprehensive information with regard to the morphology of a periodontal defect may be further achieved by intrasurgical inspection.

- Not infrequently, a definite conclusion for one or the other treatment modality can therefore only be drawn intra-operatively.

- After surgically opening of the defect, removal of the granulation tissue and careful debridement of the root surfaces within and outside the interradicular projection, the actual extent of periodontal destruction may be visible.

DIFFERENTIAL DIAGNOSIS

1. ***Problems originating from the root canal***

2. ***The result of occlusal overload - Trauma from occlusion***

TREATMENT MODALITIES

The basic rationale for therapy is

- to eliminate the etiologic factor, the furcation perse,
- arrest the progression of periodontal disease and
- to establish an environment that is conducive to adequate plaque control.

- The different treatment modalities are correlated with the classification of furcation lesions.

- The treatment can be limited to periodontal therapy or can consist of a complex multidisciplinary approach that includes restorative therapy and endodontics and/or orthodontics.

The following factors determine the prognosis, modality of therapy and clinical outcome for multirooted tooth with loss of periodontal attachment in the inter radicular area :

(A) Patient Factors:

1. Proper plaque control
2. Smoking
3. Presence of systemic disease(s) or conditions
4. Genetics
5. Wound healing potential
6. Stress
7. Succeptibility to caries
8. Recall maintainence visits

(B) Tooth and Defect Factors

1. The extent of lost attachment apparatus in a horizontal and vertical direction within the furca and the number of furcas involved in a multi rooted tooth.
2. The degree of internal furcation involvement within a maxillary molar.
3. Morphology of the inter radicular septum.
4. The length, number, shape and divergence of the roots.
5. The dimension of the root trunk and relationship of the level of the inter radicular septum to adjacent osseous structures.
6. Relationship and level of the adjacent osseous and soft tissues.
7. Root proximity to the adjacent teeth.
8. Access to the denuded interradicular area to plaque control procedures.

9. Tooth vitality
10. Apical extent of root caries
11. Strategic importance of the tooth.
12. Tooth mobility
13. Quality of prior endodontic therapy
14. Restorative requirements for the tooth and case
15. Occlusion and interarch relationship
16. Anatomic considerations such as the external oblique ridge and tori.
17. Tooth inclination and position relative to basal bone
18. Etiology of lesion i.e. pulpal, periodontal, combined or iatrogenic.

(C) Technical Factors

1. Flap management technique
2. Accessibility to the defect
3. Post operative infection control
4. Adjunctive antibiotic therapy
5. Operator skill and experience.

Table 14-1. Classification and Treatment of Furcations

Glickman (1958)	I	II		III or IV
Lindhe (1983)	—	I	II	III
Tarnow (1984)	—	A, B, or C	A, B, or C	A, B, or C
Treatment	Scaling and root planing Gingivectomy Odontoplasty	Odontoplasty* Osteoplasty*† Root resection	Odontoplasty* Osteoplasty*† Root resection Tunnel preparation Grafting GTR‡ Flap and Ca Extraction	Root resection Tunnel preparation Grafting GTR‡ Extraction

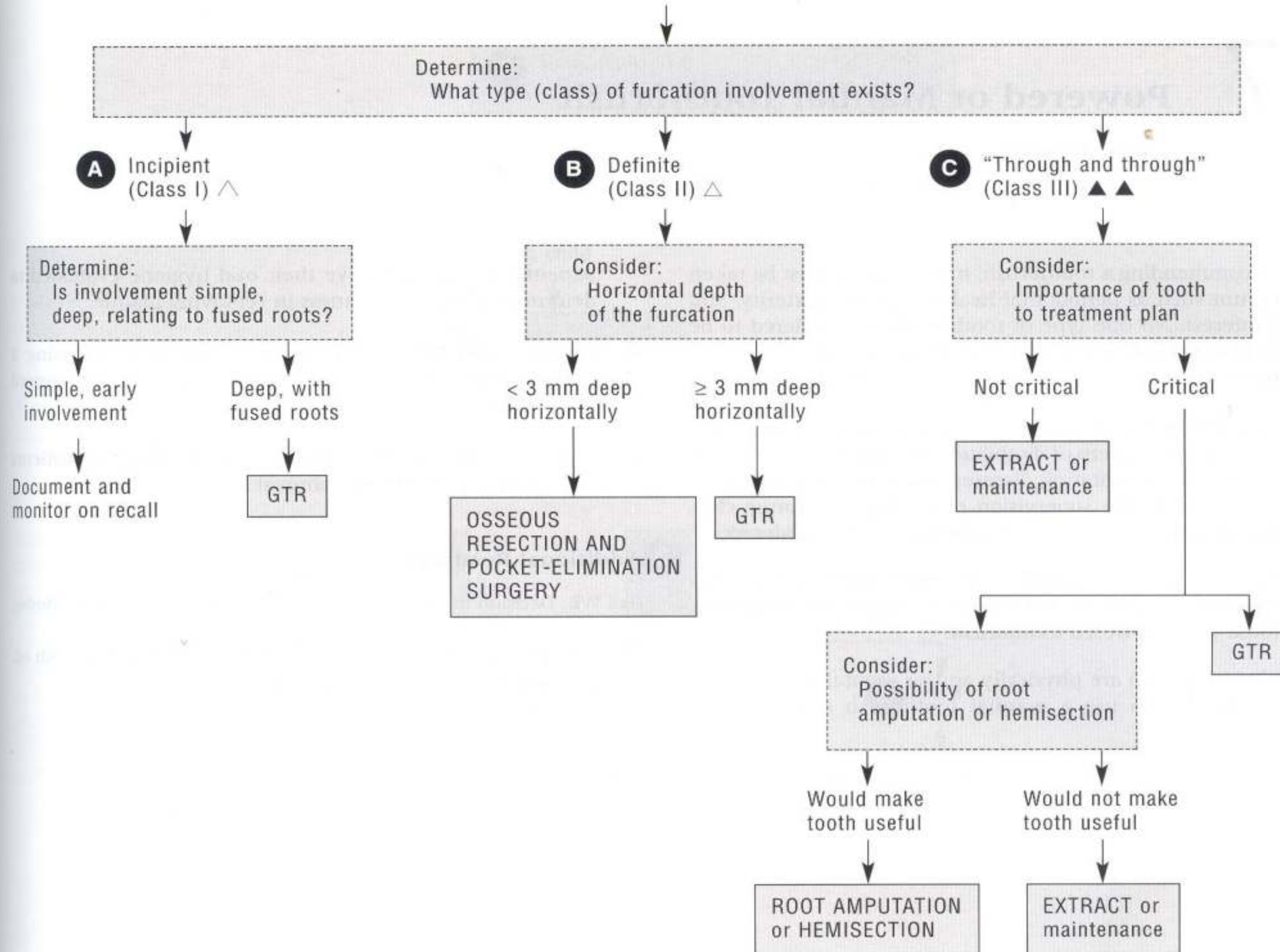
*When done together, termed furcation plasty.

†Osteoplasty is used here to mean both osteoplasty and ostectomy.

‡Guided tissue regeneration.

The principles of therapy of FI may be discussed under 3 major headings :

1. ***Conservative*** – comprises non-surgical and surgical therapy employed to debride the furcation area, excluding regeneration and root separation procedures.
2. ***Resective*** – includes root resection, hemisection and tooth extraction
3. ***Regenerative*** – includes GTR, bone grafting



Patient with a COMPLEX DENTAL PROBLEM AND A MOLAR WITH A FURCATION INVOLVEMENT
Determine:
What type (class) of furcation involvement exists?
A Incipient (Class I)
B Definite (Class II)
C "Through and through" (Class III)
Determine:
Is involvement simple, deep, relating to fused roots?
Simple, early involvement
Deep, with fused roots
Document and monitor on recall
GTR
Consider:
Horizontal depth of the furcation
< 3 mm deep horizontally
≥ 3 mm deep horizontally
OSSEOUS RESECTION AND POCKET-ELIMINATION SURGERY
GTR
Consider:
Importance of tooth to treatment plan
Not critical
Critical
EXTRACT or maintenance
GTR
Consider:
Possibility of root amputation or hemisection
Would make tooth useful
Would not make tooth useful
ROOT AMPUTATION or HEMISECTION
EXTRACT or maintenance

SCALING AND ROOT PLANING

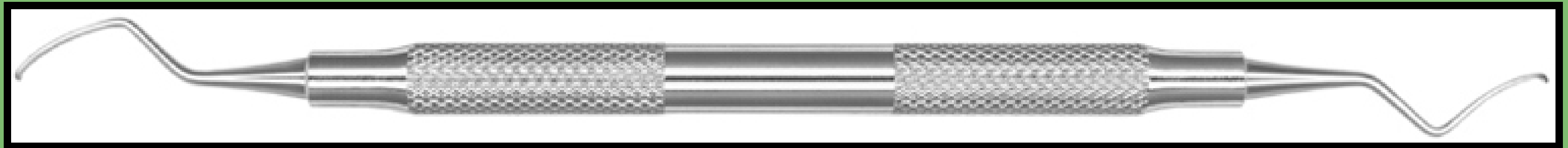
Plaque ⟶ Gingivitis ⟶ Periodontitis

- SRP is mandatory. It can be closed or open.
  - ***I. Non- surgical (Closed) scaling and Root Planing***
  - ***II. Surgical (Open) Scaling and Root planing***

- Bowers (1979) found that in 58% of upper and lower first molars, the furcation entrance diameter is narrower (<0.75 mm) than the width of conventional periodontal curette.
- Hence the use of curettes alone would result in inadequate debridement of many furcation areas.
- The use of ultrasonic scalers is more effective than hand scaling in close debridement of advanced furcations.

The various instruments that can be used are :

- Furcation curettes
- Mini Five curettes
- Ultrasonic Furcation inserts
- Rotary diamond burs



Demarco furcation curette

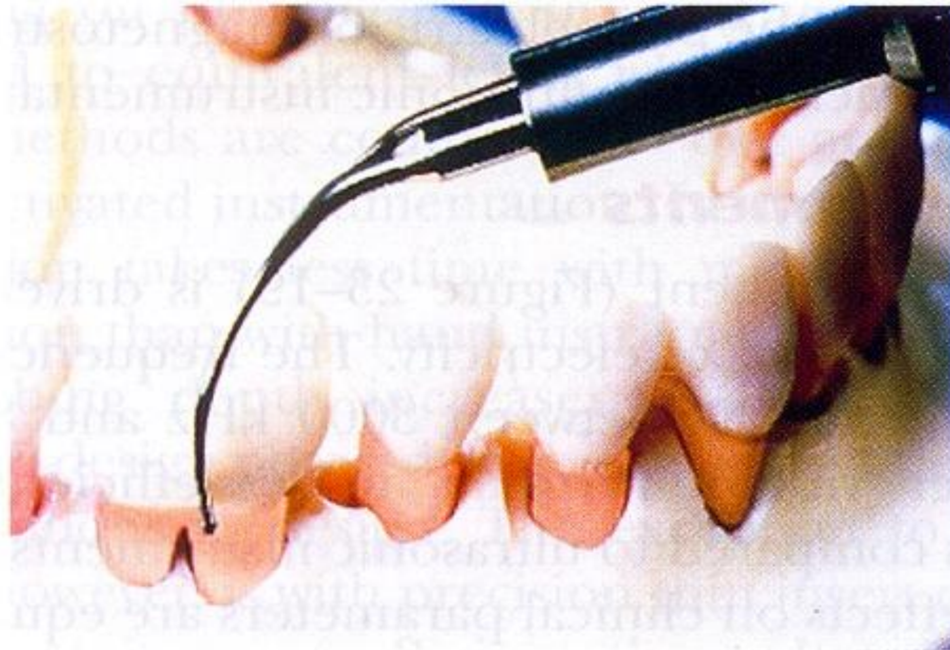


FIGURE 23–15 ✦ Furcation design. *(Courtesy Hu-Friedy Manufacturing Co., Furcation Designs.)*

Adjunctive chemotherapeutic agents have been used locally. Agents such as

- 1% metronidazole gel
- 50mg/ml Tetracycline irrigation
- Tetracycline impregnated fibers
- Povidone iodine

The sporadic, uncontrolled local delivery of antibiotic substance with SRP did not have any significant advantage.

