Furcation Involvement and it's Management

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Introduction

- ***Area of complex anatomic morphology that may be difficult or impossible to debride by routine periodontal instrumentation***

- ***Furcation involvement – one clinical finding – advanced periodontitis – poor prognosis***

The furcation lesion has been defined as 'the pathologic resorption of bone in the anatomic area of a multirooted tooth where the roots diverge'

-American Academy of Periodontology

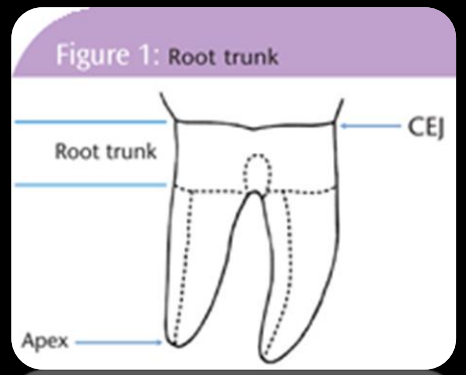
The root complex may be divided into two parts

Root trunk *- The root trunk represents the undivided region of the root*

Root cone *-The root cone is included in the divided region of the root complex*

Entrance: *The transitional area between the undivided and the divided part of the root*

Fornix: *The roof of the furcation*



The roof – [furcation fornix]

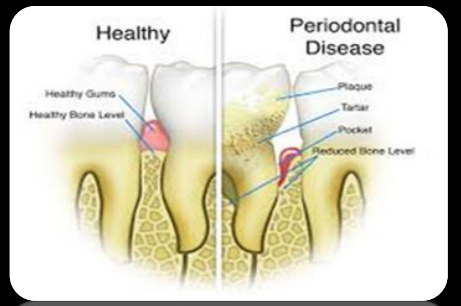
The surface immediately coronal to the root separation – [flute]

The area of root separation

Etiology & contributing factors

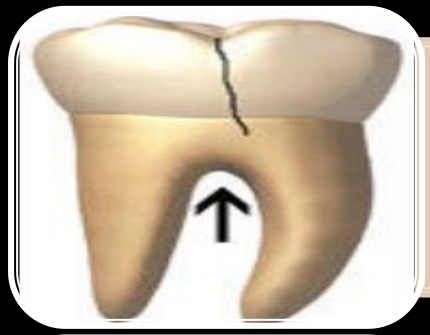
- *Plaque associated origin*
- *Contributing anatomical factors*
- *Endodontic origin*
- *Occlusal origin*
- *Iatrogenic origin*
- *Combined origin*

Plaque associated origin

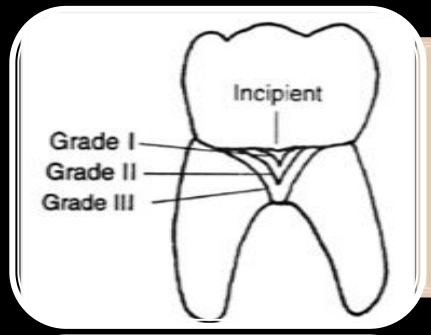


Extension of inflammatory disease processes into the furcation area leads to furcation defects

Contributing Anatomical Factors



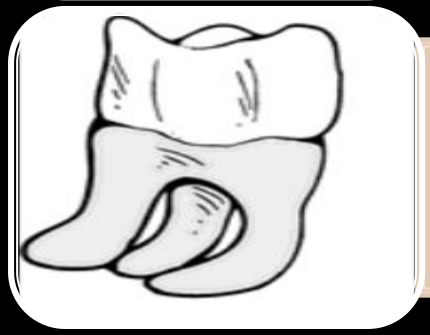
- *Furcation entrance diameter*



- *Cervical enamel projections*

- *Root trunk length*

- *Enamel pearls*



- *Presence of root concavities*

- *Bi-furcation ridges*

Contributing Anatomical Factors

Furcation entrance diameter

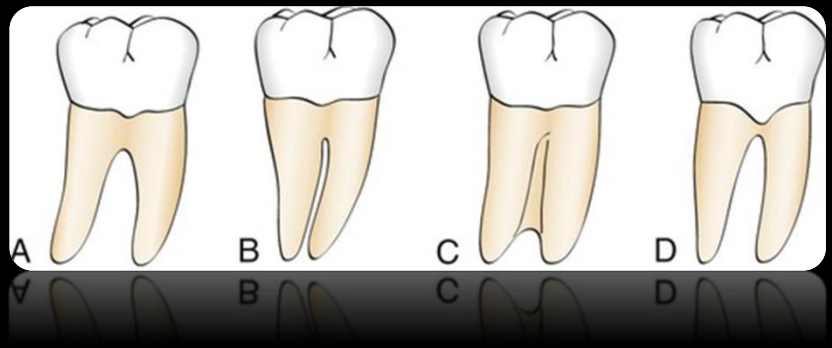
60% of molar furcation entrances < 0.75 mm

Mandibular molars: *Buccal wider than Lingual*

Maxillary molars: *Mesial > Distal > Buccal*

Bower R.C et al.
Journal of Periodontology 1979;50:23–27

Root Trunk Length



Short root trunk early involvement but more accessible

Longer root trunk late invasion but less accessible

Contributing Anatomical Factors

Root concavities

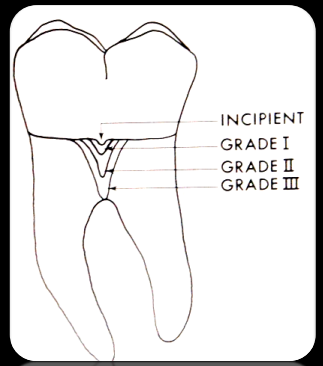
Present on proximal root surfaces

May make instrumentation almost impossible

↑ plaque retention

Cervical enamel projections

- ***8.6 – 28.6% of molars***
- ***Mandibular & Maxillary 2nd molars***



Masters & Hoskins 1964

Grade I: The enamel projection extends from the cementoenamel junction of the tooth toward the furcation entrance.
Grade II: The enamel projection approaches the entrance to the furcation. It does not enter the furcation, therefore there is no horizontal component.
Grade III: The enamel project actually extends horizontally into the furcation.

Contributing Anatomical Factors

Enamel pearls

Prevalence is less than cervical enamel projections

Incidence of 2.6 %

Predominantly in maxillary 2nd molar

Bi-furcational ridges

Running across the roof of furcation connecting mesial and distal roots (Incidence – 73%)

Formed mostly of cementum

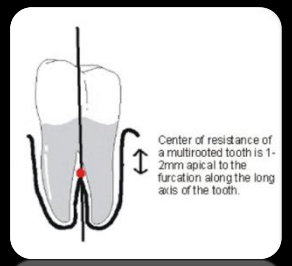
Everett (1958)

Occlusal origin

Excessive occlusal forces

Inflammation & tissue destruction in furca

Glickman [1966]



Iatrogenic factors

- Faulty dentistry like <u>perforations during RCT & poorly contoured restorations</u> can lead to attachment loss in furca area
- <u>Overhanging margins</u>
- Pin & endodontic perforations

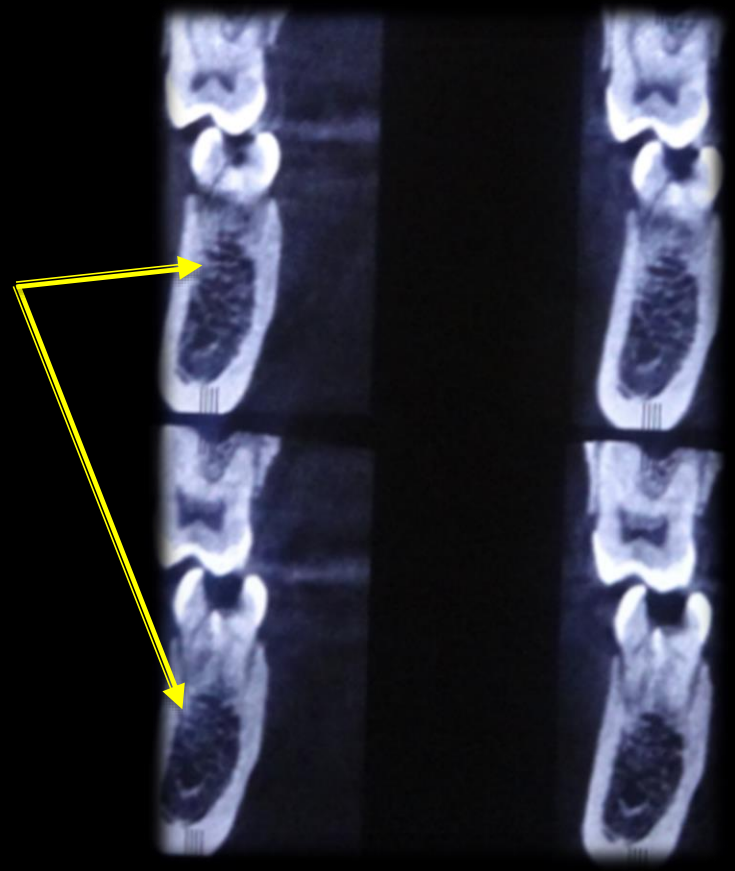
Pulpal pathology

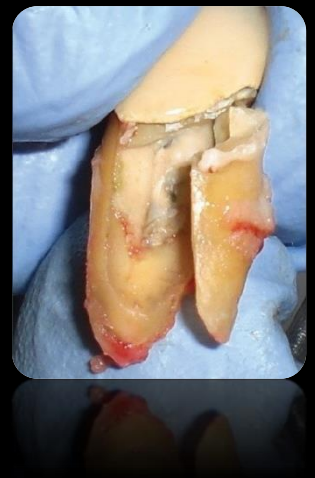
- Incidence of accessory canals –
  - 36% maxillary first molars,
  - 12% of maxillary second molars,
  - 32% of mandibular first molars
  - 24% of mandibular second molars.
- **D/D –** Vitality test
- In the absence of established periodontal involvement

