

TO THERE AND BACK AGAIN: A FURCATION'S TALE

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Topics of Conversation

- ▣ Etiology/Contributory Factors
- ▣ Diagnosis and Classification
- ▣ Prognosis
- ▣ Treatment Considerations
 - Nonsurgical periodontal therapy
 - Flap/Osseous with debridement
 - Tunneling
 - Odontoplasty
 - Root Resection/Hemisection
 - GTR

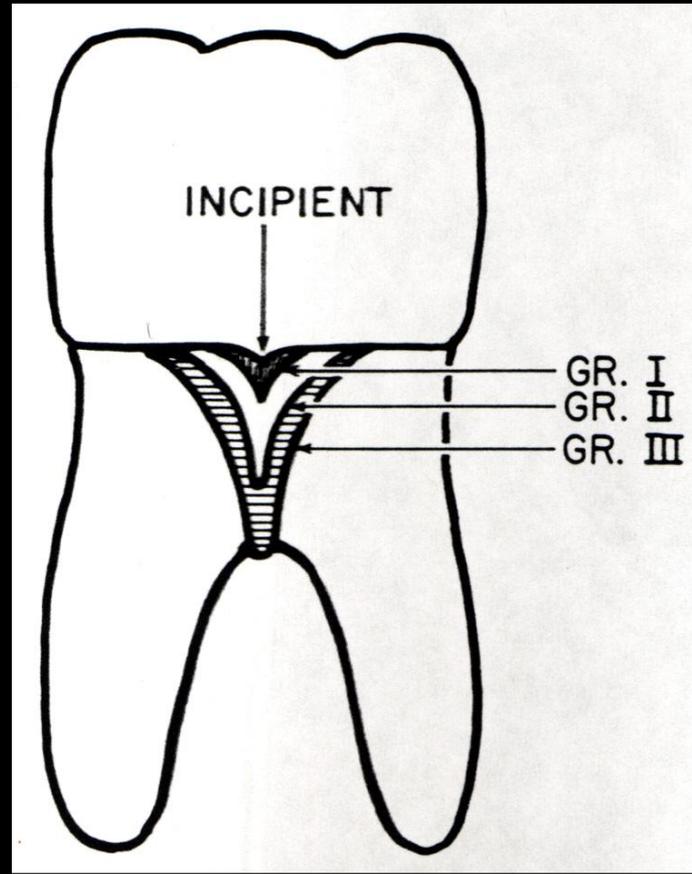
Etiology/Contributory Factors

- ▣ Bacterial plaque
- ▣ Defective margins of restorations
- ▣ Cervical enamel projections
- ▣ Root trunk length
- ▣ Root anatomy
- ▣ Dental caries
- ▣ Iatrogenic dentistry
- ▣ Age
- ▣ Occlusion

Cervical Enamel Projections

- ▣ Masters/Hoskins (1964)
- ▣ Developed classification scheme for projections.
- ▣ Grade I: Projection extends from CEJ of tooth towards furcation entrance
- ▣ Grade II: Projection approaches entrance of furcation, but does not enter
- ▣ Grade III: Projection extends horizontally into the furcation

Classification



Cervical Enamel Projection Examples

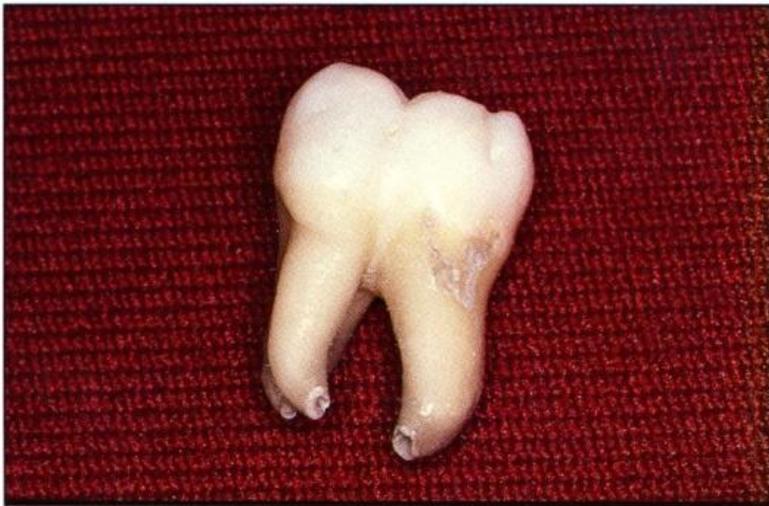


Fig 14-11 A cervical enamel projection is present in the furcation of this molar.