Del Peloso Ribeiro E (2006) found that use of topically applied povidone-iodine as an adjunct to subgingival instrumentation does not provide additional benefits.

OBLITERATION OF THE FURCATION - OCCLUSIVE BARRIER

- The various materials tried are Zinc Phosphate cement, amalgam, Glass ionomer cement (GIC) and resin ionomer cement. However, only GIC and resin ionomer have been found to be effective.

- Von Swol et al (1989) compared Zinc Phosphate cement, amalgam and GIC in the treatment of surgically created furcation in non-human primates. Radiographs taken at various time intervals demonstrated only slight radiolucent changes that were less likely to progress with time when using GIC. They reported greatest biocompatibility with GIC via histologic evaluation.

The potential advantage of using GIC as an occlusive barrier in the treatment of Furcation defects has the following advantages :

- GIC restoration provides a barrier seal to furcation entrance from epithelial, bacterial and food debris invasion.
- Enable easier home care due to reduced furcation area of the furcation left to clean.
- Ease of placement
- Does not require suture for stability
- Does not interefere with epithelial attachment. Long junctional epithelial attachment to GIC – biocompatible
- Does not require complete coverage by the gingival flap
- Bacteriostatic due to fluoride release
- Lower cost
- GIC has been used in orthopaedics for joint replacement therapy and has been found to have potential osteogenic properties.

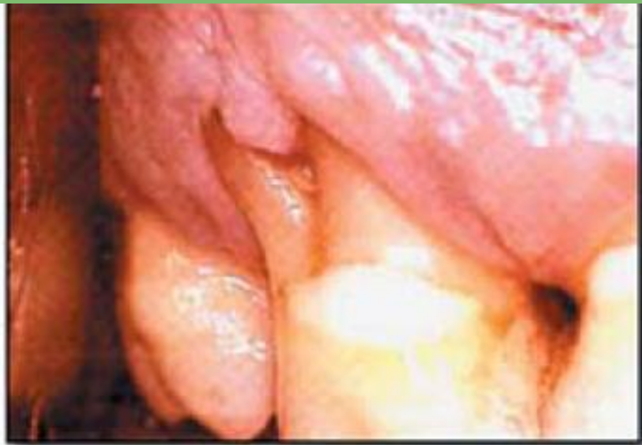


Figure 1. Pre-operative view of the right maxillary first molar with Class III furcation defects.

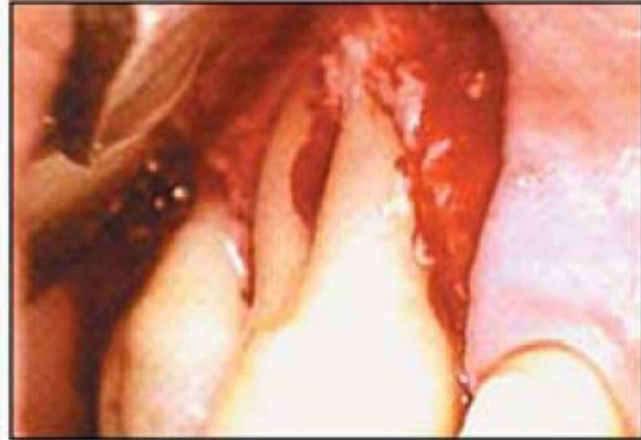


Figure 2. Buccal furcation defect following debridement.

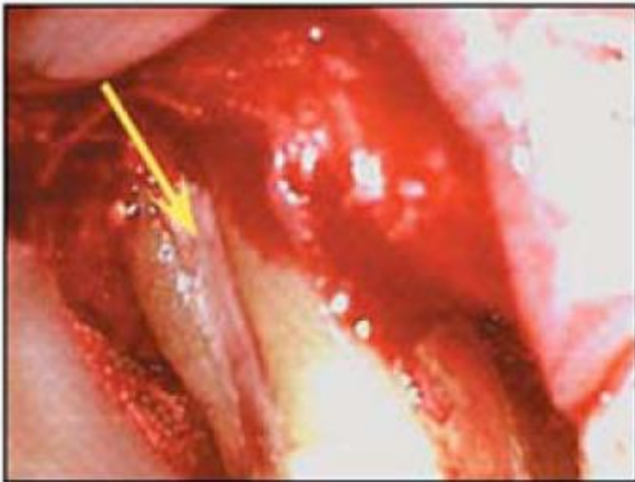


Figure 3. Buccal furcation defect restored with glass ionomer.

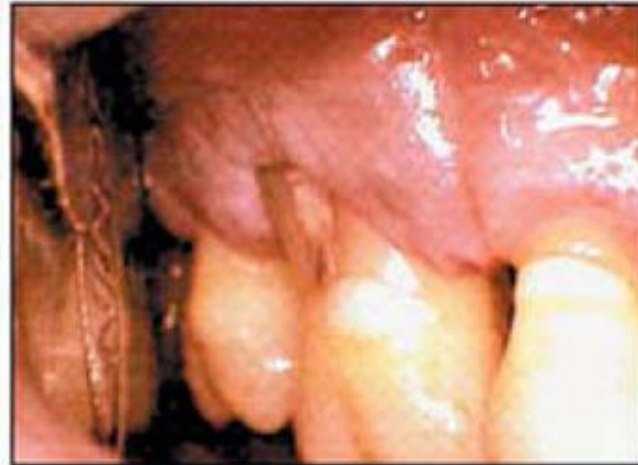


Figure 4. One year following view. Discoloration of the sealant in the furcation is due to staining.

- Dragoo (1997) have found histologic findings suggesting epithelium and connective tissue attachment to resin ionomer restorative materials during wound healing.

- Charles R. Anderegg (2000) - showed that teeth with hopeless prognoses might be retained by decreasing probing depths, bleeding upon probing, and mobility when furcation areas are sealed with a resinionomer

- Many authors (Reddy KP et al 2005, and others) have found that molars with grade III FI, especially maxillary molars, when restored with GIC, showed a reduction of probing depth, tooth mobility over a period of time.

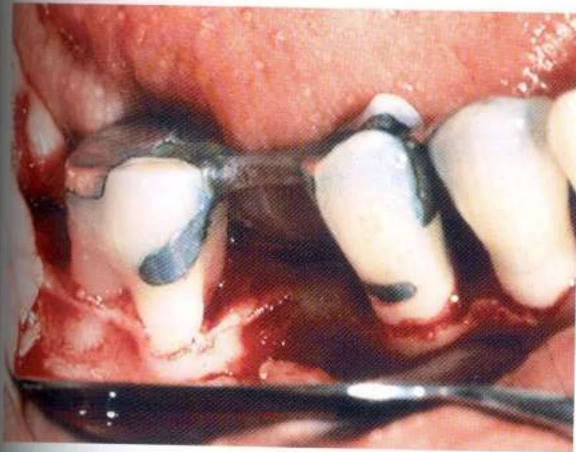
GINGIVECTOMY/APICAL POSITIONED FLAP

- Reducing or eliminating the soft tissue pockets over the furcation region increases access for plaque control and allows resolution of periodontal inflammation.

- Gingivectomy or apically repositioned flaps may be used depending on the pocket depth, the fibrosity of the tissue and the amount of the attached gingiva.

FURCATION OPERATION / FURCATIONPLASTY

- It should lead to the elimination of interdental defect
- It comprises of odontoplasty and osteoplasty
- Odontoplasty i.e. removal of tooth substance in the furcation area in order to widen a narrow entrance of the furca and to reduce the horizontal depth of the involvement. It eliminates the dentinal hood of tooth structure over the furcation and provide a smooth surface from the seam of the root surface and bone to occlusal surface of the tooth.
- Osteoplasty - recontouring of bony defects in the furcation area, if indicated.
- It results in the establishment of a soft tissue papilla which covers the entrance to the inter-radicular periodontal tissues.



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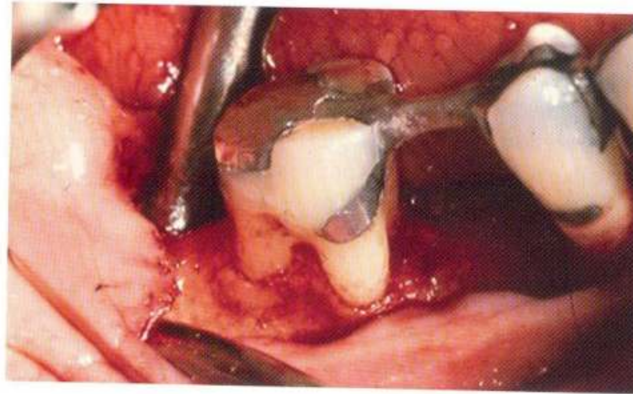

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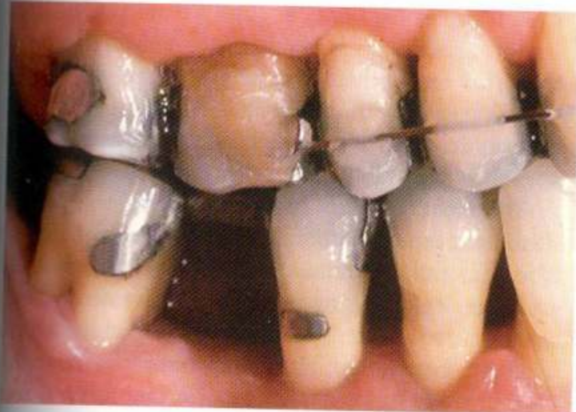

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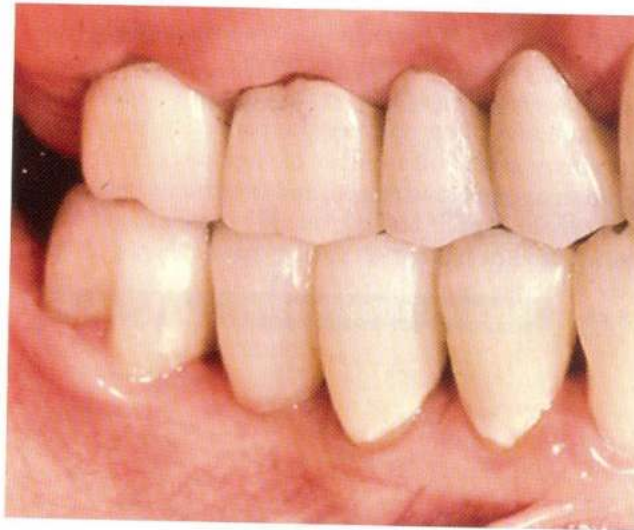

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Figure 24-3. Management of a Class II furcation with odontoplasty and osteoplasty. **A,** Full-thickness flaps are reflected to expose the furcation of the mandibular right second molar and adjacent areas. Note the Class II, type 1 involvement. There are also combination one-, two-wall bony defects on the mesial and distal aspects of the molar. **B,** Odontoplasty has been performed to remove a portion of facial aspect of the furcation dome; osteoplasty has been performed to remove the horizontal component of the Class II furcation. In addition, osteoplasty and some ostectomy has been used to eliminate the adjacent bony deformities. **C,** Facial 3-week postoperative view. **D,** An 8-week postoperative view after placement of provisional restorations. Note that the provisional restoration reconstructs the desired fluting between the mesial and distal roots of the second molar, with a flat emergence profile extending coronally from the crown margin.