  -- sinus tracts → RCT → complete resolution
- **T/t –**
  - RCT
  - Re-evaluation at 3-4 weeks
  - Periodontal therapy after 6 month

Root fractures involving furcation

- Rapid, localized, alveolar bone loss - often seen associated with vertical root fractures
- If root fractures involve trunk of a multi-rooted molar and extend into a furcation → rapidly forming isolated furcation defect
- Prognosis → Poor and usually results in the loss of such a tooth





Classification – Glickman 1953

GRADE - I

- Early or incipient stage
- Pocket formation into the furcation
- Intact interradicular bone

GRADE - II

- Pocket formation
- Loss of interradicular bone
- Not extending to the opposite side
  [*portion of alveolar bone is still attached*]

Classification – Glickman 1953

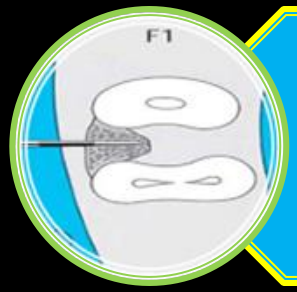
GRADE - III

- Complete loss of interradicular bone
- Pocket formation probable to the opposite side [*Through and through lesion*]
- Early grade III – opening may be filled with soft tissue

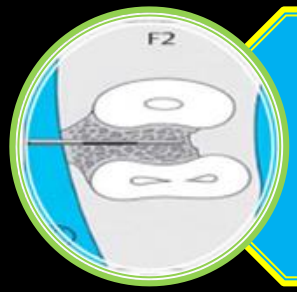

GRADE - IV

- Loss of attachment & recession seen
- Furcation is clearly visible to clinical examination
- ie .. *Through and through lesion with gingival recession*

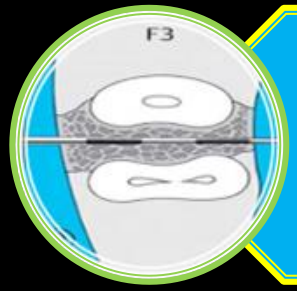

Classification – Hamp et al 1975



Degree I : [INITIAL]
Horizontal loss of periodontal support not exceeding 1/3rd of width of tooth

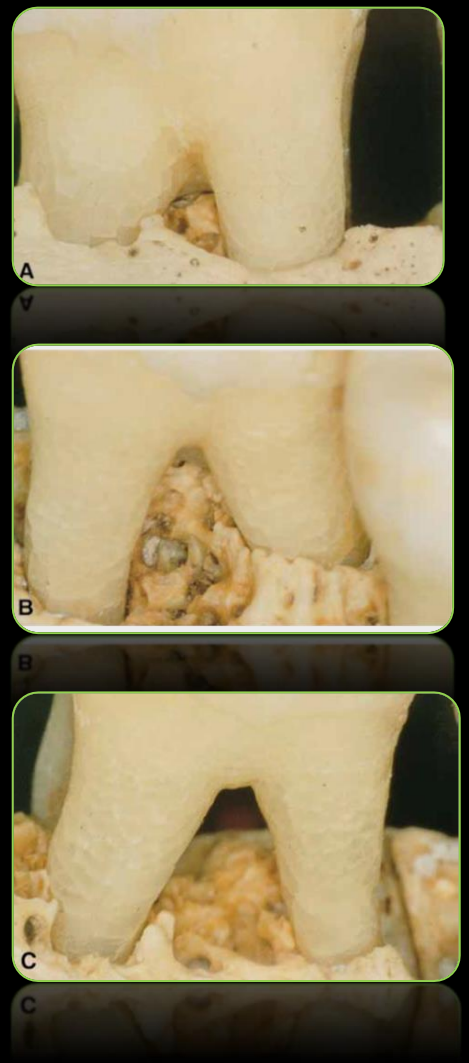


Degree II : [PARTIAL]
Horizontal loss of periodontal support exceeding 1/3rd of width of tooth, but not encompassing total width of furcation area



Degree III : [TOTAL]

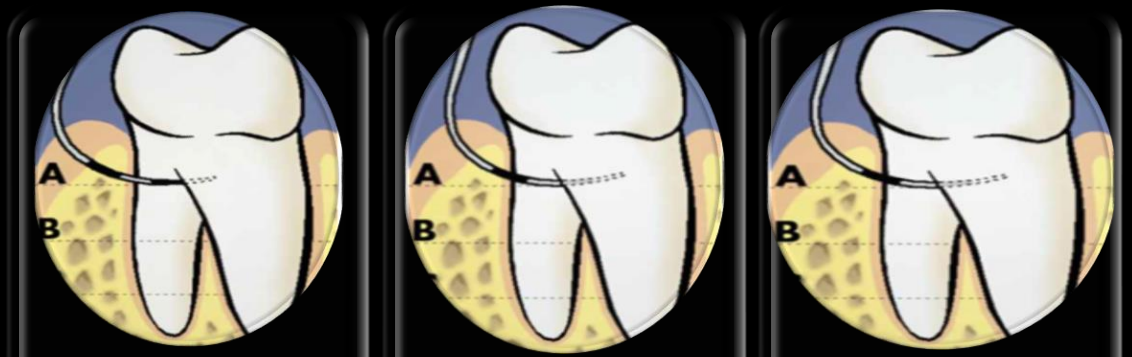
"Through & through" destruction of periodontal tissues in furcation area



Classification

Modification of Hamp's classification

Carnevale 1997



Class I
< 3mm

Class II
3 or >3mm

Class III
Thru & Thru

Horizontal Component

Tarnow & Fletcher – 1984

Floor of the furca to the Roof of the furca

Sub Class A
1 – 3 mm

Sub Class B
4 – 6 mm

Sub Class C
≥ 7 mm

Vertical Component

Classification

Other classification systems are

- **Ramjford and Ash - 1979 [horizontal component]**
- **Rosenberg's classification - 1980**
- **Lindhe's classification - 1983**
- **Basarba's classification - 1990**
- **Hou & Tsai - 1997**
- **Hou et al. – 1998 [horizontal & vertical components]**

Diagnosis

The extent of furcation invasion is often difficult to diagnose, and therefore a combination of radiographs, clinical probing using a curved Naber's probe is advisable

The buccal furca of maxillary molars
&
Buccal & lingual furcas of mandibular molars -- normally accessible for examination by clinical probing

Distal furcation - located midway bucco-lingually - probing from both sides

Mesial furcation - located 2/3rd towards palate - probed from palatal aspect

Diagnosis

Slight radiographic change - furcation area should be investigated clinically, esp. if there is bone loss on adjacent roots

Diminished radiodensity in furcation area in which outlines of bony trabeculae are visible suggests furcation involvement

Whenever there is marked bone loss in relation to a single molar root, it may be assumed -- furcation is also involved