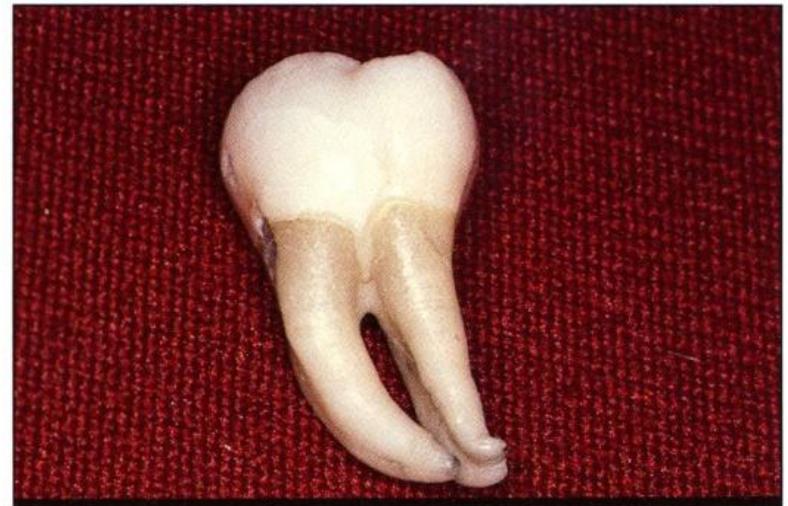


Fig 14-12 A cervical enamel projection and a bifurcation ridge are present in this mandibular molar.

More Examples



Masters/Hoskins

- ▣ Examined 474 maxillary/mandibular molar teeth
- ▣ 87/304 (28.6%) mandibular molars exhibited CEPs (more frequently on facial)
- ▣ 4.3% of mandibular molars had Grade III CEPs
- ▣ 28/170 (17%) maxillary molars exhibited CEPs (seen facially/distally)
- ▣ 4.8% of maxillary molars had Grade III CEPs

Masters/Hoskins

- ▣ Do cervical enamel projections correlate to furcation involvement?
 - Study showed a 90% incidence of isolated furcation involvement with presence of cervical enamel projections

The Intermediate Bifurcational Ridge

- ▣ Definition: Ridge that originates from mesial surface of distal root roughly 2mm from height of bifurcation, traverses the bifurcation, and ends high up on the mesial root where it blends into the concavity.

Everett (1957)

- ▣ Examined 328 lower first molars for presence of bifurcational ridge
- ▣ Demonstrated that 73% of molars examined possessed the bifurcational ridge
- ▣ What does this mean for therapy?
 - Provides another nidus of attachment for plaque and another area to deal with when instrumenting a deep furcation involvement

Width of Furcation Entrance as Contributory Factor

- ▣ Bower (1979)
 - Related average width of furcation entrance to average width of periodontal curette
 - Average curette width is 0.75 to 1.1mm
 - 81% of furcations (max/mand) have an entrance diameter less than 1.0mm
 - Furthermore, 58% of molars have an entrance less than 0.75mm
 - All the more reason for the mini-curettes

Accessory Canals as Contributory Factors

- Gutmann (1975)
 - Evaluated 102 molar teeth (51max/51 mand)
 - Dissecting microscope
 - Observed overall 28.4% of molars contained accessory canals in the furcation
 - 29% in maxillary molars and 28% of mandibular molars

Root Trunk Length

- Dunlap (1985)
 - Evaluated mandibular molars for relative amount of attachment area on molars
 - Root trunk contributes 31% of total attachment area
 - 37% for mesial root and 32% for distal roots

Root Trunk Length

- ▣ Hermann (1983)
 - Evaluated relative attachment areas of maxillary molars
 - Demonstrated overall attachment for maxillary 1st molar root trunks to be 32%
 - Mesial root = 25%, Distal root = 19%, Palatal root = 24%