TUNNEL PROCEDURE

- It is the intentional creation of a Class III furcation with its entrance accessible for oral hygiene procedure.
- It is a very conservative approach in the treatment of Class II and Class III furcation involvement.
- The objective of this treatment is to obtain the possibility of cleaning the furcal area by the patient using an interdental tooth brush.
- The main *advantage* of this technique is the avoidance of prosthetic reconstruction and for mandibular molars, endodontic therapy.
- It can be utilized only when the furcation entrance dimension is wide enough and coronally located to allow for an easy utilization of cleaning devices. A degree of divergence longer than 30" is required.

- It can be implemented sometimes in maxillary molars (Hellden et al 1989).In this situation, however one of the three roots may have to be resected to improve accessibility to the furcation area.
- During surgery, bone is reshaped to obtain a scalloped morphology and the soft tissues are apically positioned, care must be taken that the space obtained under the roof of the furcation will allow proper plaque removal.
- Surgical packs may be applied to prevent excessive granulation tissue forming in the tunnel space during healing, which may interfere with accessibility to oral hygiene devices.
- Tunneled teeth appear to be at higher risk for the development of caries (Hellden et al 1989).
- Furcations treated with resective osseous surgery for tunnel preparation are expected to result in a slight loss in attachment as a consequence of the therapy.

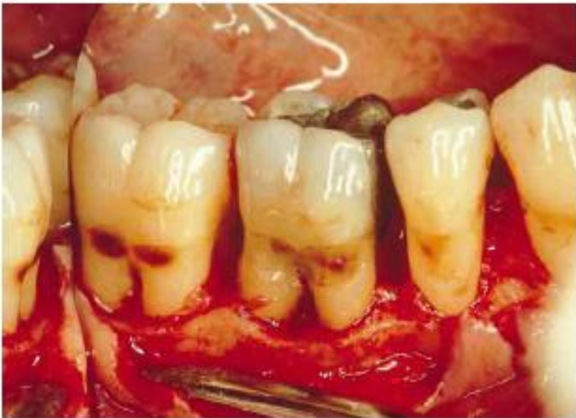


Fig. 4. Class III furca involvement of first lower molar to be treated with tunnel preparation

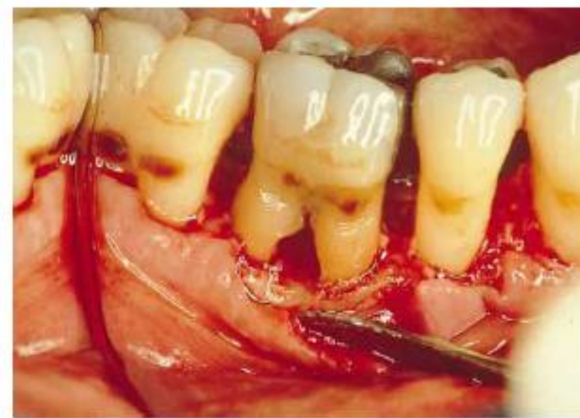


Fig. 5. The bone is recontoured to obtain a scalloped morphology and the furcation area is reshaped.

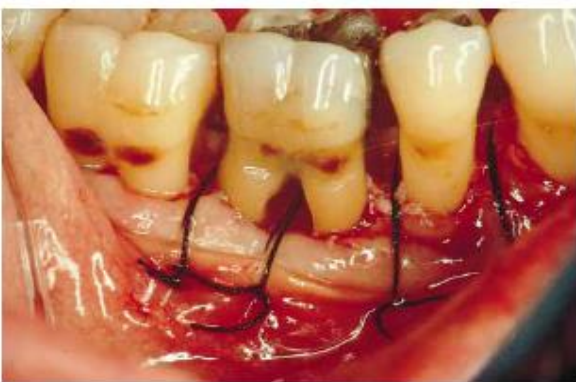


Fig. 6. The flap is apically positioned; the space obtained under the roof of the furcation will leave the entrance of the furcation exposed and thus allows for proper oral hygiene.

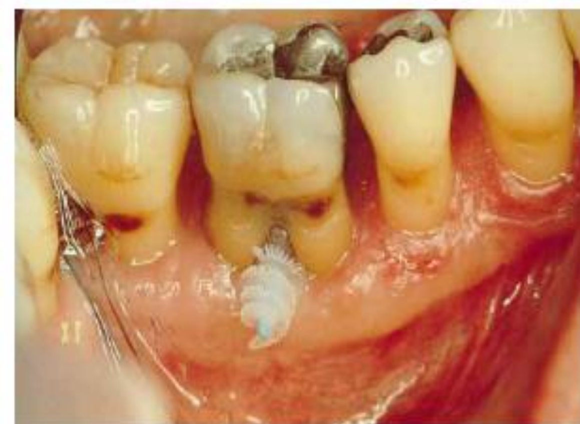


Fig. 7. Healing of the tunnel preparation allows proper oral hygiene.

BICUSPIDIZATION

- Separation of a two-rooted tooth (mandibular molar) & restoration of the crown portion of each section has been described to enhance plaque control & to convert the part of the tooth most susceptible to caries attack (dentin & cementum in the furcation) into metal.

  Indication : Grade III furcation involvement & divergent well supported roots.

  Disadvantages : Time, expense & attention to detail required for successful completion of the case.
- Three disciplines of dentistry are involved. They have been described at endodontic, restorative and surgical.
- Minor tooth movement is effective to separate the two roots orthodontically and open the embrasure space.

RESECTIVE PERIODONTAL SURGERIES

- Resective techniques are designed to eliminate the morphological characteristics and create an area conducive to good oral hygiene.

  The 1986 Glossary of periodontic terms lists the following clinical situations and definitions:
- *Root resection (root amputation, radectomy, radiectomy) :* The process by which one or more roots are removed at the level of the furcation while leaving the crown and remaining roots in function.
- *Hemisection :* The surgical separation of a multi rooted tooth through the furcation area in such a way that a root or roots may be removed with the associated portion of the crown.

- The guidelines for periodontal therapy produced by the AAP in 1992 list only root resection and tooth hemisection as resective treatment of multi-rooted teeth.

- *Root separation (Bicuspidazation)* is indicated as the sectioning of the root complex and the maintenance of all.

Key periodontal anatomical factors include

- the lack of fusion between the roots,
- the length of the root trunk,
- the position of the root separation,
- the divergence between the roots as well as their shape and length,
- the amount of residual attachment,
- the anticipated stability of the individual roots, and
- the access for oral hygiene procedures.

Objective of Root Resection is the obliteration of the furcation as a problem in periodontal maintainence.

- The ideal tooth is the one with well developed long roots that have adequate divergence and a narrow root trunk.
- The furcation area should have a good deal of remaining bone, and the remaining roots should have adequate support and a favourable crown-root ratio.

Disadvantages of root resection:

- Time consuming
- Costly
- often requires interdisciplinary approach
- technique-sensitive procedure

Table 4. Indications for root resection and separation treatment

Periodontal indications

- severe bone loss affecting one or more roots untreatable with regenerative procedures
- class II or III furcation invasions or involvements
- severe recession or dehiscence of a root

Endodontic or conservative indications

- inability to successfully treat and fill a canal
- root fracture or root perforation
- severe root resorption
- root decay

Prosthetic indications

- severe root proximity inadequate for a proper embrasure space
- root trunk fracture or decay with invasion of the biological width

Table 5. Contraindications to root resection and separation treatment

General contraindications to periodontal surgery
- systemic factors
- poor oral hygiene

Factors associated with local anatomy
- fused roots
- unfavorable tissue architecture

Endodontic factors
- retained roots endodontically untreatable
- excessive endodontic instrumentation of retained roots
- excessive deepening of pulp chamber floor

Restorative factors
- internal root decay
- presence of a cemented post in the remaining root

Strategic considerations
- consider adjacent teeth available for conventional prosthetic restoration
- consider removable prosthesis
- consider implants

Which root and Why?

The therapist should remove the root that :

- has the least amount of bony support
- will obliterate the furcationand contribute to the elimination of any associated periodontal defect
- will facilitate plaque removal by the patient and instrumentation by the therapistduring periodontal maintainence
- the most difficult for the endodontist or restorative dentist to treat
- the ability of the remaining root(s) of the tooth after resection, to serve as an abutment if a fixed or removable partial denture is planned

The most common root resection is the removal of distobuccal root of maxillary first molar.

Vital versus Nonvital root resection

Although root resection can be successfully performed on vital teeth, it is preferable to have pulp extirpation precede the resection due to following reasons:

- The completion of endodontics and filling the pulp chamber before root resection facilitates the surgical removal of the root, because it allows more extensive odontoplasty to be performed.
- It also minimizes the potential for postoperative pain
- It is quite distressing to perform a vital root resection and to subsequently discover that the remaining roots cannot be instrumented or to have one of the roots inadvertently split or perforated.

Conversely, it is equally disconcerting to have the endodontic therapy performed and then to discover during surgery that extraction of tooth is indicated, rather than root resection.

Treatment planing criteria (Longer & coauthors, 1981) :

1) Use only teeth with large roots & clinical crowns
2) Avoid small isolated mandibular molars
3) Develop conservative endodontic access
4) Devote special attention to developing a proper occlusal scheme
5) Provide continual maintenance care

Guidelines for Sectioning Molars

- Do *not* section excessively mobile teeth.
- Try *not* to section heavily restored teeth.
- Remove *all* overhanging tooth structure at the time of sectioning
- Do *not* be aggressive with endodontic instrumentation.
- Do *not* use post and core restorations for mesial roots of mandibular molars.
- Do *not* use internalized tooth preparations. There is no need to make room for ceramics in the tooth preparation. It can be done in the casting, and the restoration can have a gold collar.
- Do *not* construct large occlusal tables.
- Recognize the moment when it is too late to section the tooth successfully.

Procedure :

- All tooth sectioning procedures require the use of buccal and lingual(palatal) flaps for access and visibility both for sectioning and osseous surgery.

- If resection of the root requires cutting through metallic restorations, it is generally wise to reduce or section through the metal before incision and reflection of the flap. This prevents metallic fragments from becoming embedded in the soft tissues.