Diagnosis

Perioscope

Introduced subgingivally to visualize furcation

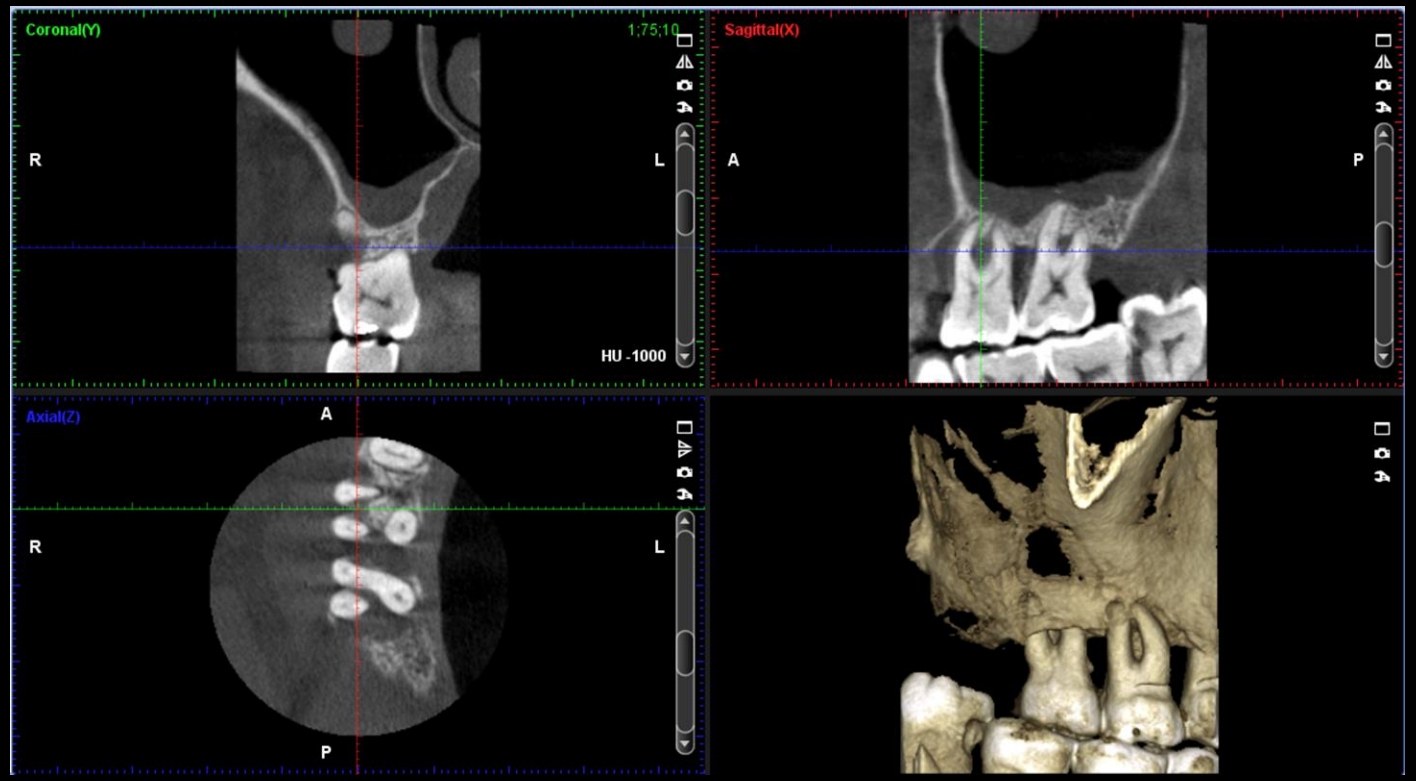
Consist of re-usable fiber optic endoscope which fits onto the periodontal probes & ultrasonic instruments that have been designed to accept it

Transgingival Probing

Determine the contour of underlying bone

- *Reduces the underestimation following normal probing*
- *Greenberg et al (1976) sounding yielded accurate measurements when compared to surgical reentry measurements*

Diagnosis



CBCT Data provided Substantial Information regarding

- *Complete Furcation Anatomy, Furcation Involvement*
- *CBCT Analysis revealed discrepancies in treatment recommendations for the majority of molars*

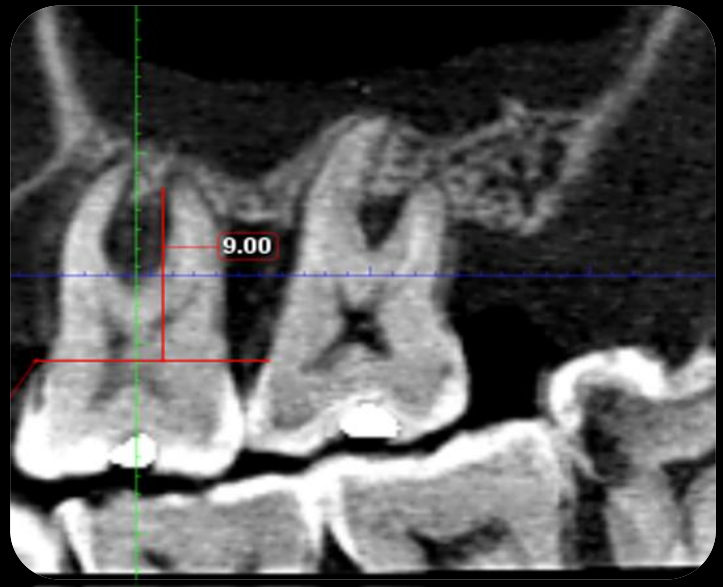
Int J Dent Hyg. 2014 Dec 16. doi: 10.1111/idh.12116. [Epub ahead of print]

Comparison of clinical and cone beam computed tomography measurements to diagnose furcation involvement.

Darby I[1], Sanelli M, Shan S, Silver J, Singh A, Soedjono M, Ngo L.

Diagnosis

Radiographic v/s Cone Beam Volumetric Tomography [Vertical Component Comparison]



IOPA (From CEJ to Most Apical Point of the Defect)	CBVT (Sagittal) (From CEJ to Most Apical Point of the Defect)
6 mm	9 mm

Treatment

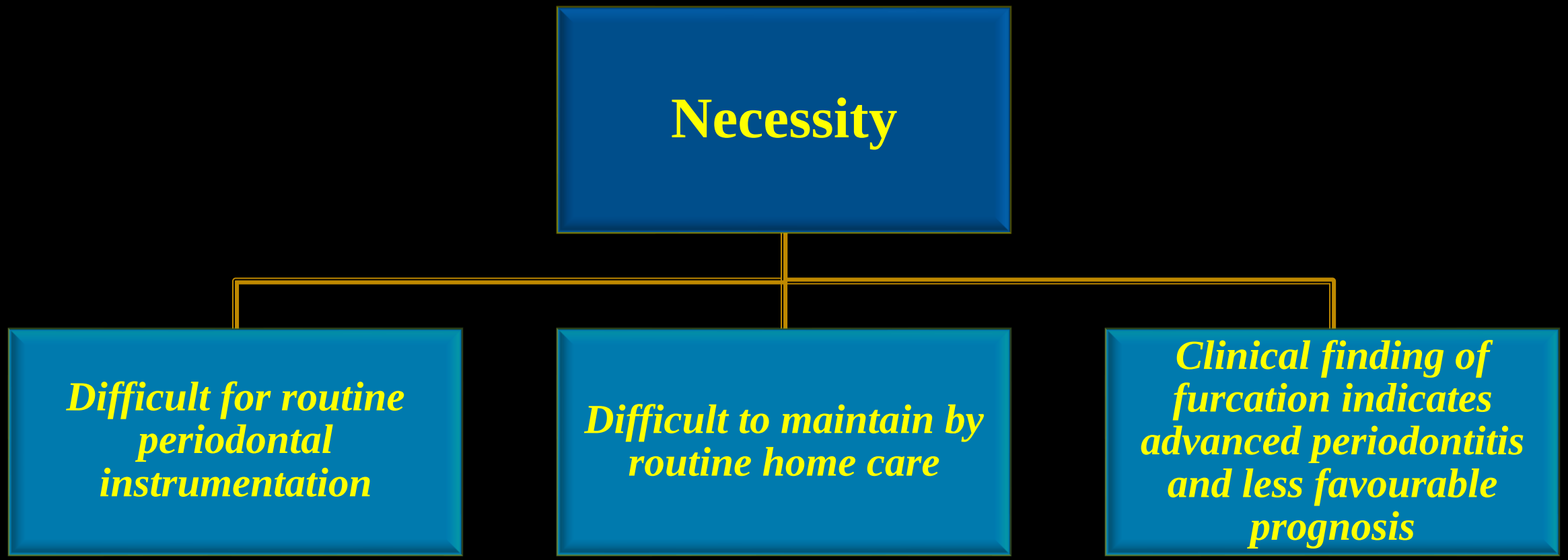
Objectives :

- Elimination of microbial plaque
- Facilitate self maintenance
- Prevent further attachment loss
- Obliterate furcation defects
- Restore normal function by *regeneration functional apparatus*

and

correcting pulpal pathology if present

Treatment


Necessity
Difficult for routine periodontal instrumentation
Difficult to maintain by routine home care
Clinical finding of furcation indicates advanced periodontitis and less favourable prognosis

Treatment

Concept : *Kalkwarf & Reinhardt et al*

FACTORS

- *Severity of furcation invasion*
- *Amount of remaining bone support*
- *Status of abutment teeth*
- *Strategic importance of the involved tooth*

PROCEDURES

- *Root Curettage*
- *Odontoplasty*
- *Osteoplasty*
- *Root Resection*
- *Hemisection*
- *Tunneling*
- *Regeneration*

Treatment

Concept : *Kalkwarf & Reinhardt et al*

	Degree I	Degree II	Degree III
Maintain Furcation	**Scaling & Root Planing** **Flap Curettage**	**Flap Curettage**	**Flap Curettage**
Increase Access to Furcation	**Apically Position Flap** **Odontoplasty** **Osteoplasty , Osteotomy**		
Removal of Furcation		**Root Resection** **Hemisection**	**Root Resection** **Hemisection**
Closure of Furcation with New Attachment		**Flap Curettage with Barrier Membrane (GTR)**	**Flap Curettage with Barrier Membrane (GTR)**

Treatment

Principles : *Cattabriga et al 2000*

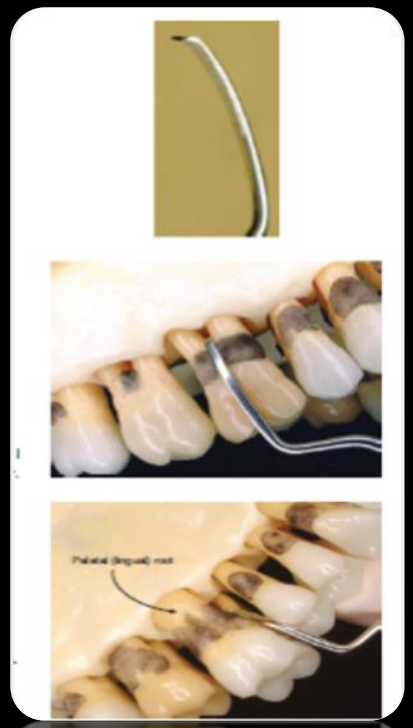
- *Conservative*
- *Regenerative*
- *Resective*