Age as a Contributory Factor

- ▣ Tal (1981)
 - Looked at 100 dry human mandibles
 - Made measurements of furcations
 - Generalized conclusions
 - 1st molars affected more than 2nd molars
 - Buccal affected more than lingual
 - Normal/mild involvements more frequent in 3rd/4th decades
 - Moderate/Severe involvements more frequent in 5th thru 7th decades

Classification Schemes (Glickman 1958)

- Grade I: Early furcation involvement barely into the fluting of the furcation. No significant destruction of bone or connective tissue in furcation



Glickman Grade II

- ▣ Distinct horizontal destruction of the furcation area. Often referred to as a “cul-de-sac” lesion. Destruction does not extend entirely through furcation. Extent of horizontal probing determines whether furcation lesion is shallow or deep. Vertical bone loss may be present.



Glickman Grade III

- ▣ Destruction of bone and connective tissue all the way through the furcation. Instrument can be passed from its opening to its exit. Defect is not visible clinically.



Glickman Grade IV

- Destruction of bone and connective tissue entirely through furcation. Gingival recession extends to a point that allows visual examination of furcation invasion. Often referred to as a “tunnel”.

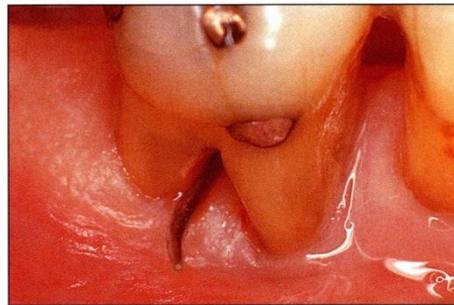


Fig 13-17a An instrument has been placed into the lingual furcation and emerges through the buccal furca. The patient tries to be compliant but caries is present on the inferior surface of the trunk.

Hamp's (1975) Horizontal Classifications

- Degree I: Horizontal loss of periodontal tissue support less than 3mm
- Degree II: Horizontal loss of support exceeding 3 mm, but not encompassing the total width of the furcation area
- Degree III: Horizontal “through and through” destruction of the periodontal tissue in the furcation

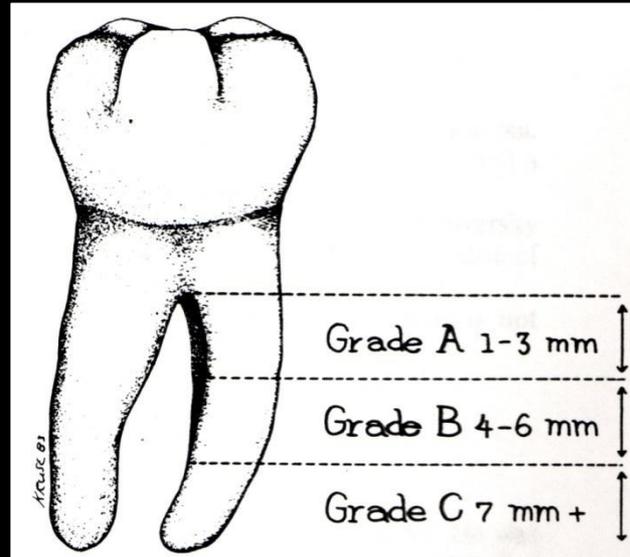
Tarnow's (1983) Vertical Classifications

- ▣ Measures amount of vertical bone loss from roof of furcation.
- ▣ Subclassification of Glickman's Definitions
- ▣ Grade A: 1-3mm
- ▣ Grade B: 4-6mm
- ▣ Grade C: 7mm +