- Insertion of a curved furcation probe, such as Naber's probe or explorer into the furcation can serve to guide the plane of the surgical section. To prevent damage to the adjacent roots, toothpicks or orthodontic wire are sometimes inserted into the open furcations to act as stops or guides.

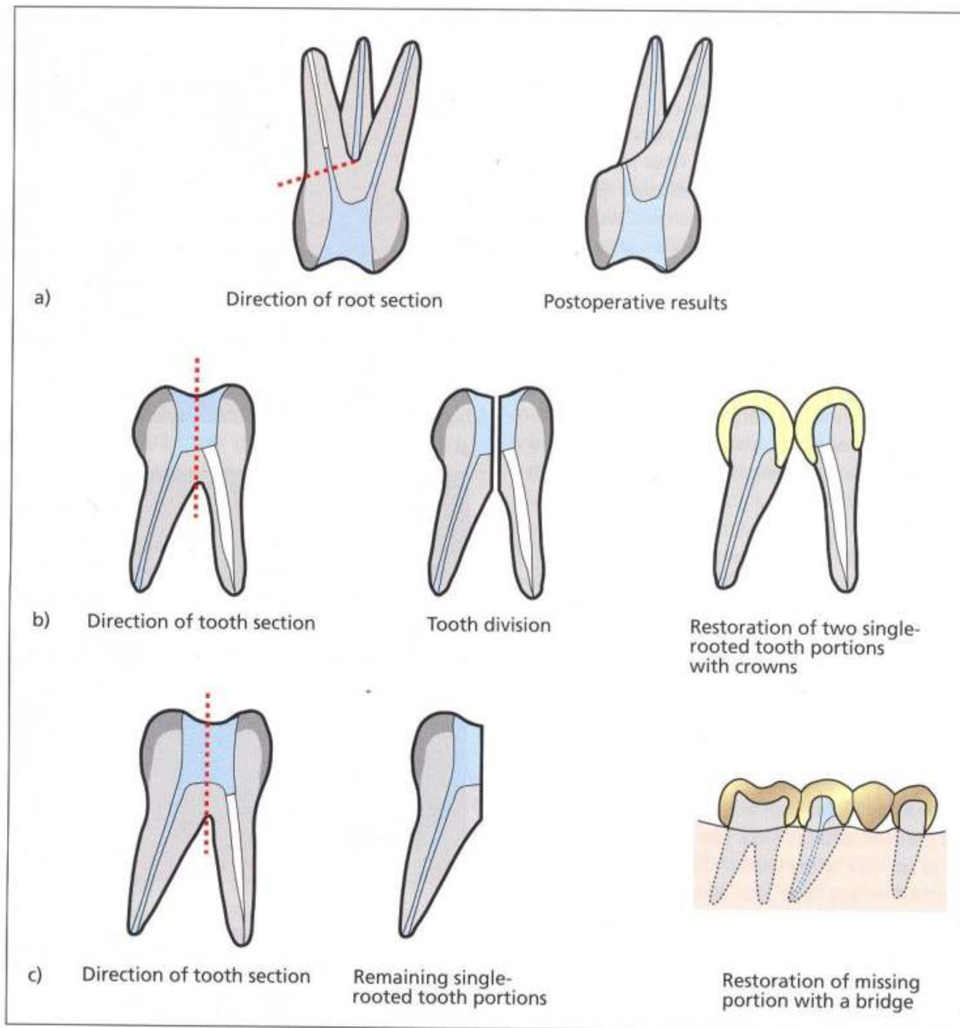


Figure 20.11 Diagrams to show the procedures for treating more advanced class III furcation involvement: **(a)** root amputation; **(b)** tooth division; **(c)** hemisection. In all cases the tooth must be first be endodontically treated

- The removal of the portion of the crown of the tooth immediately coronal to the root (odontoplasty) and the placement of a long beveled section into the dome of furca also facilitates subsequent removal of the root and increase access to and visibility of the internal furcation.
- The root is gently removed.
- Attention must be paid to removing any residual spurs of pulpal floor left attached to the root or undercuts and checking for and removing any residual internal furcations.
- The remaining tooth structure in the furcation is smoothed to prevent any overhangs, and the coronal portion of tooth is blended.
- Subsequent to the removal of the root, ostectomy and osteoplasty are required to eliminate remaining bony deformities and for establishing final physiologic form with adjacent teeth.
- Not every sectioned tooth requires a crown and, if stable, it does not have to be splinted.

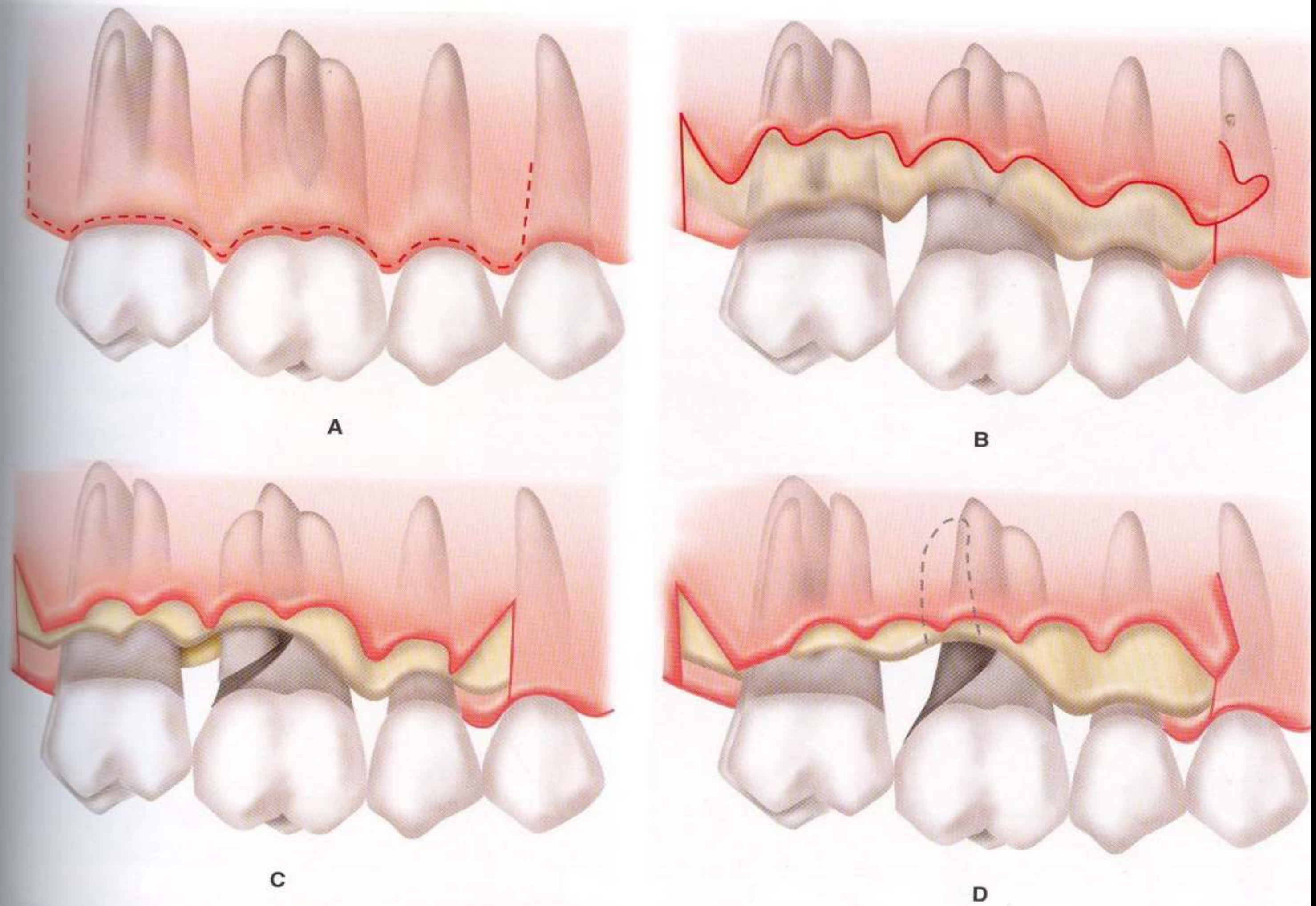
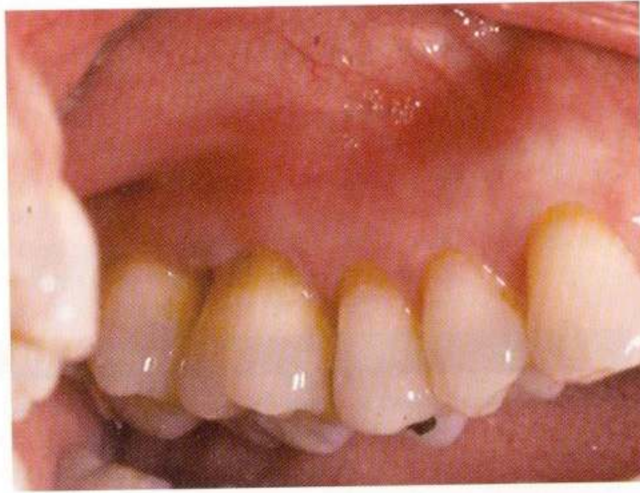


Figure 24-4. Distobuccal root resection. **A,** Outline of initial incisions to expose the surgical area for removal of a distobuccal root from the ma[xil]lary right first molar. **B,** Full-thickness flap reflected and area degranulated to expose the furcation and the adjacent bony structures. **C,** Remova[l of] some facial marginal bone over the distal root and the root sectioned to allow elevation and removal. **D,** Final contour of area before flap closure



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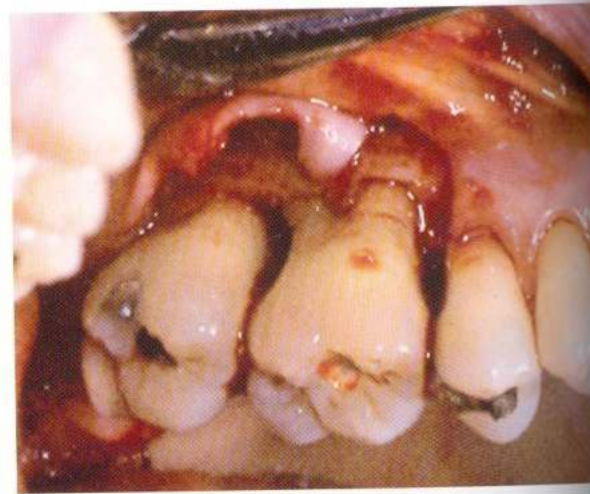

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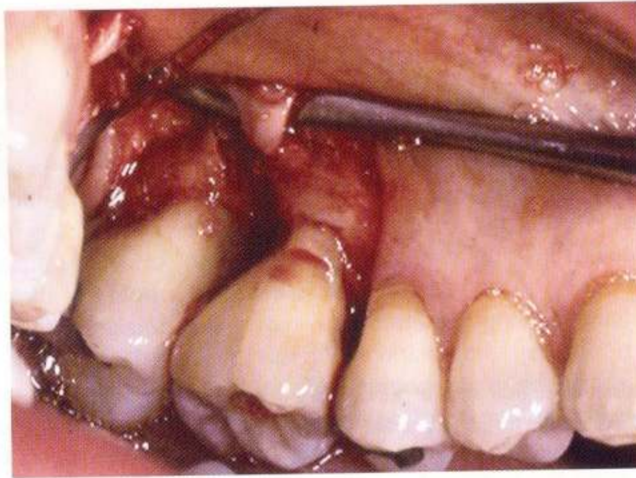