Treatment - Non Surgical

- Effective way of producing a satisfactory result in grade I & shallow grade II – less favourable in deeper sites
- Earlier the furcation is detected & treated good long term result is obtained
- Hand & powered instruments – used
- *Residual calculus* in furcation areas > than in non furcation involved teeth

Treatment - Non Surgical

Instruments



Quetin Furcation Curettes

Diamond coated Files

Cavitron Slim line Inserts

O'Hehir Curettes

1. *Small disk shaped blades curve into the tooth and easily adapt into the furcations*
2. *Long terminal shanks allow access into deep narrow periodontal pockets*

Treatment - Non Surgical

Local Drug Delivery

- Only scaling & root planing alone – no long term advantage

- ***High concentration of antimicrobials combined with conventional treatment have the potential of improving the clinical response at furcation sites during the supportive periodontal care – Tonetti et al…***

Efficacy of subgingivally delivered 1.2-mg simvastatin in the treatment of individuals with class II furcation defects by A R Pradeep et al 2012 was found to have significant bone fill

Treatment - Non Surgical

Odontoplasty

- Reshaping of the tooth coronal to the furcation to improve access to plaque control

- Eliminate any *facial grooves*
  enamel pearls
  cervical enamel projections

- Potential complication is
  hypersensitivity
  increased risk of root caries

[Goldman 1958, Fleischer et al 1989]

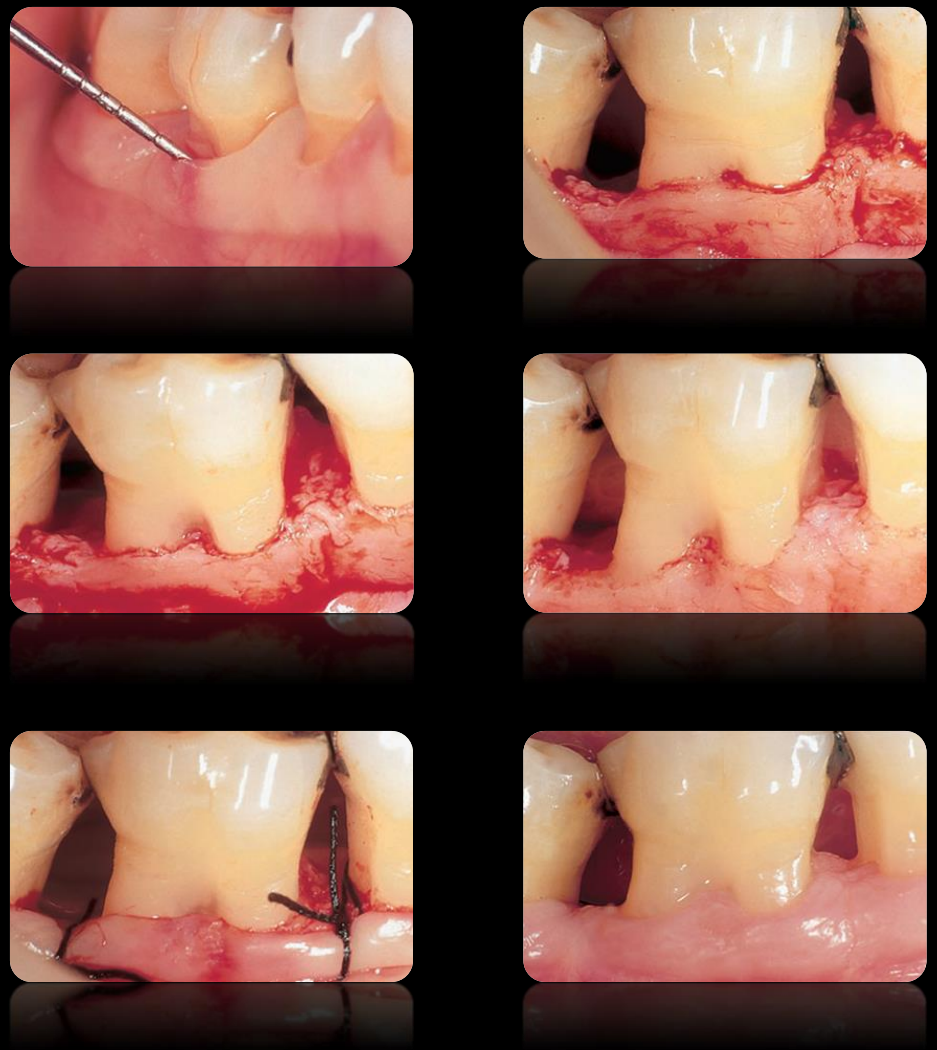
Treatment - Surgical

Indications

- A significant horizontal involvement of one or more furcations of a multirooted tooth
- Inability to adequately instrument the furcation by routine scaling and root planing
- Persistence of inflammation or exudate after adequate phase 1 therapy

Treatment – Surgical

Furcationplasty

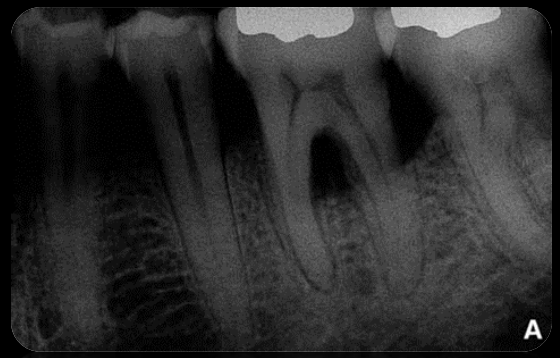


Odontoplasty + *Osteoplasty & / or Ostectomy* → *Furcationplasty*

- Most effective in grade II furcation
- Remove the lip of defect to reduce horizontal depth
- Bone ramps into the furcation to enhance plaque control
- Reduce probing depths

Treatment - Surgical

Tunneling



- ✓ Short root trunk
- ✓ Wide separation angle
- ✓ Long divergence

Drawbacks:

- Risk for root sensitivity
- Root caries
- Slight LOA expected

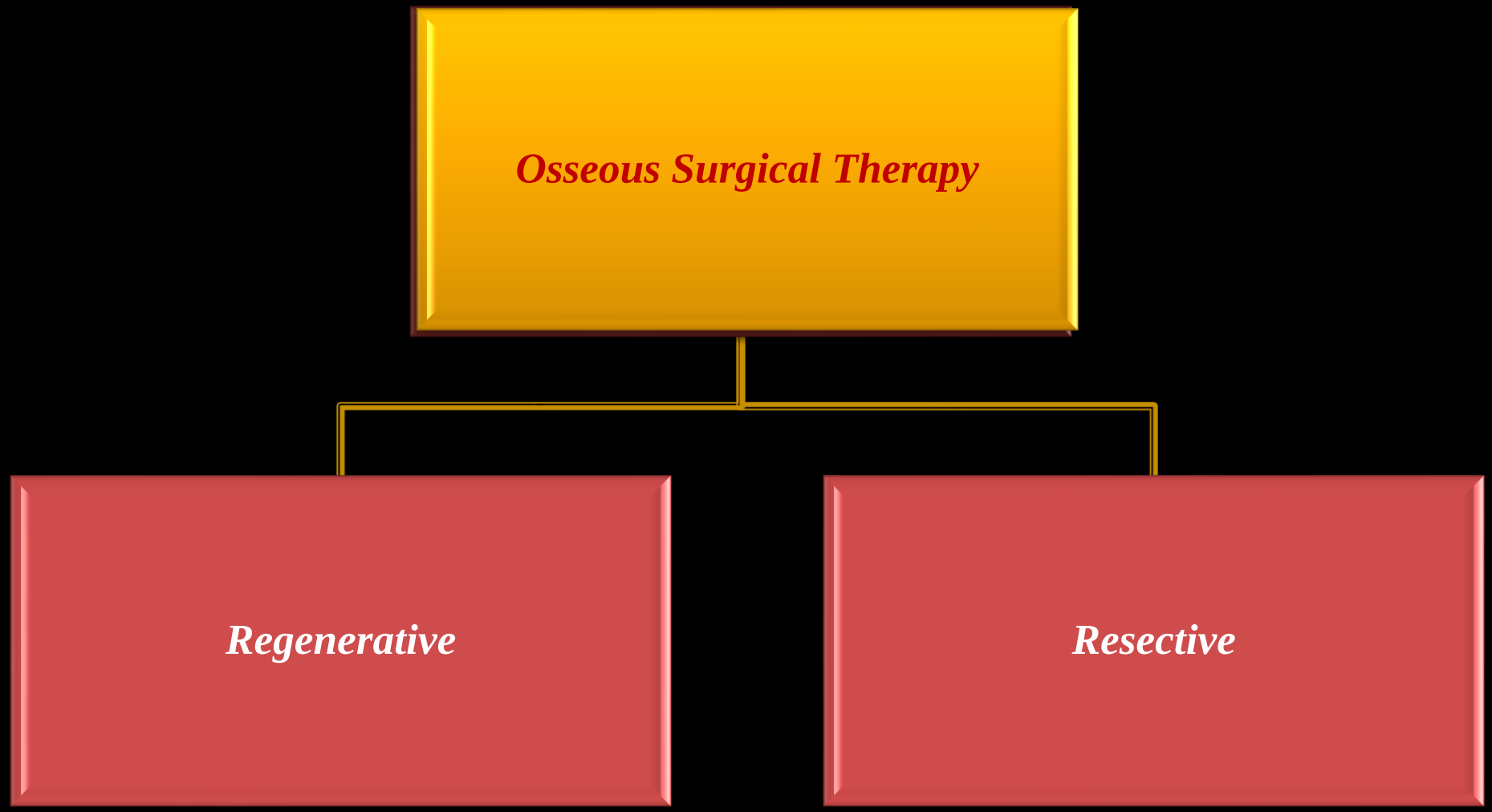
Treatment - Surgical

Tunneling

Tunneling success

Author	# of Teeth Tunneled	Years of Study	Success
Hamp	7	5	57.1%
Little	18	5.8	88.9%
Hellden	149	3.1 avg	93.3%
Kuhrau	14	5.8 avg	85.7%
Eicholz	78	2 avg	92.6%