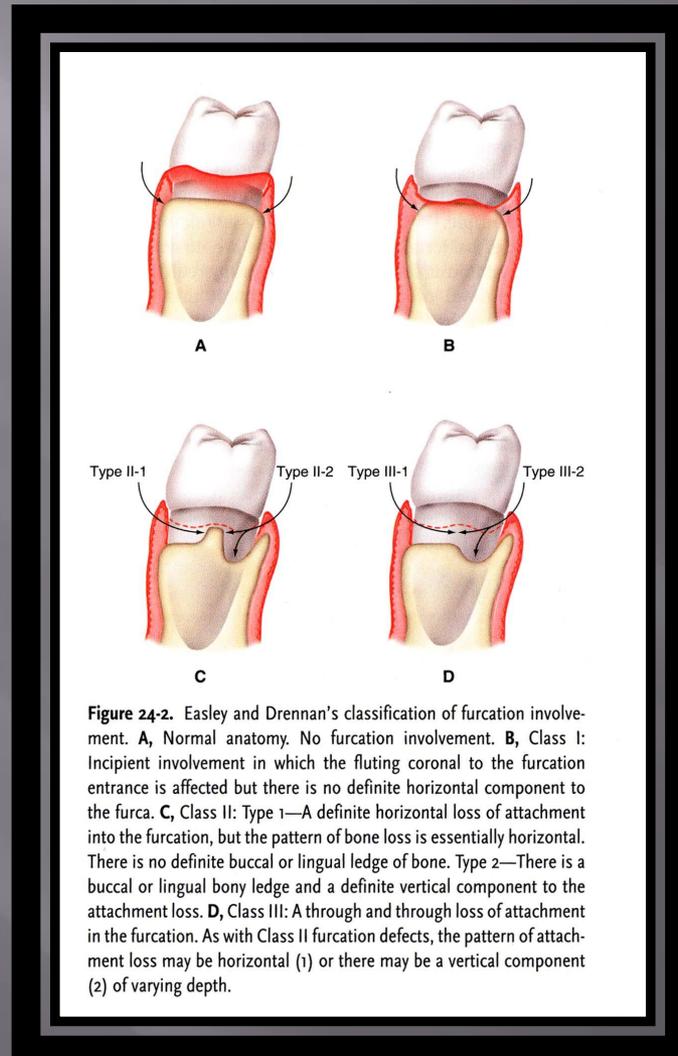
Useless cocktail party conversation starter: Did you know that the average buccal and lingual measurements from the cej to the entrance of the furcation in mandibular 1st molars is 3 and 4 mm, respectively?
(Wheeler's Dental Anatomy)

Tarnow's Subclasses

Not so useless cocktail party factoid: The average distance from the cej to the mesial, buccal, and distal furcation entrances in maxillary 1st molars is 3,4, and 5mm, respectively.



Easley/Drennan's (1969) Classifications



Prognosis

- ▣ McGuire/Nunn (1996)
- ▣ As it pertains to furcation involvements
 - Fair: Class I furcation with the location and depth allowing proper maintenance with good home care
 - Poor: Class II furcation with location and depth allowing proper maintenance, but with difficulty
 - Questionable: Class II furcation not easily accessible to maintenance care or a class III furcation
 - Circling the drain: Modified Killeen-Whitney prognosis replacing the old term “hopeless”

What do I tell my patient if they ask... "what if I do nothing?"

- ▣ Becker (1979)
 - Evaluated 44 patients that refused periodontal therapy after 5 years post initial exam
 - 184/268 molars presented without furcation involvements (31% developed furcation lesions over 5 years)
 - 84 molars presented initially with furcation involvements (22% had worsened at 5 years)
 - Bjorn (1982) showed 3 fold increase in furcation site breakdown frequency over 13 years of monitoring

What if the patient asks, “How long can I expect to keep this upper tooth if we treat it”?

- ▣ Ross/Thompson (1978)
 - Maxillary molar furcation involvement study
 - 384 molars in 100 patients
 - Performed nonsurgical and surgical therapy (pocket reduction, no osseous resection)
 - Observation period of 5 to 24 years
 - Radiographic review showed roughly 75% of teeth exhibiting no significant change.
 - 11% showed continued bone loss
 - 12% extracted (1/3rd were in function 11-18 years)

Treatment Considerations

- ▣ Nonsurgical Periodontal Therapy/ Surgical Periodontal Therapy
- ▣ Kalkwarf/Kaldahl (1988)
 - Evaluated coronal scaling, root planing, modified Widman, and flap/osseous in terms of horizontal probe depth reduction and probing attachment level
 - 2 year follow up revealed mean net loss of horizontal probing attachment level regardless of treatment employed
 - Flap/Osseous at 2 years showed least amount of furcation site breakdown