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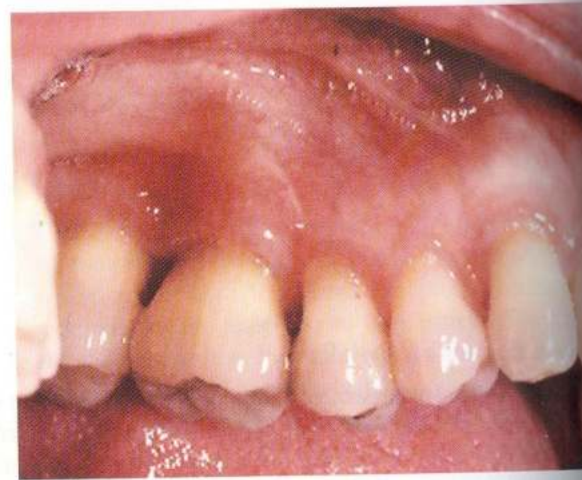

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Figure 24-5. Distobuccal root resection to eliminate a distal Class II furcation and root approximation. **A,** Buccal preoperative view of the maxillary right molar area. **B,** Full-thickness flap reflected. Note the interproximal bone loss and the root approximation as the distal root of the first molar flares toward the mesial of the second molar. The area between the first and second molars has severe bone loss. **C,** Distal root of the first molar resected and removed. Odontoplasty has been performed to reduce the bulge of the crown contour where the resected root resided. **D,** Buccal view 6 months after surgery. Note the dimension for access to the interproximal area for maintenance. (*From Prichard JF: The diagnosis and treatment of periodontal disease in general dental practice, Saunders, Philadelphia, 1979.*)

- Reported failures are categorized as caries, root fracture, endodontics, and periodontal disease, but the etiology of most failures is nonperiodontal.
- The retrospective longitudinal studies ranging from 3 to 12 years and have reported success rates ranging from 100% to 62%. None found a periodontal failure rate of greater than 10%.

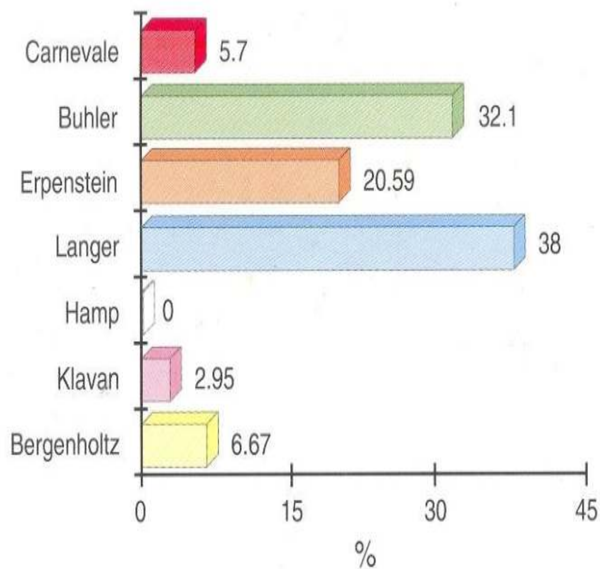


Fig 13-20a Comparison of failure after root amputation procedures.[37] (Figs 13-20a and 13-20b from Carnevale.[37] Reprinted with permission.)

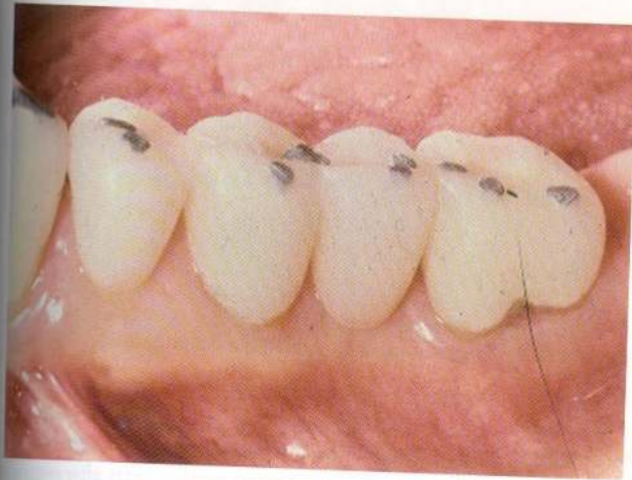
Author		Root/Tooth fracture	Periodontal	Endodontic	Caries cement washout	Total failures	Total cases
Carnevale	1990	12	3	4	9	28	488
Buhler	1988	1	2	5	1	9	28
Erpenstein	1983		1	6		7	34
Langer	1981	18	10	7	3	38	100
Hamp	1975					—	87
Klavan	1975		1			1	34
Bergenholtz	1972		2			3	45

Fig 13-20b Retrospective analysis of failures after root amputation. In these six studies, failures are categorized as caries, root fracture, endodontic complication, and periodontal disease. Collectively, most failures are caused by problems other than periodontal disease. This underscores the need to evaluate the ability to complete a root canal successfully, to ascertain the effect of occlusion on the resected molar, and to evaluate whether a tooth is a candidate for root resection therapy by analysis of the root anatomy and the dentist's ability to restore the sectioned root.

- The 1989 World Workshop in Periodontics stated that root resection therapy is a procedure which should still remain as part of the periodontal armamentarium to treat very specific problems which cannot be solved by any other therapeutic approach and when the tooth in question has a very high strategic value.

Procedure for Hemisection :

- It is often convinent to draw a straight line in pencil on the tooth from both the buccal and lingual furcations to the occlusal surface where they are joined. The line is drawn with the same axial inclination as the tooth. This gives the clinician a perspective on sectioning the tooth, particularly if the molar is tilted.
- The initial cuts are made by starting at the furcation entrance and drawing the bur outward and upward along the pencil lines. The sectioning is continued until the buccal and lingual grooves are joined together.
- The remaining procedure is similar to that for root resection.



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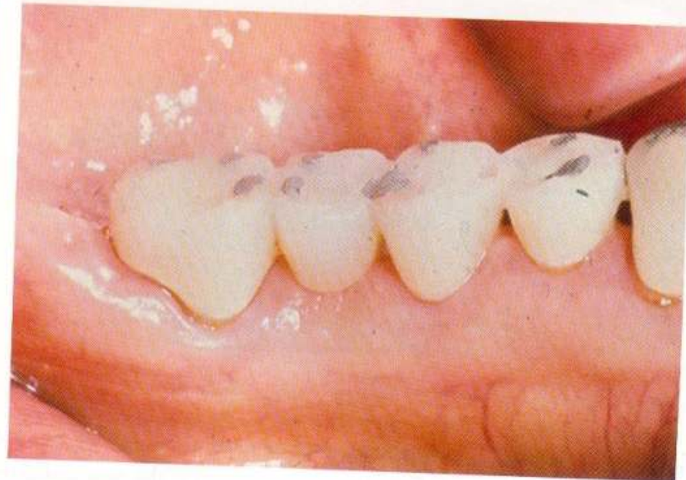

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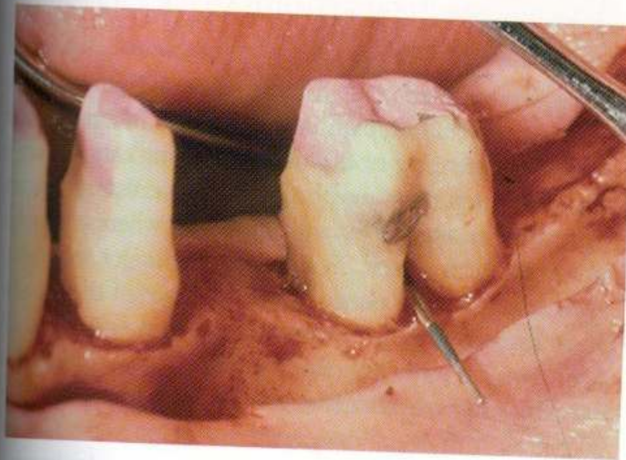

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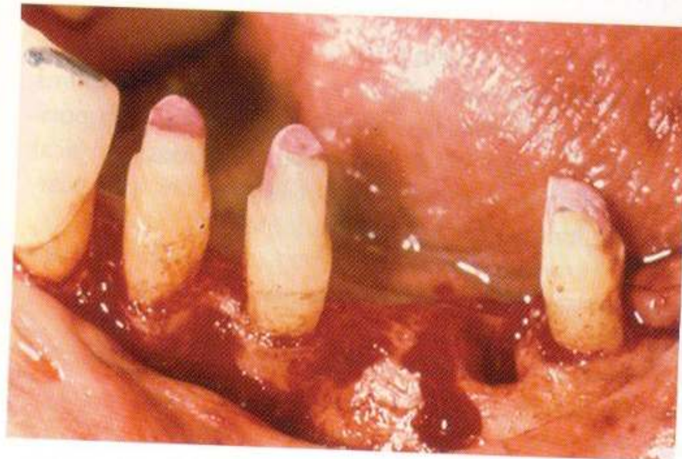
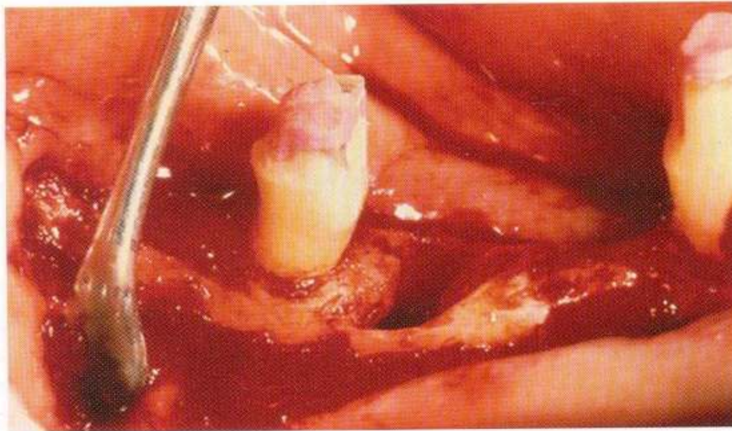


D

Figure 24-9. Hemisection of mandibular left second molar. **A,** Buccal preoperative view with provisional fixed partial denture in place. **B,** Lingual preoperative view. **C,** Buccal view showing periodontal probe inserted through the Class III furcation to guide the hemisectioning of the molar. **D,** Buccal view after removal of the mesial root and osseous recontouring to eliminate the bony defects.