Treatment – Surgical



Treatment – Surgical

Regenerative

- Aims to eliminate defect in furcation by generating new bone, cementum & fiber attachment within the furca

- *Bone grafts or bone substitutes*
- *Use of barrier membranes based → principles of GUIDED TISSUE REGENERATION*
- *Growth factors*
- *Combined therapy*

- ***Many surgical procedures using a variety of grafting materials have been tested on teeth with different classes of furcation involvement***

- ***Deep two-walled or three- walled components may be suitable for reconstruction procedures***

Treatment – Surgical

Regenerative – Bone Grafts

- Little or no vascularity to support bone graft → success is limited in furcations.

  (Sepe and colleagues 1978; saunders and colleagues, 1983).

- Indicated where destruction of the furcation is only partial (grade I or II) or where deep vertical lesions have still left some bone on the inner aspect of the roots.

  (Bowers and colleagues, 2003).

- Contain bone forming cells - ***Osteogenesis***
- Serve as a scaffold for bone formation - ***Osteoconduction***
- Matrix of the grafting material contains bone inductive substances - ***Osteoinduction*** stimulating both the regrowth of alveolar bone and the formation of new attachment

Treatment – Surgical

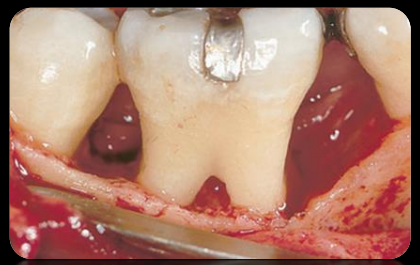
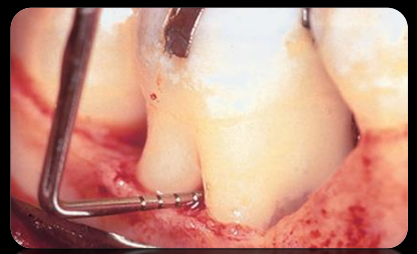
Regenerative – Bone Grafts

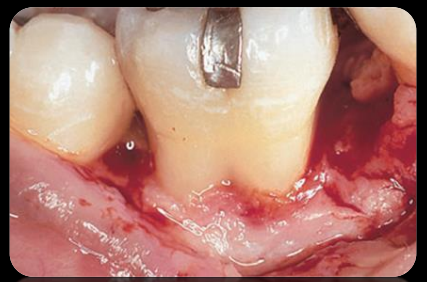
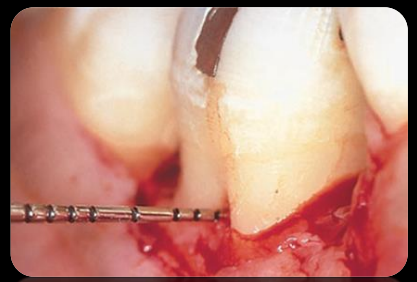
Table 1. Controlled human clinical studies on furcations treated with citric acid, bone grafts, alloplastic materials or combined regenerative techniques

Study	Treatment	Defect		Clinical attachment level change (mm)		Defect fill (mm)		Closures
		n	Type	Vertical	Horizontal	Vertical	Horizontal	
Gantes et al. (37)	coronally flap positioning + citric acid	14	degree II furcation	1.6		2.4	2.6	6/14
	coronally flap positioning + citric acid + demineralized freeze-dried bone allografts	16	mandibular	1.5		2.4	3.0	7/16
Garrett et al. (40)	coronally flap positioning + citric acid + demineralized freeze-dried bone allografts	16	degree II furcation			2.2	2.7	9/16
	dura mater membrane + citric acid + demineralized freeze-dried bone allografts	15	mandibular			2.2	1.8	3/15
Gantes et al. (38)	coronally flap positioning + citric acid	14	degree III furcation	2.2				1/14
	coronally flap positioning + citric acid + demineralized freeze-dried bone allografts	13	mandibular	1.5				3/13
Kenney et al. (57)	porous hydroxyapatite	23	degree II furcation	1.8		2.0	1.6	21/23
	debridement	23	mandibular	0.0		−0.3	−0.3	
Pepelassi et al. (84)	composite synthetic graft	13	degree II furcation	1.9	3.7	2.3	3.4	0/13
	debridement	13	mandibular	0.6	1.1	0.5	1.2	0/13
Pepelassi et al. (84)	composite synthetic graft	7	degree III furcation	2.2		2.6	3.3	0/7
	debridement	7	mandibular	−0.4		0.5	−0.2	0/7
Fuentes et al. (36)	coronally flap positioning	13	degree II furcation	0.4		0.4	1.6	0/13
	coronally flap positioning + citric acid	14	mandibular	0.7		1.1	1.8	0/14
Yukna et al. (111)	composite synthetic graft	15	degree II furcation	0.8		1.6	1.9	1/15
	autogenous graft	15	mandibular	1.0		1.7	0.8	0/15

Treatment – Surgical

Regenerative – GTR

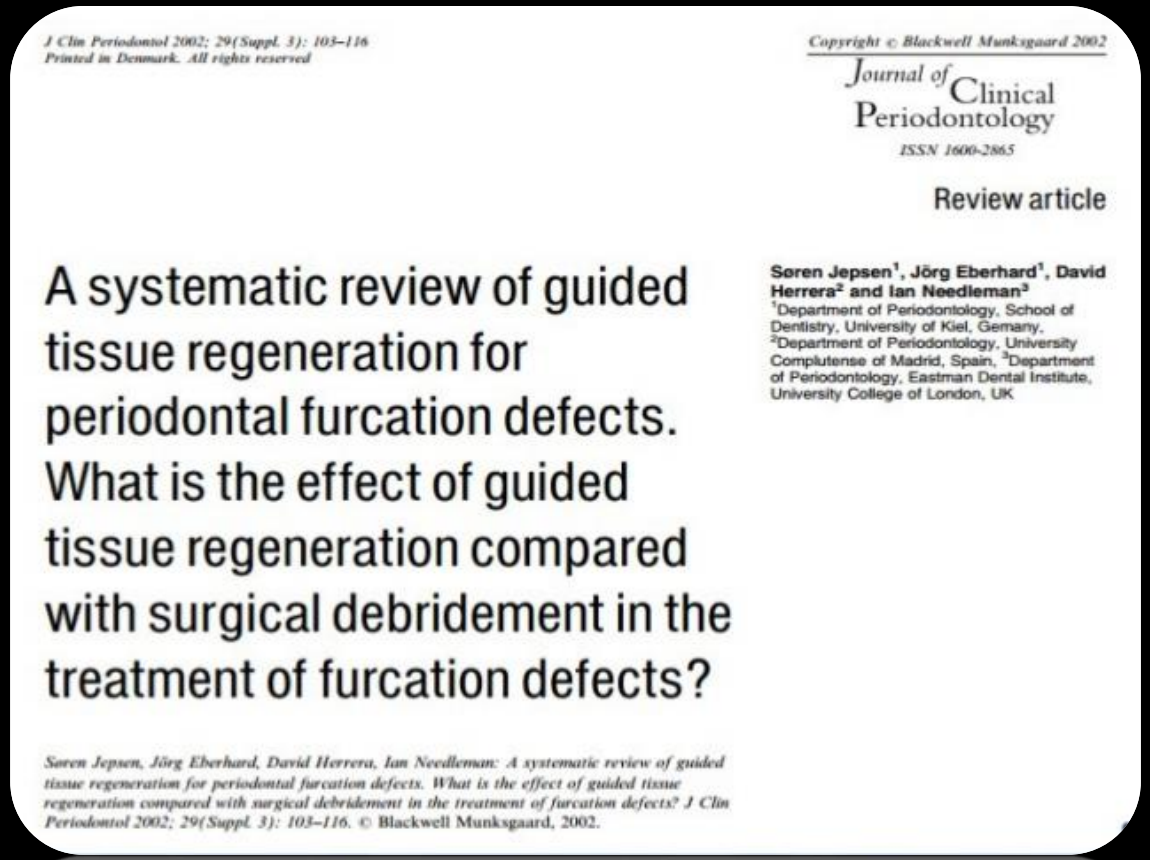
- ***GTR significantly improved the horizontal clinical attachment***
- ***GTR significantly improved vertical attachment and reduction in probing depth***

21 Clinical trails [423 mandibular grade II furcation molars]

LINDHE 2003 – REVIEW

Treatment – Surgical

Regenerative – GTR



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Journal of Clinical Periodontology
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Review article

A systematic review of guided tissue regeneration for periodontal furcation defects. What is the effect of guided tissue regeneration compared with surgical debridement in the treatment of furcation defects?