7 year follow up

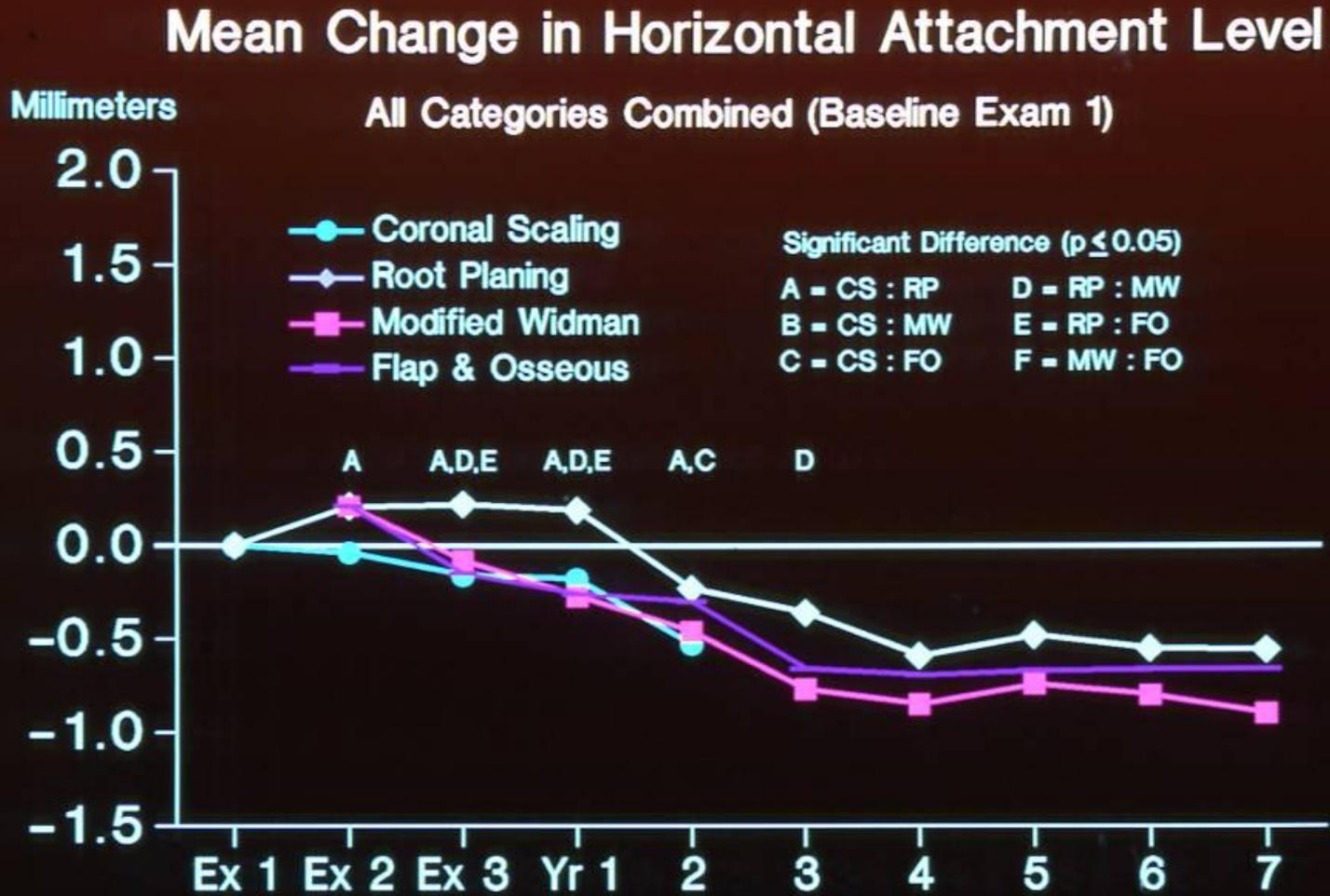
Mean Change in Horizontal Attachment Level

Baseline Exam 3 (All Categories Combined)

Millimeters



7 year follow up



Tunneling Furcations

- ▣ Hamp/Lindhe (1975)
 - Treatment for deep class II or class III furcations
 - Involves removal of supporting bone in furcation roof, apical positioning of flaps, and creation of a passageway for an interdental brush through the furcation
 - Limited data
 - Study reported on 7 treated molars. 4 of which developed caries, and 3 were resultantly extracted

Caries in the Furcation



Fig 13-17b Extraction of the molar in Fig 13-17a reveals caries in the furcation. Few patients maintain an open furcation satisfactorily.