Continued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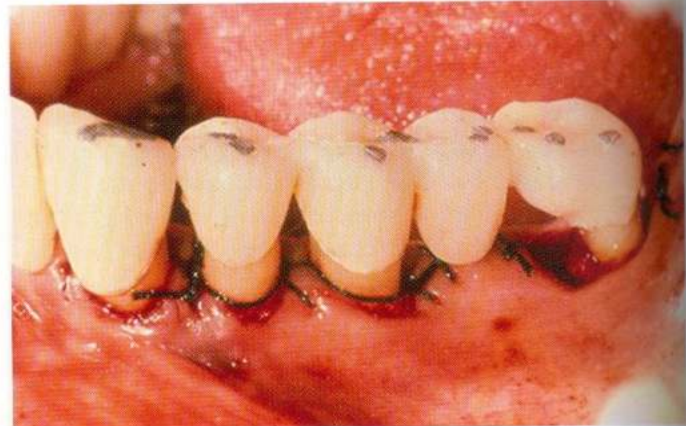
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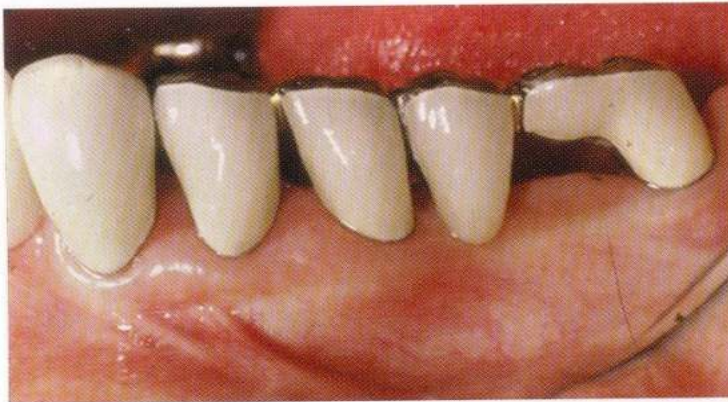
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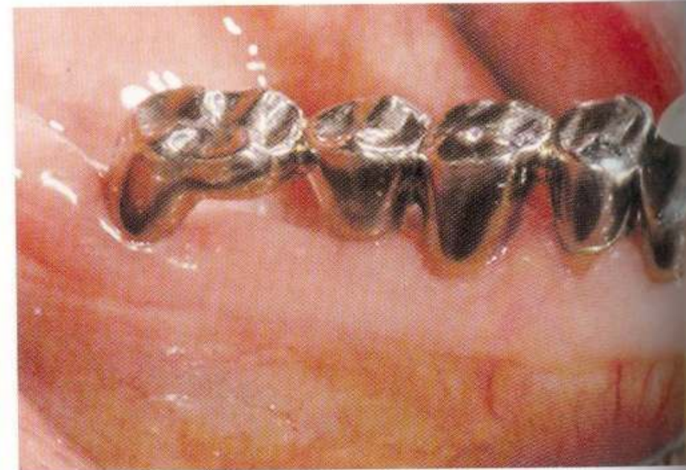
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Figure 24-9. cont'd E, Lingual view after removal of the mesial root and recontouring of the bony defects and ledging. **F,** Buccal view after apical positioning and suturing of flaps and recementation of the provisional restoration. **G,** Buccal view of the hemisected molar 5 years after restoration. Excellent access for oral hygiene has been created in the final restoration. **H,** Lingual view of the hemisected molar 5 years after surgery.

REGENERATIVE PROCEDURES:

- It is always preferable to regenerate the lost periodontium

Regenerative Procedure for the Treatment of Furcation defects includes a variety of surgical approaches :

- Root conditioning combined with coronally advanced flap procedure.
- Placement of bone grafts or bone substitute implants.
- Guided Tissue Regeneration.
- Autogenous PDL grafts

Root conditioning

- Root conditioning is intended to decontaminate, detoxify and demineralize the root surface, removing the smear layer and exposing collagen matrix.
- Agents commonly used are:

  - Citric acid
  - Tetracycline HC1
  - Fibronectin

  Others - EDTA, Detergents, Phosphoric acid, Bile salts.
- Polson and Proye 1983 suggested that a fibrin linkage to the exposed collagen fibrils is a precursor to the connective tissue attachment. This fibrin network may serve to prevent apical migration of epithelium allowing migration of periodontal precursor cells to the root.

- Acid treated defects have been predictably closed with new connective tissue attachment, while nonacid treated controls regularly showed failure by re-epithelization (Crigger et al.1978, Nilveus et al. 1980, Nilveus & Egelberg 1980).

- The research has also demonstrated the need for adequate wound closure during treatment of more extensive defects.

- Either extreme coronal positioning of the surgical flaps covering most of the tooth crown, or a more modest coronal positioning of the flaps combined with use of crown-attached sutures, was necessary for furcation closure (Klinge et al. 1981, 1985).

CORONALLY POSITIONED FLAPS AND CITRIC ACID

Stahl and Froum (1991) have confirmed histologically the ability to achieve new attachment using this technique.

Indications

1. Class II or Class III mandibular furcations
2. Class II maxillary buccal furcations

Advantages

1. Simple
2. Predictable
3. Cost effective

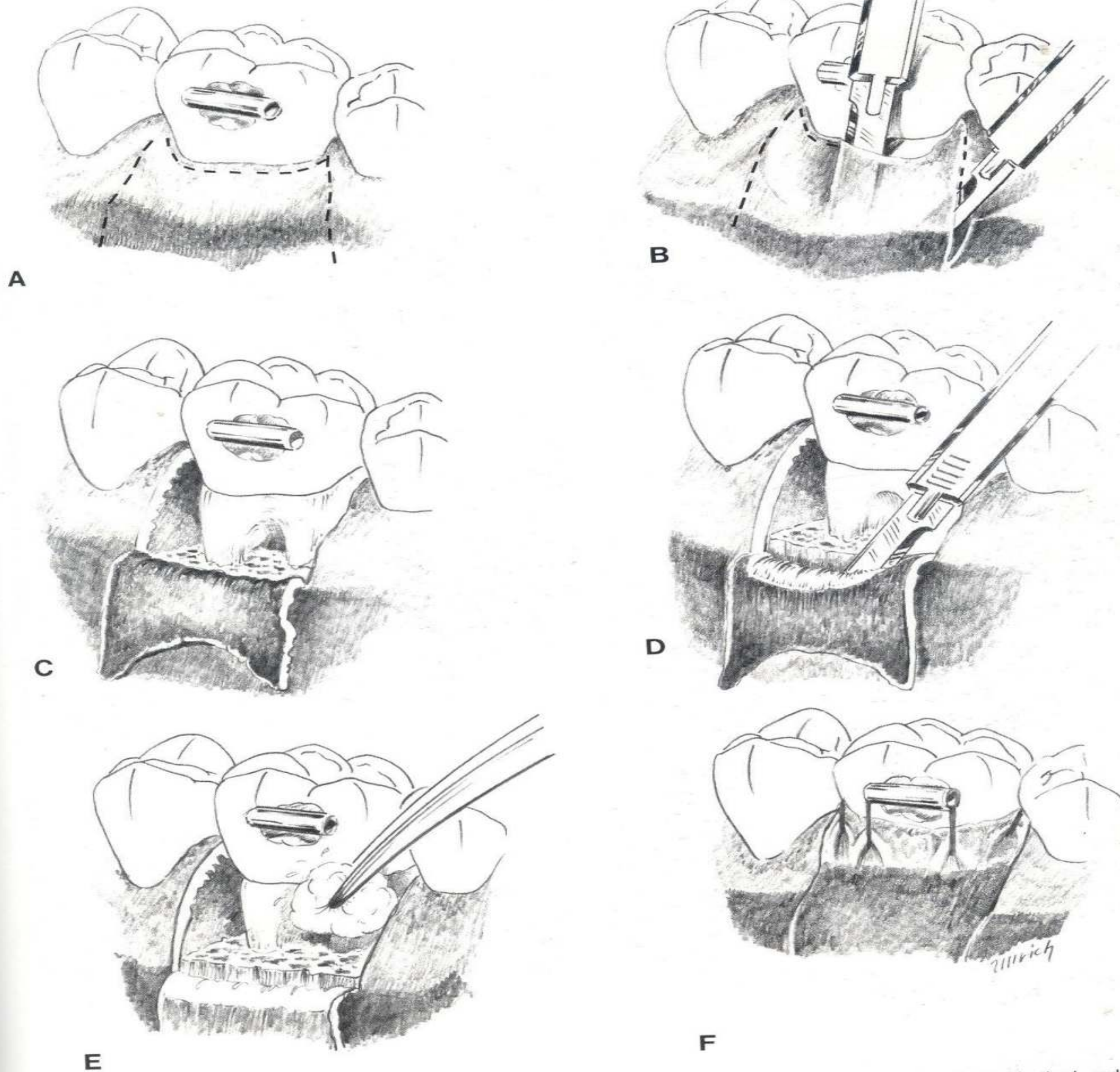
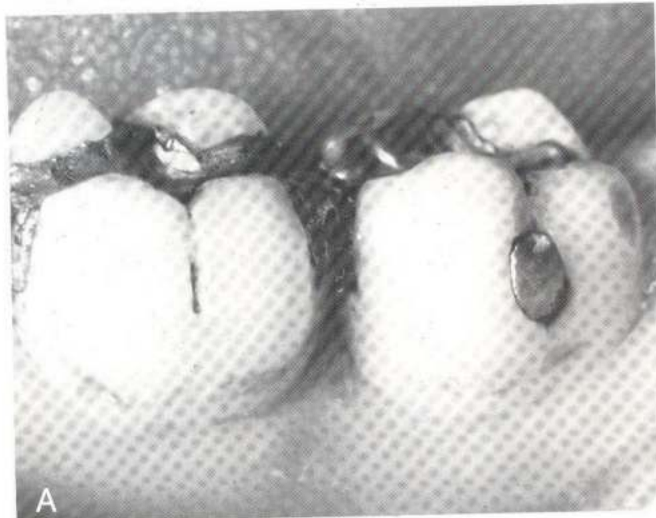
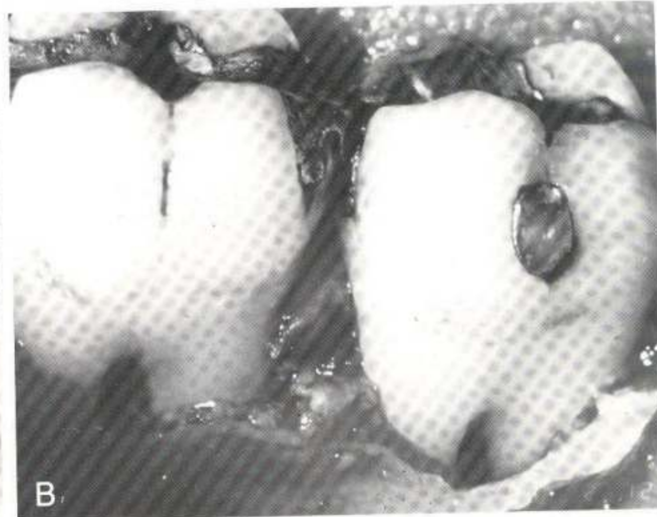
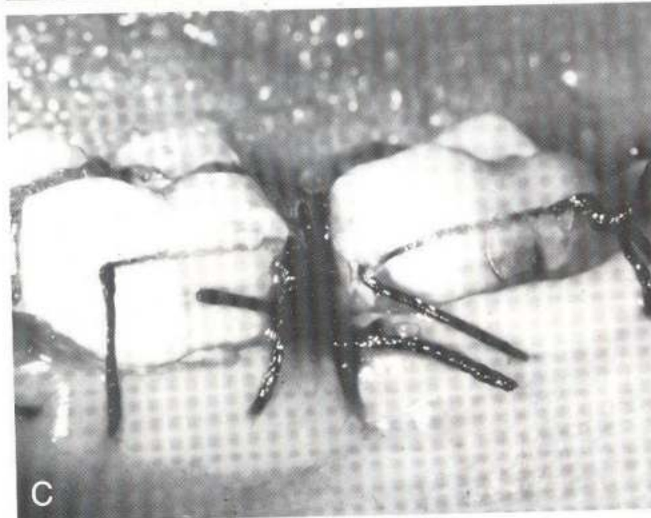


Fig. 12-20. Citric Acid and Coronally Positioned Flaps. **A,** Before treatment with incisions outlined. **B,** Vertical and sulcular incision being made. **C,** Flap reflected with furcation exposed. **D,** Apical periosteal fenestration for flap release for coronal positioning. **E,** Citric acid application (pH 1.0 for 3 min). **F,** Flap coronally positioned and sutured.