Søren Jepsen[1], Jörg Eberhard[1], David Herrera[2] and Ian Needleman[3]
[1]Department of Periodontology, School of Dentistry, University of Kiel, Germany, [2]Department of Periodontology, University Complutense of Madrid, Spain, [3]Department of Periodontology, Eastman Dental Institute, University College of London, UK

Søren Jepsen, Jörg Eberhard, David Herrera, Ian Needleman: A systematic review of guided tissue regeneration for periodontal furcation defects. What is the effect of guided tissue regeneration compared with surgical debridement in the treatment of furcation defects? J Clin Periodontol 2002; 29(Suppl. 3): 103–116. © Blackwell Munksgaard, 2002.

- GTR vs OFD: GTR → Significantly greater reduction in horizontal & vertical furcation depth of class II furcation defects.
- A complete closure of class II molar furcation defects following placement of barrier membranes appears to be an unpredictable outcome. (surgical reentry)
- Limited data on the effects on Class III

Treatment – Surgical

Regenerative – GTR

REVIEW ARTICLE

A systematic review and meta-analysis of guided tissue regeneration/osseous grafting for the treatment of Class II furcation defects

Tsung-Hung Chen [a], Yu-Kang Tu [b], Chia-Chen Yen [a], Hsein-Kun Lu [c*]

- GTR therapy is more effective in treating Class II furcation defects than OFD.
- Treatment outcome is more consistent in the mandibular molars than maxillary molars.
- The conjunctive osseous grafting enhanced clinical outcomes of GTR in treatment of mandibular molars.

Journal of Dental Sciences (2013)

More Predictable outcome - degree II FI mandibular molars

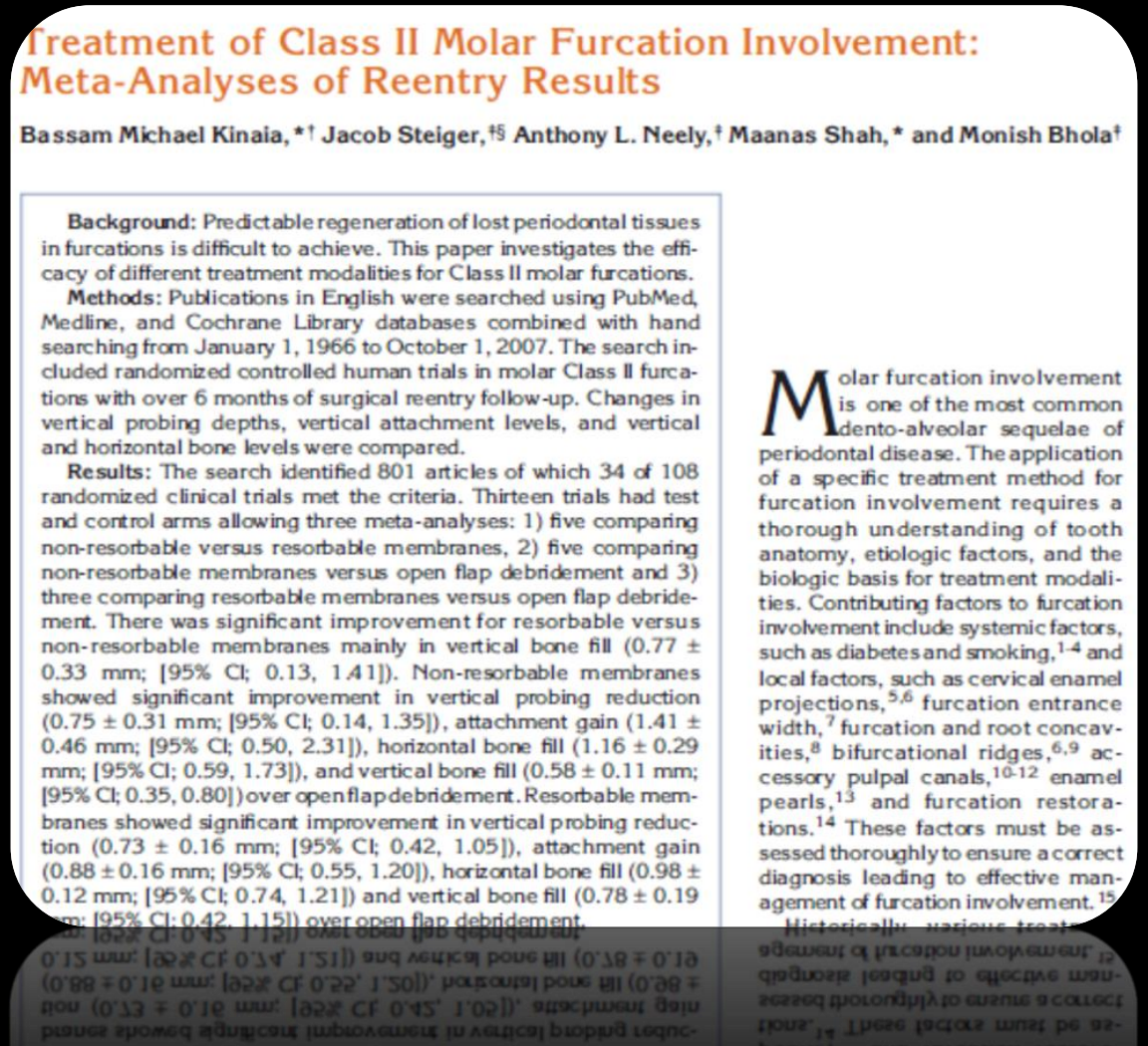
Less favourable results – degree III FI of max & mand molars

degree II FI of max. molars

[Pontoriero et al. 1989; Metzeler et al. 1991;Pontoriero & Lindhe 1995]

Treatment – Surgical

Regenerative – GTR



Treatment of Class II Molar Furcation Involvement: Meta-Analyses of Reentry Results

Bassam Michael Kinaia,*† Jacob Steiger,†§ Anthony L. Neely,† Maanas Shah,* and Monish Bhola†

Background: Predictable regeneration of lost periodontal tissues in furcations is difficult to achieve. This paper investigates the efficacy of different treatment modalities for Class II molar furcations.

Methods: Publications in English were searched using PubMed, Medline, and Cochrane Library databases combined with hand searching from January 1, 1966 to October 1, 2007. The search included randomized controlled human trials in molar Class II furcations with over 6 months of surgical reentry follow-up. Changes in vertical probing depths, vertical attachment levels, and vertical and horizontal bone levels were compared.

Results: The search identified 801 articles of which 34 of 108 randomized clinical trials met the criteria. Thirteen trials had test and control arms allowing three meta-analyses: 1) five comparing non-resorbable versus resorbable membranes, 2) five comparing non-resorbable membranes versus open flap debridement and 3) three comparing resorbable membranes versus open flap debridement. There was significant improvement for resorbable versus non-resorbable membranes mainly in vertical bone fill (0.77 ± 0.33 mm; [95% CI; 0.13, 1.41]). Non-resorbable membranes showed significant improvement in vertical probing reduction (0.75 ± 0.31 mm; [95% CI; 0.14, 1.35]), attachment gain (1.41 ± 0.46 mm; [95% CI; 0.50, 2.31]), horizontal bone fill (1.16 ± 0.29 mm; [95% CI; 0.59, 1.73]), and vertical bone fill (0.58 ± 0.11 mm; [95% CI; 0.35, 0.80]) over open flap debridement. Resorbable membranes showed significant improvement in vertical probing reduction (0.73 ± 0.16 mm; [95% CI; 0.42, 1.05]), attachment gain (0.88 ± 0.16 mm; [95% CI; 0.55, 1.20]), horizontal bone fill (0.98 ± 0.12 mm; [95% CI; 0.74, 1.21]) and vertical bone fill (0.78 ± 0.19 mm; [95% CI; 0.42, 1.15]) over open flap debridement.

Molar furcation involvement is one of the most common dento-alveolar sequelae of periodontal disease. The application of a specific treatment method for furcation involvement requires a thorough understanding of tooth anatomy, etiologic factors, and the biologic basis for treatment modalities. Contributing factors to furcation involvement include systemic factors, such as diabetes and smoking,[1-4] and local factors, such as cervical enamel projections,[5,6] furcation entrance width,[7] furcation and root concavities,[8] bifurcational ridges,[6,9] accessory pulpal canals,[10-12] enamel pearls,[13] and furcation restorations.[14] These factors must be assessed thoroughly to ensure a correct diagnosis leading to effective management of furcation involvement.[15]

- Both types of membranes were more effective than OFD
- Addition of bone graft to a resorbable membrane enhanced results (PD & CAL) compared to resorbable membranes alone

Treatment of Class II molar furcation involvement: meta-analyses of reentry results

B.M. Kinaia, J.Steiger, A.L.Neely,et al

J Periodontol. 2011;82(3):413

Treatment – Surgical

Regenerative – GTR

Good predictability

- The interproximal bone is located closer CEJ
- Comprehensive debridement
- Membrane is properly positioned
- Plaque control

Limited predictability

- Morphology of the periodontal defect - in root complex often ‘horizontal’
- Anatomy of furcation prevents instrumentation
- Changing gingival margins during healing may cause exposure

Treatment – Surgical

Regenerative – GTR with Bone Grafts

- The predictability of connective tissue attachment gain is high using GTR for furcation involvement, but new bone formation is not predictable in the same area.