Odontoplasty

- ▣ Definition: Provides a means of reducing the intermediate bifurcation ridge and the extent of the dome over the furcation, ultimately reducing the volume of the furcation defect (Lindhe 1989).
- ▣ Allows for better plaque control, and ease of maintenance procedures

Example of Odontoplasty

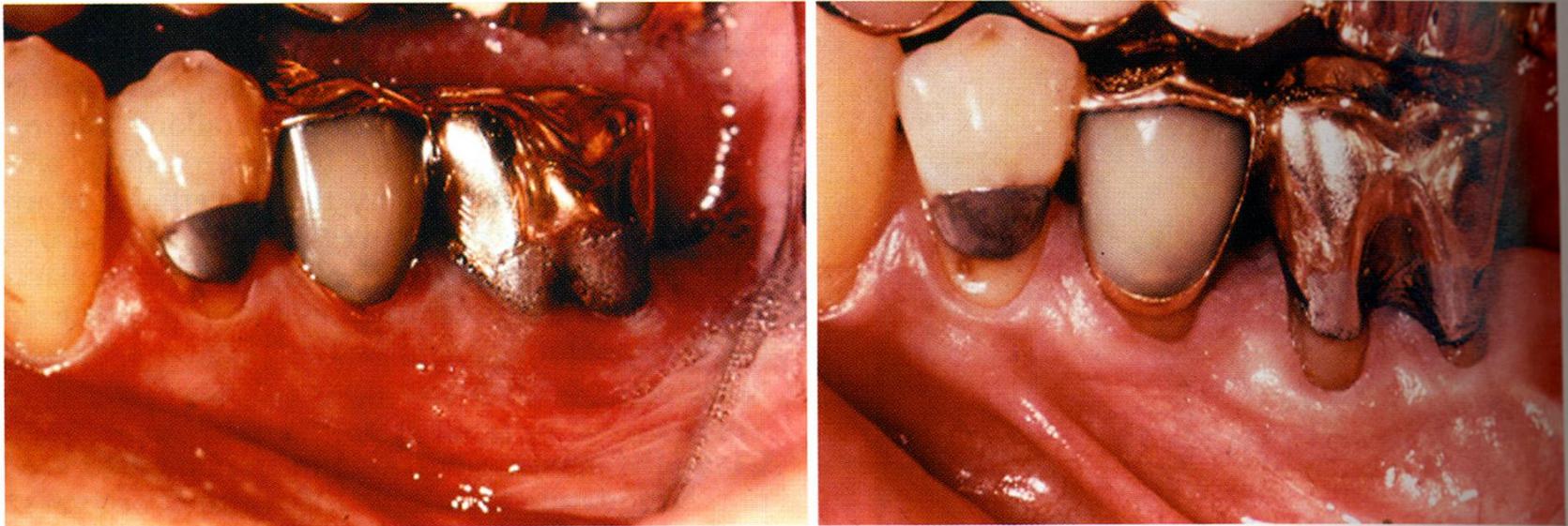


Figure 68-6 Treatment of a grade II furcation by osteoplasty and odontoplasty. **A**, This mandibular first molar has been treated endodontically and an area of caries in the furcation repaired. A class II furcation is present. **B**, Results of flap debridement, osteoplasty, and severe odontoplasty 5 years postoperatively. Note the adaptation of the gingiva into the furcation area. (Courtesy Dr. Ronald Rott, Sacramento, Calif.)