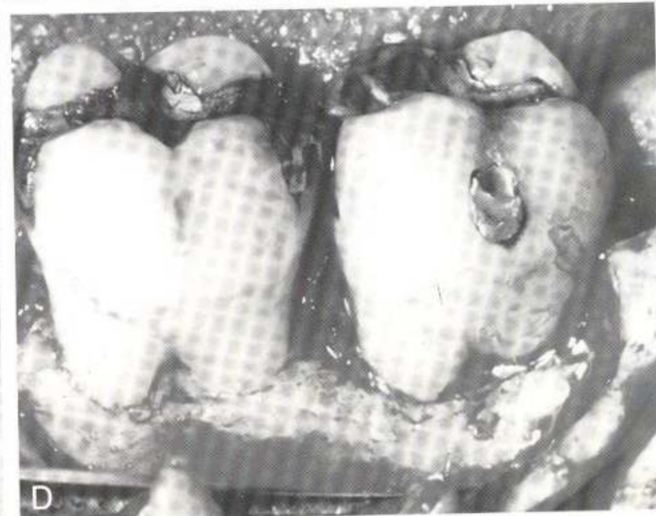


Fig. 12-21. Citric Acid and Coronally Positioned Flaps. **A,** Before surgery. **B,** Grade II furcations exposed. **C,** Flaps sutured coronally. **D,** Re-entry 1 year later. Complete bone regeneration; compare to figure B. (Contributed by Dr. Bernard Gantes.)

BONE GRAFTING

- The various types of bone grafts are autografts, allografts, xenografts and alloplasts.
- The *primary rationale* for the use of bone grafts is to enhance the regenerative capability of the bone and achieve a new attachment apparatus. It is the assumption that the material may either.

  i) Contain bone forming cells (osteogenesis)

  ii) Serve as a scaffold for bone formation (osteoconduction)

  iii) Matrix of the grafting material contains bone inductive substances (osteoinduction).

Indication : Grade II furcation of mandibular molars

Various bone grafts and alloplastic materials are being evaluated in furcation defects

- Schallhorn O.(1967) observed probing depth reduction and bone fill of degree II furcation objects following transplantation of illiac grafts.
- Kenney et al. (1988) used porous hydroxylapatite as a grafting material in treating Class II furcations (a 2.0-mm gain of vertical fill in bone graft sites).
- The effect of bone replacement graft (BRG) with demineralized freeze-dried bone allograft (DFDBA) and citric acid in treating Class II furcations reported by Gantes et al. (1988) showed a similar vertical bone fill of 2.4 mm.
- Tsao et al (2006) evaluated the effects of mineralized human cancellous bone allograft (MBA), with and without a bioabsorbable collagen membrane, for the treatment of mandibular class II furcation defects. Results indicate that MBA, with or without collagen membrane, can significantly improve bone fill in mandibular Class II furcation defects.

The furcation area is characterized by defects, the walls of which are made primarily of the tooth structure. Therefore, although the area is capable of holding a graft, it has little or no vascularity to support one. *For this reason, the success of grafts is limited in furcations.* Grafts may be indicated where the destruction of the furcation is only partial or where deep vertical lesions have still left some bone on the inner aspects of the roots.

GUIDED TISSUE REGENERATION:

- (AAP) Glossary of Periodontal Terms (1992) defined *Guided Tissue Regeneration* (GTR) as procedures wherein regeneration of lost periodontal structures (i:e cementum, PDL and alv. bone) is sought via selective cell and tissue repopulation of the periodontal wound.
- World Workshop in Periodontics (1996) defined *Guided Tissue Regeneration* (GTR) as "procedures attempting to regenerate lost periodontal structures through differential tissue responses. Barriers are employed in the hope of excluding epithelium and gingival corium from the root surface in the belief that they interefer with regeneration." These barriers can be absorbable / non-absorbable.
- Karring et al. 1993 in a series of experiments showed that only cells residing in the periodontal ligament are capable of forming a layer of new cementum on the diseased root surface.

Indication : Grade II furcation of mandibular molars

Less predictable : Grade III furcation of mandibular and maxillary molars

- The hemostatic function of GTR will enhance early wound stabilization and clot formation.
- This indirectly promotes better flap adaptation, thus resulting in less membrane exposure.
- Furthermore, the chemotactic function of the collagen membrane promotes fibroblast migration that ensures primary wound coverage can be facilitated.
- New connective tissue attachment may form without a concomitant buildup of the alveolar bone.

- From the systematic review by Jepsen et al. (2002), the mean difference of horizontal defect fill between the GTR and OFD groups was 0.87 mm when combined with mandibular and maxillary molars; however, it was 1.51 mm when only mandibular molars were included.
- In this systematic review, only one case out of eight reentry studies showed complete furcation fill among cited randomized controlled trials of GTR in furcations.

- Eickholz et al (2006) evaluate the long-term results after GTR therapy of Class II furcation defects using non-resorbable and bioabsorbable barriers clinically. The study failed to show a statistically significant difference in stability of CAL-H gain between non-resorbable and bioabsorbable barriers group after GTR therapy.

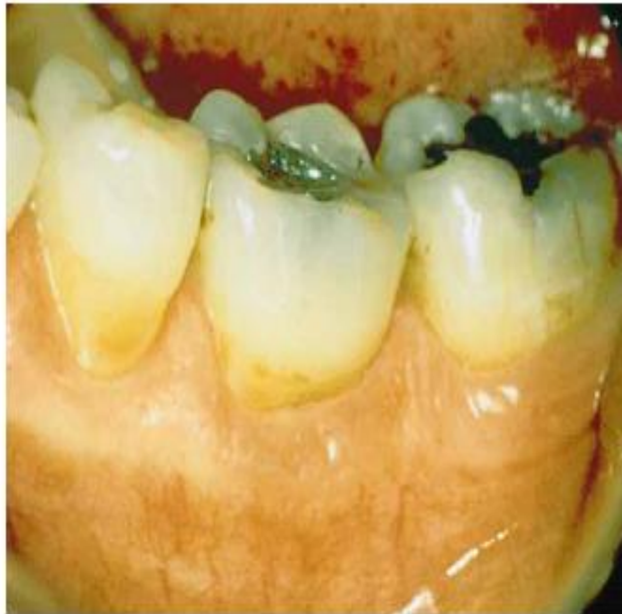
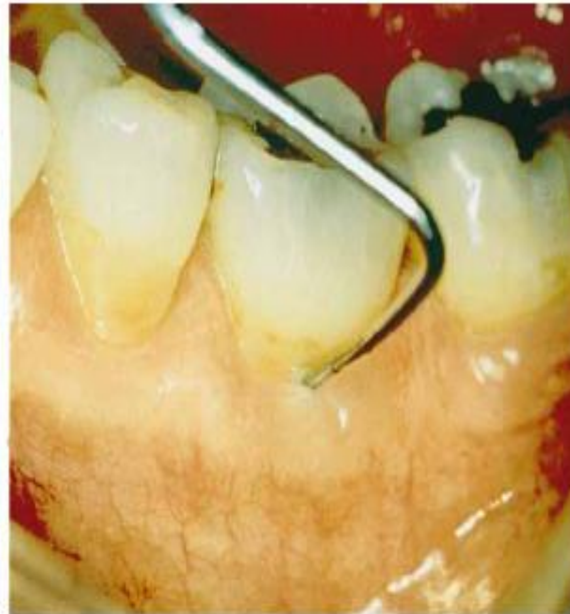



Fig. 1. A class II furcation on the buccal aspect of the first left mandibular molar

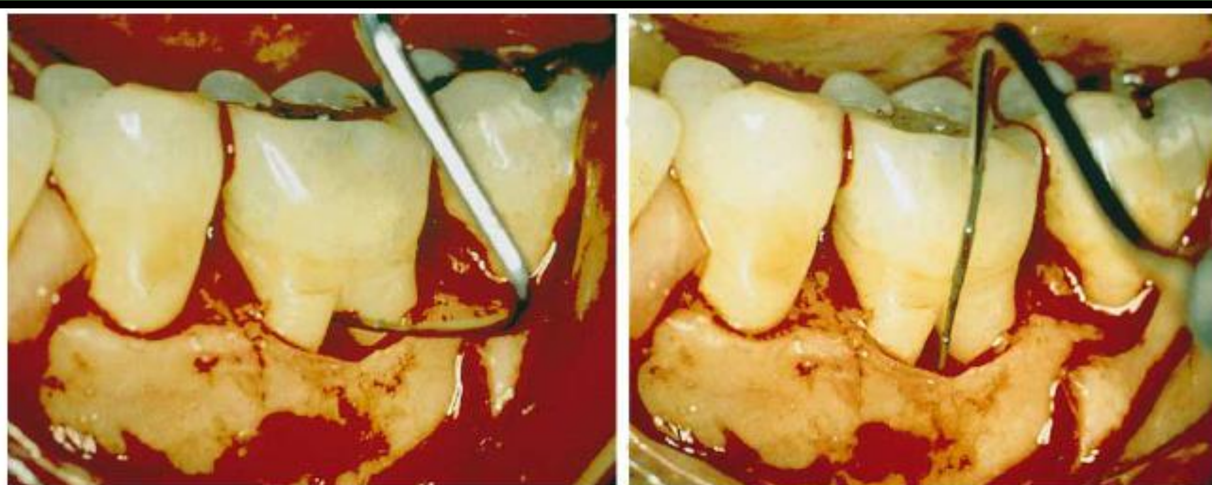


Fig. 2. Horizontal (left) and vertical (right) probing after flap elevation and debridement