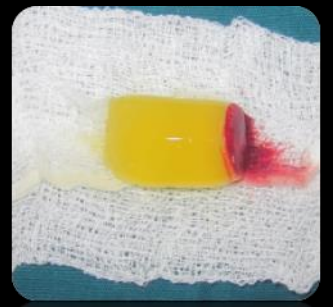
  Schallhorn, Becker

- Reports have shown that bone regeneration is increased by the use of bone grafts in combination with GTR for new bone formation.

  Schallhorn and McClain

Biologic Mediators

- Enamel matrix derivative [EMD]
- Platelet-derived growth factor [PDGF]
- Platelet concentrates [PRP, PRF]
- Bone morphogenetic proteins [BMPs]
- Fibroblast growth factor [FGF]



Biologic Mediators

Rossa et al 2000	Nevins et al 2003	Ryo Jimbo et al 2014	Mansouri et al 2012
Regeneration of Class III furcation defects in dogs with bFGF + GTR.	Demonstrated the use of purified rhPDGF-BB + Allograft leading to robust periodontal regeneration in both Class II furcation & intrabony defect	Effect of Brain-Derived Neurotrophic Factor (BDNF) on Periodontal Furcation Defects– non human primate – Class II furcation defect suggested	Mandibular class II furcation Bovine porous bone mineral [BPBM] with plasma rich growth factors [PRGF]
bFGF in smaller doses may enhance regenerative results in Class III furcation lesions , leading to greater filling with both mineralised & non-mineralised tissues.	1st report of demonstrating periodontal regeneration histologically in human class II furcation defects.	Use of BDNF in combination with a scaffold such as hyaluronic acid in periodontal furcation defects may be an effective treatment option	Healing but not statistically significant

Biologic Mediators

Clinical outcomes with bioactive agents alone or in combination with grafting or guided tissue regeneration

Authors: Trombelli, Leonardo; Farina, Roberto

Source: Journal of Clinical Periodontology, Volume 35, Supplement 8, September 2008, pp. 117-135(19)

Publisher: Wiley-Blackwell

limited evidence supports the use of BAs either alone or in association with graft/GTR for the treatment of furcation defects.

J Periodontol. 2012 Jun;83(6):707-20. doi: 10.1902/jop.2011.110266. Epub 2011 Nov 3.

Periodontal regeneration with enamel matrix derivative in reconstructive periodontal therapy: a systematic review.

Koop R[1], Merheb J, Quirynen M.

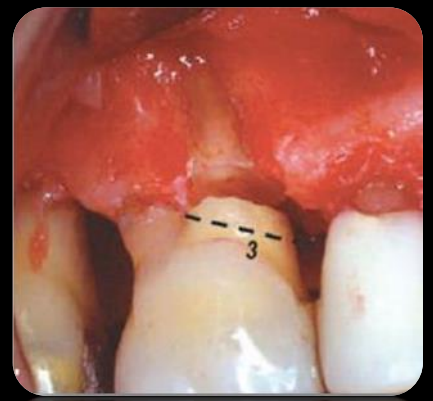
- Evaluated EMD in intrabony defects, furcations, and recessions
- Primary outcome variable for –
  - Intrabony defects : change in CAL,
  - Furcations : change in horizontal furcation depth,
  - Recessions: complete root coverage.

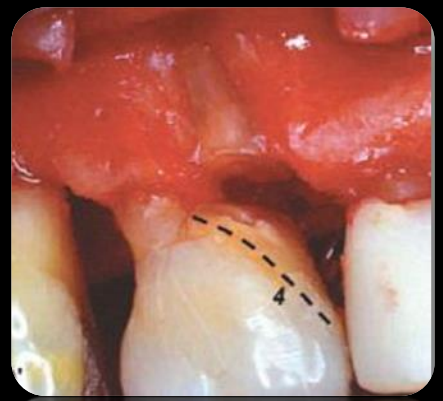
Conclusion :

- Intrabony defects -- EMD >> OFD , EDTA or placebo BUT as effective as resorbable membranes.
- Recession coverage : EMD + CAF >> CAF alone BUT as effective as CTG .
- Furcations: EMD >> resorbable membranes -- more ↓ in horizontal furcation defect depth.

Treatment – Surgical

Resective – Root Resection





Surgical removal of all or a portion of a tooth root

Treatment – Surgical

Resective – Hemisection




The surgical separation of a

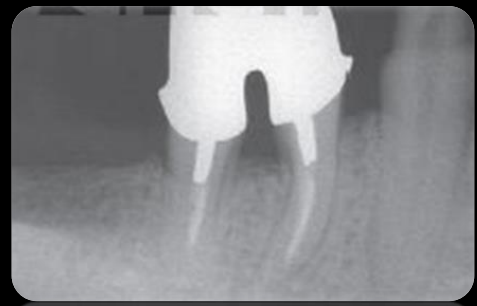
multi rooted tooth, especially a mandibular molar,

through the furcation in such a way that a root and associated portion of the crown may be removed or restore

Treatment – Surgical

Resective – Bicuspidization



Is the splitting of a mandibular molar & retaining both the fragments so as to change the molar into two separate units

Treatment – Surgical

Resective - Indications

Periodontal indications

- Severe bone loss affecting one or more root
- Class II or III
- Severe recession or dehiscence of a root

Endodontic indications

- Inability to successfully treat and fill a canal
- Root fracture or root perforation
- Severe root resorption
- Root caries

Prosthetic indications

- Caries with invasion of the biological width
- Extreme root proximity

Treatment – Surgical

Resective - Contraindications

Periodontal Surgery	Local Anatomy	Endodontic Factors	Restorative Factors
Systemic factors	Fused roots	Retained roots - endodontically untreatable	Presence of cemented post in the remaining root
Poor oral hygiene	Unfavourable tissue architecture	Excessive endodontic instrumentation of retained roots	
Insufficient bone support around remaining roots		Excessive deepening of pulp chamber floor	

Treatment – Surgical

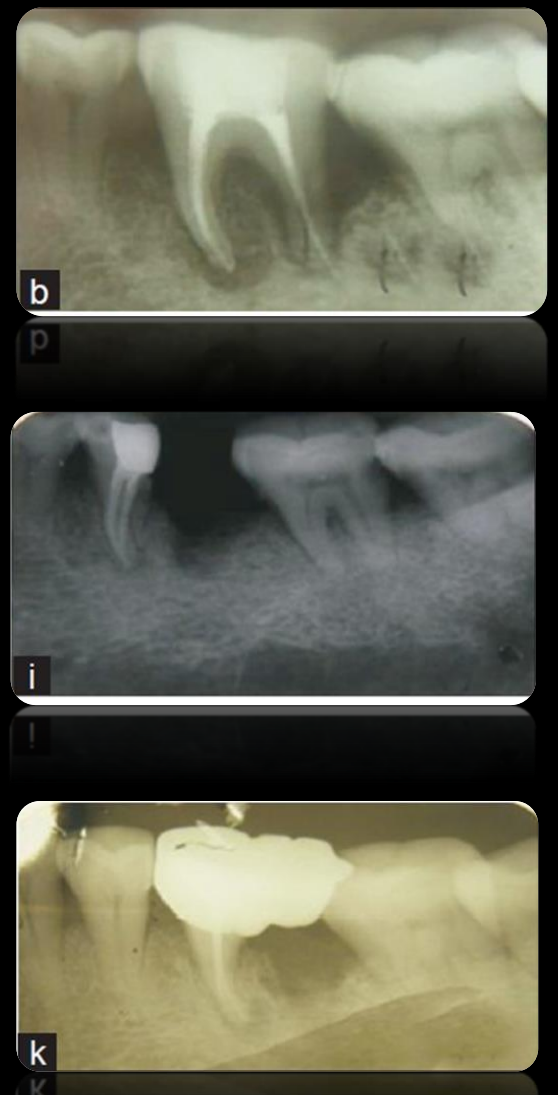
Resective - Factors

- Length of root trunk
- Divergence between root cones
- Length & shape of root cones
- Fusion between root cones
- Amount of remaining bone support around individual roots
- Stability of individual roots
- Access for oral hygiene devices
- Edentulous span
- Endodontics

Treatment – Surgical

Resective – Which root to resect

- Greatest amount of attachment loss
- Eliminate the furcation and produce an easily maintainable
- Greatest number of anatomic problems like severe curvature, developmental grooves or accessory and multiple canals
- Difficult for endodontist to treat
- Remove the root that best contributes to the elimination of periodontal problems on adjacent teeth