Hemisection/Root Resection

- Hemisection: Surgical procedure in which a mandibular molar is converted into two separate single rooted teeth
- Root Resection: Surgical procedure that entails the removal of one or more roots at the level of the furcation while leaving the clinical crown and remaining roots in function.
- Cocktail party factoid: The distobuccal root of the maxillary 1st molar is the most commonly resected (Klavan 1975)

Indications for Root Resection (Basaraba 1969)

- ▣ Vertical bone loss on one root that is not amenable to regeneration
- ▣ Furcation invasion not correctable by odontoplasty
- ▣ Non-maintainable furcation invasion
- ▣ Periodontally involved abutment tooth with a hopeless prognosis on one root
- ▣ Vertical/Horizontal root fracture
- ▣ When endo therapy is impossible on one root

Contraindications for Root Resection (Basaraba 1969)

- ▣ Advanced bone loss with poor crown:root ratio
- ▣ Fused roots unable to be separated
- ▣ If remaining root would be compromised as prosthetic abutment
- ▣ When periodontal support is inadequate to withstand normal occlusal forces
- ▣ Inability to create a good postsurgical gingival environment
- ▣ Inadequate oral hygiene

Long Term Follow Up with Root Resections

Study	# Teeth	Caries	Endo	Perio	Other	Total Failures	% Failure
Carnevale (1998)	175	3	4	3	2	12	7
Fugazotto (2001)	701	7	5	8	4	24	3.4
Langer (1981)	100	3	7	10	18	38	38

Langer: 84% of failures occurred after 5 years. Mostly due to root fracture.

Examples of Root Resection



Figure 68-7 Resection of a root with advanced bone loss. **A**, Facial osseous contours. There is an early grade II furcation on the facial aspect of the mandibular first molar and a class III furcation on the mandibular second molar. **B**, Resection of the mesial root. The mesial portion of the crown was retained to prevent mesial drift of the distal root during healing. The grade II furcations were treated by osteoplasty. **C**, Buccal flaps adapted and sutured. **D**, Lingual flaps adapted and sutured. **E**, Three-month postoperative view of the buccal aspect of this resection. New restorations were subsequently placed. **F**, Three-month postoperative view of the lingual aspect of this resection.

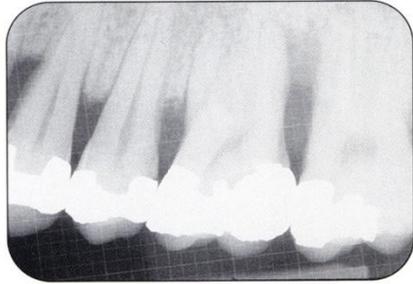


Fig 14-19a There is significant loss of periodontal attachment between the distal root of the maxillary left first molar and the mesial root of the adjacent second molar. It is not possible to locate the buccal and palatal dimensions of bone loss from a two-dimensional radiograph without clinical correlation.



Fig 14-19b The probing depth approaches 10 mm on the buccal surface.



Fig 14-19c The surgical procedure reveals extensive interproximal bone loss involving the distal root of the first molar, the mesial root of the second molar, and both furcations.

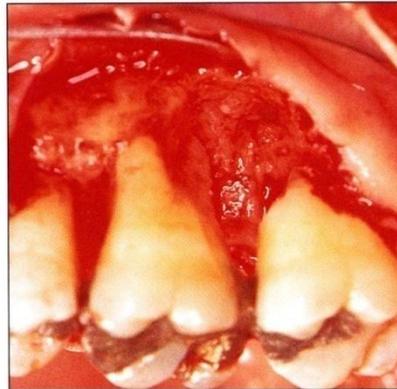


Fig 14-19d The distobuccal root of the maxillary left first molar and the mesiobuccal root of the second molar have been resected. The mesial furcation on the first molar has not been violated, and the distal furcation of the second molar is also intact. The procedure is both investigatory and therapeutic. The interproximal space is inadequate to establish parabolic architecture, and there will be no possibility of cleansing the open proximal furcations. Now is the time to determine the prognosis of both molars. If the remaining furcations are intact and the teeth are stable, it is reasonable to proceed to endodontic therapy.



Fig 14-19e Postsurgical result at 6 months. The area has healed nicely, and the embrasure is accessible for plaque removal.

Real Life Example...in what not to do



Yea for failing endo!



Apico,
anyone?



Oh baby, let the
perio guys have a
try!

Preop



Surgery



Postop Follow up



How is he going to keep this clean with a closed lingual embrasure....way to go dummy!

Guided Tissue Regeneration

- ▣ GTR: Surgical procedure that involves the placement of a physical barrier between the gingival flap and the root surface in an attempt to regenerate alveolar bone, cementum, and connective tissue.