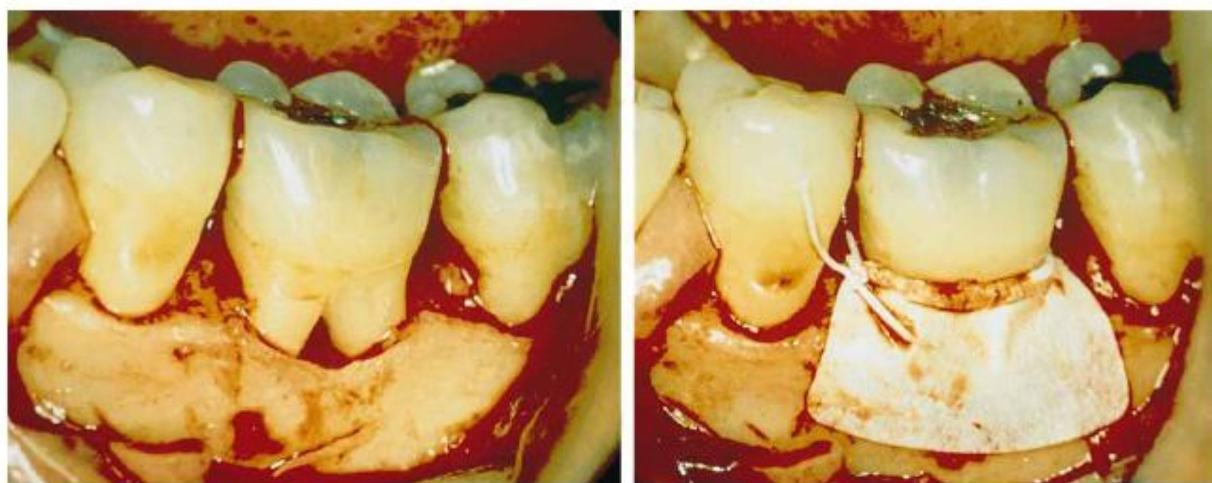


Fig. 3. A nonresorbable expanded polytetrafluoroethylene membrane positioned to cover the furcation entrance

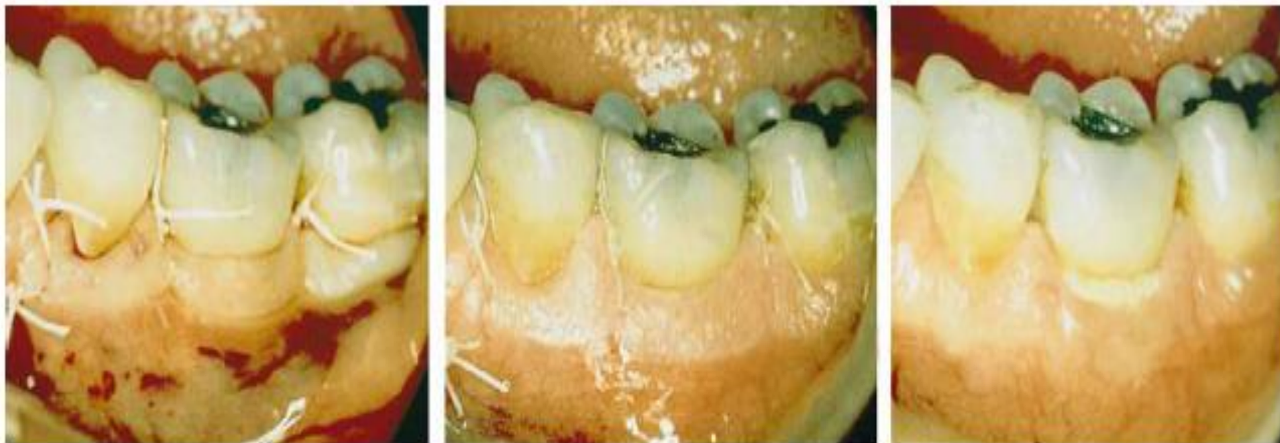


Fig. 4. From left to right: membrane coverage with the flap; the area after 1 week; membrane still covered at time of removal

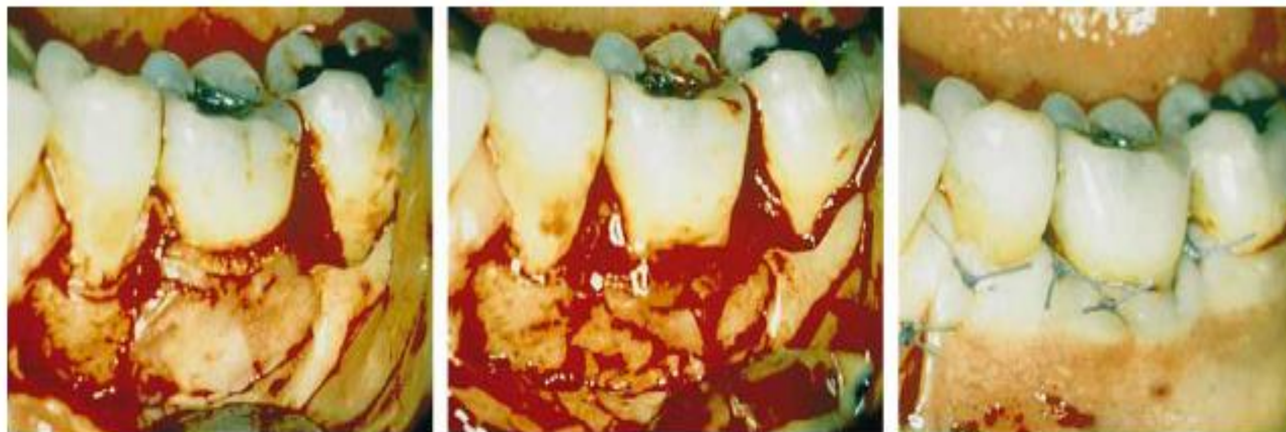


Fig. 5. From left to right: membrane uncovered after flap elevation; the regenerated tissue after membrane removal; replacement of the flap to protect the regenerated tissue

- More recently, techniques aimed at using *bone grafts and barrier materials* have been evaluated in regenerating furcation defects. Encouraging results have been shown in some studies.

  Additional placement of collagen membrane over bone graft could promote PDL fibroblast and osteoblast cell adhesion and enhance periodontal regeneration via collagen membrane hemostatic and chemotactic function.

- Machtei and Schallhorn (1995) in a metaanalysis stated that in the regeneration of mandibular class II defects, GTR, used alone or in combination with bone replacement grafts, had the highest overall ranking. A combination of GTR and bone replacement grafts yielded better results than did GTR alone.

- Recent systematic reviews by Jepsen et al 2002 and Reynolds et al 2003 stated that it is not possible to compare the outcomes from different barrier and grafting materials for the treatment of furcations due to the limited controlled clinical trials available.
- Lekovic et al (2003) reported that the platelet-rich plasma (PRP), bovine porous bone mineral (BPBM) and guided tissue regeneration (GTR) combined technique is an effective modality of regenerative treatment for mandibular grade II furcation defects.
- It was demonstrated that the combination of platelet-derived growth factor (PDGF) and GTR results in faster and more complete regeneration of the periodontal ligament and the alveolar bone in degree III furcation defects in dogs than GTR alone (Park et al. 1995), indicating that a combined treatment of these defects might lead to a more predictable healing.

- Recently, the use of ***enamel matrix derivatives (EMD)*** was introduced as a new treatment alternative for periodontal regeneration (Hammarstrom, 1997). It was suggested that the application of such proteins on a previously diseased root surface promotes periodontal regeneration because they mimic events that take place during the development of the periodontal tissues.
- Donos et al (2003) evaluate the healing of mandibular degree III furcation involvements histologically following treatment with EMD, GTR or a combination of EMD and GTR. The results provided histological evidence suggesting that both GTR and EMD may result in true periodontal regeneration.
- Chitsazi et al (2007) evaluated the efficacy of OFD with and without EMD in the management of class II furcation involvement. They concluded that the adjunctive use of EMD enhances the efficiency of OFD in the management of mandibular class II furcation defects.

PERIODONTAL REGENERATIVE POTENTIAL OF AUTOGENOUS PERIODONTAL LIGAMENT GRAFTS IN CLASS II FURCATION DEFECTS

Akbay et al (2005) evaluated the regenerative potential of autogenous periodontal ligament (PDL) grafts in the treatment of Class II furcation defects. In experimental defects, flaps were coronally positioned following placing autogenous PDL grafts that were obtained from third molars; in controls, coronally advanced flap procedure without graft was applied.

Vertical and horizontal defect fill was evaluated with open clinical measurements at initial surgery and reentry after 6 months. Gingival biopsies from the experimental and control defects were obtained at reentry and evaluated histopathologically in order to examine the soft tissue response towards PDL grafts.

Sites treated with PDL grafts demonstrated significant improvement in vertical and horizontal defect fill, PD, and CAL at 3 and 6 months compared to presurgical values.

No foreign body reaction was observed in PDL grafts.

TOOTH EXTRACTION

The extraction of a periodontally involved multirooted tooth will of course predictably eliminate the disease in this particular area.

Saxe and Carmen (1969) had stated that the indications for removal of a tooth with a Grade III furcal defects are:

1) The existence of an unopposed molar which is the terminal tooth in the arch.

2) A first molar with adjacent second premolar and second molar each with adequate bone support.

3) A solitary distal abutment tooth which exhibits mobility

Prichard (1979) stated that "comfortable, functional teeth should not be extracted just because there is evidence of bone resorption, pocket depth, furca invasion or mobility".

Indications are :

1. The extraction of tooth must always be considered for molars with advanced attachment loss in the furcation or the presence of unfavourable tooth anatomy.
2. Extraction may also be performed when the maintenance of the affected tooth will not improve the overall treatment
3. When the treatment will not result in a tooth / gingival anatomy which allows proper self-performed plaque control measures.
4. When, due to endodontic or caries-related lesions, the preservation of tooth will represent a risk factor for the long term prognosis of the overall treatment.
5. Although molars with advanced class II or class III FI can be maintained for significant periods by frequent instrumentations, they should be removed before allowing the development of bony deformities that would require major surgical repair or would preclude routine prosthesis.
6. When the patient is financially compromised to undergo regenerative or resective therapy (which involves the disciplines of endodontics and restorative dentistry).

PROGNOSIS OF TREATMENT OF MOLAR FURCATIONS

- The significant difference between mandibular and maxillary FI is that the mandibular furcations open in the buccal or lingual directions. Therefore, no matter how advanced the loss of bone, it does not damage the interdental bone for the adjacent teeth. The maxillary molars have mesial and distal furcations, and inflammatory lesions can result in the loss of interdental bone on adjacent teeth.

- The long-term prognosis of teeth with FI treated with conventional therapy demonstrates a higher frequency of tooth loss than non-furcated teeth.

- McGuire and Nunn (1996) reported that the risk of periodontitis progression in the Furcation lesions increases with the severity of the Furcation involvement and thus Class I Furcation lesions have better prognosis than Class II and class III lesions
- Wang et al (1994) noted that mobile furcated molars are at greater risk for loss of attachment in the furcation area.
- The factor which determines the success or failure in the long perspective following surgery is the degree of plaque control that can be obtained and maintained.
- Successful treatment requires that all the tooth surfaces are properly cleaned during the active phase of treatment and that patients are thereafter enrolled in a professionally supervised maintenance program including measures which prevent recurrence of the disease.

CONCLUSION

- The complete removal of plaque, calculus and bacterial products from the subgingival environment plays an important role in the success of periodontal therapy. Because it hampers complete subgingival cleaning, the presence of radicular furcation in multi-rooted teeth may be particularly responsible for the poor prognosis of these teeth.

- The keys to successful treatment of molar FI are the same as for any other periodontal problem – that is, early diagnosis, thorough treatment planning, good oral hygiene by the patient, careful technical execution of the therapeutic modality, and well-designed and implemented program of periodontal maintainence.

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THANK YOU