Studies on Furcation Regeneration using GTR

- ▣ Pontoriero (1988)
 - Bilateral mandibular molar class II furcations
 - 21 subjects
 - Compared teflon membrane GTR to conservative nonsurgical therapy
 - Concluded that GTR with teflon eliminated entire furcation involvement 90% of the time
 - Conservative therapy only eliminated furcation 20% of time

Pontoriero (1995)

- ▣ Bilateral maxillary class II furcations in 28 patients
- ▣ Utilized e-PTFE membranes (test) versus OFD (control)
- ▣ OFD decreased probe depths modestly, however, bone levels and probing attachment did not improve
- ▣ GTR at buccal furcations improved probe depths, bone gain, and probing attachment levels
- ▣ Benefits noted on buccal furcation were not experienced in mesial and distal furcations

Pontoriero (1994)

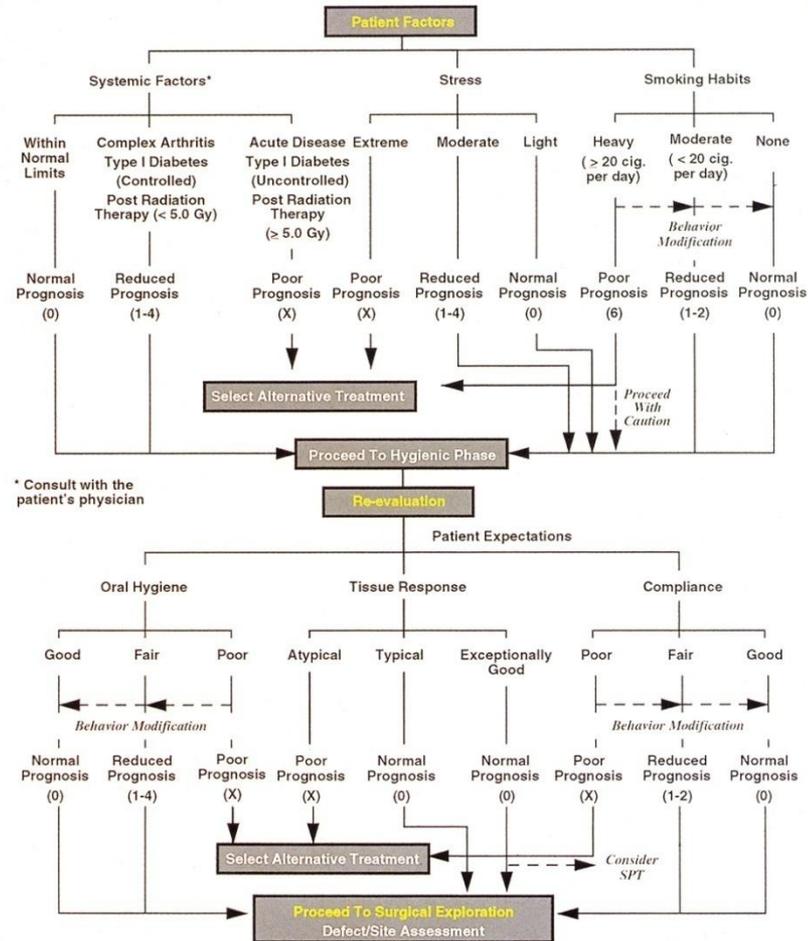
- ▣ 11 patients with bilateral maxillary class III furcations
- ▣ Patients received either e-PTFE in test sites and conservative nonsurgical therapy in controls
- ▣ Concluded that none of the class III furcations were closed at 6 month reopening.
- ▣ Slight decrease in probing depths and a modest gain in probing attachment was found

Calcium Sulfate

- ▣ Couri (2002)
- ▣ UNMC study
- ▣ 13 pairs of mandibular molar class II furcation defects
- ▣ Treated with ePTFE/DFDBA or Calcium sulfate/DFDBA
- ▣ Concluded the following: ePTFE showed greater bone fill as a barrier versus calcium sulfate
- ▣ However, attachment levels gains for calcium sulfate were significantly higher than ePTFE at 12 months

A Nice Diagram to Think About (Machtei 1995)

Chart 3 Class II Furcation Decision Tree



Last slide.....I promise