Treatment – Surgical

Resective – Sequence of resective therapy

- ***Endodontic treatment*** → *Structural integrity of root*; *Minimal root dentin removed*; *Direct filling with amalgam/composite*
- ***Provisional restoration***
- ***RSR***
- ***Periodontal surgery***
- ***Final Prosthesis***

MASSIMO DESANCTIS & KEVIN G.MURPHY

The role of resective periodontal surgery in the treatment of furcation defects

Periodontology 2000, Vol. 22

RESTORATIVE CONSIDERATIONS AFTER RSR

- *30% of root resected molars had residual roots and ledges subgingivally.*
- *Incomplete removal of furcation flutes and root concavities creates plaque-retentive factors that may lead to the recurrence of periodontal defects* ***- Nevins & Cappetta 1998***
- *In addition, the use of posts and cores should be avoided if possible to reduce the risks of root fracture* ***- Aabou-rass et al. 1982***
- *Narrow occlusal table and reduced cuspal inclines should be established to minimize excessive occlusal loads* ***- Newell 1998***

Study results evaluating root resection in furcally-involved molars

Study	# cases	Duration (years)	Total failures	Perio	Endo	Root fx	Caries
Bergenholtz (1972)	45	2–10	3 (6%)	2	1	–	–
Klavan (1975)	34	3	1 (3%)	1	–	–	–
Hamp et al. (1975)	87	5	0	–	–	–	–
Langer et al. (1981)	100	10	38 (38%)	10	7	18	3
Erpenstein (1983)	34	4–7	7 (20.6%)	1	6	–	–
Bühler (1988)	28	10	9 (32%)	2	5	1	1
Carnevale et al. (1991)	488	3–11	28 (5.7%)*	3	4	12	9
Carnevale et al. (1998)	175	10	12 (7%)	3	4	2	3

- Success rate 62% -100%
- Most failures were non-periodontal
- Perio failures 0-10%
- Endodontic complications & root fractures

Survival of molar teeth after resective periodontal therapy – A retrospective study. J Clin Periodontol 2012; 39

Lee KL, Corbet EF, Leung WK.

Factors affecting molar tooth survival after resective periodontal therapy:

Younger age at resection and splinting of resected teeth to neighbouring teeth conferred significant positive effects

Teeth with reduced pre-treatment radiographic bone levels on the root(s) and teeth with pre-resective mobility of Degree II or above were at risk of earlier loss.

COMMON REASONS FOR FAILURE AFTER RESECTIVE THERAPY

Root fracture – Over instrumentation,

Inadequate restoration

Poor tooth selection

Incomplete sectioning

Failure to diagnose other furcation

Failure to correct osseous deformities

Inadequate plaque control

Restorative materials in the treatment of furcation involvement

The goal was to improve plaque control by eliminating the automatic niches within the furcation where bacteria can accumulate

Zinc Oxide Eugenol cement

Silver Amalgam

GIC

Future

LASER - Photodynamic Therapy

- A study to evaluate the influence of ***Photodynamic Therapy (PDT)*** on bone loss in furcation areas in rats with experimentally-induced periodontal disease was conducted
  - **Concluded that within the parameters used in this study, PDT may be an effective alternative for control of bone loss in furcation areas in periodontitis**

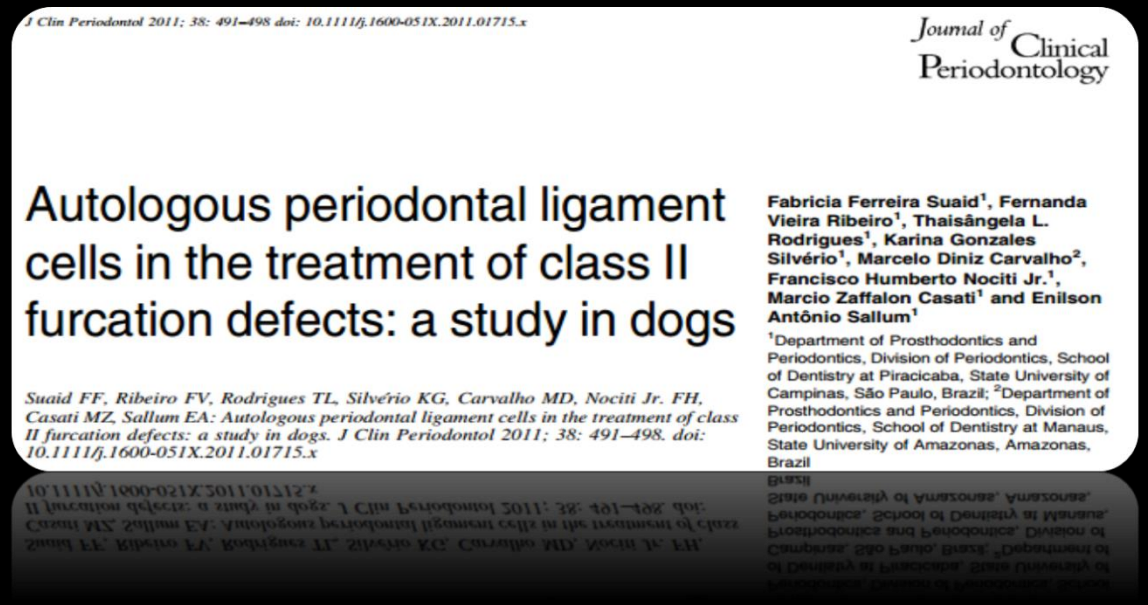
J Periodontol • September 2010

A Pilot Study Evaluating the Effect of Recombinant Human Bone Morphogenetic Protein-2 and Recombinant Human Beta-Nerve Growth Factor on the Healing of Class III Furcation Defects in Dogs

Xiang-Zhen Yan,*† Shao-Hua Ge,*† Qin-Feng Sun,*† Hong-Mei Guo,*† and Pi-Shan Yang*†

- This study found significant improvement in the quality & quantity of regenerated bone in furcation defects as observed by SEM and histological evaluation.
- Topical application of rhBMP2 and rhb-NGF may improve the quality and quantity of regenerated bone in artificially created Class III furcation defects of beagle dogs.

Future



J Clin Periodontol 2011; 38: 491–498 doi: 10.1111/j.1600-051X.2011.01715.x

Journal of Clinical Periodontology

Autologous periodontal ligament cells in the treatment of class II furcation defects: a study in dogs

Fabricia Ferreira Suaid[1], Fernanda Vieira Ribeiro[1], Thaisângela L. Rodrigues[1], Karina Gonzales Silvério[1], Marcelo Diniz Carvalho[2], Francisco Humberto Nociti Jr.[1], Marcio Zaffalon Casati[1] and Enilson Antônio Sallum[1]

[1]Department of Prosthodontics and Periodontics, Division of Periodontics, School of Dentistry at Piracicaba, State University of Campinas, São Paulo, Brazil; [2]Department of Prosthodontics and Periodontics, Division of Periodontics, School of Dentistry at Manaus, State University of Amazonas, Amazonas, Brazil

Suaid FF, Ribeiro FV, Rodrigues TL, Silvério KG, Carvalho MD, Nociti Jr. FH, Casati MZ, Sallum EA: Autologous periodontal ligament cells in the treatment of class II furcation defects: a study in dogs. J Clin Periodontol 2011; 38: 491–498. doi: 10.1111/j.1600-051X.2011.01715.x

Conclusion:

PDL cells in association with GTR may be a viable approach to promote periodontal tissue regeneration in class II furcation defects.

J Periodontol. 2012 Jan;83(1):61-9. doi: 10.1902/jop.2011.100769. Epub 2011 May 12.

Porous titanium granules in the treatment of mandibular Class II furcation defects: a consecutive case series.

Wohlfahrt JC[1], Lyngstadaas SP, Heijl L, Aass AM.

- Study showed that PTG is safe to use in close proximity to root surfaces, but no significant improvements in clinical endpoints of defect resolution were observed.

Maintenance therapy

- FOR INTERPROXIMAL FURCATION AREAS
  - Close proximity of roots complicates oral hygiene
  - Thin Birchwood sticks & superfloss are effective
  - When roots are not that close, interproximal brushes are effective
- FOR FACIAL OR LINGUAL FURCATIONS
  - Unitufted or interproximal brushes are useful

Extraction

- Extensive attachment loss
- Endodontic & Prosthetic Therapy??
- Treatment will not result in maintainable area
- Retaining involved tooth will not improve overall prognosis
- Risk factor for long term prognosis of overall treatment

Long term evaluation of furcation therapy

Loss of molars in periodontally treated patients: a retrospective analysis five years or more after active periodontal treatment.

Dannewitz et al

- Overall periodontal therapy results in a good prognosis of molars for at least 5 years.
- Degree III FI leads to a significant deterioration of prognosis particularly in maxillary molars.
- Beyond FI smoking, baseline bone loss, and number of molars left influence the survival of molar

How long do multirooted teeth with furcation involvement survive with treatment? *(Needleman I)*

Conclusion

- Good long-term survival rates (up to 100%) of multirooted teeth with furcation involvement were obtained following various therapeutic approaches.
- Initial furcation involvement (degree I) could be successfully managed by nonsurgical mechanical debridement.
- The most frequent complications included caries in the furcation area after tunnelling procedures.
- Vertical root fractures and endodontic failures were the most frequent complications observed following resective procedures.

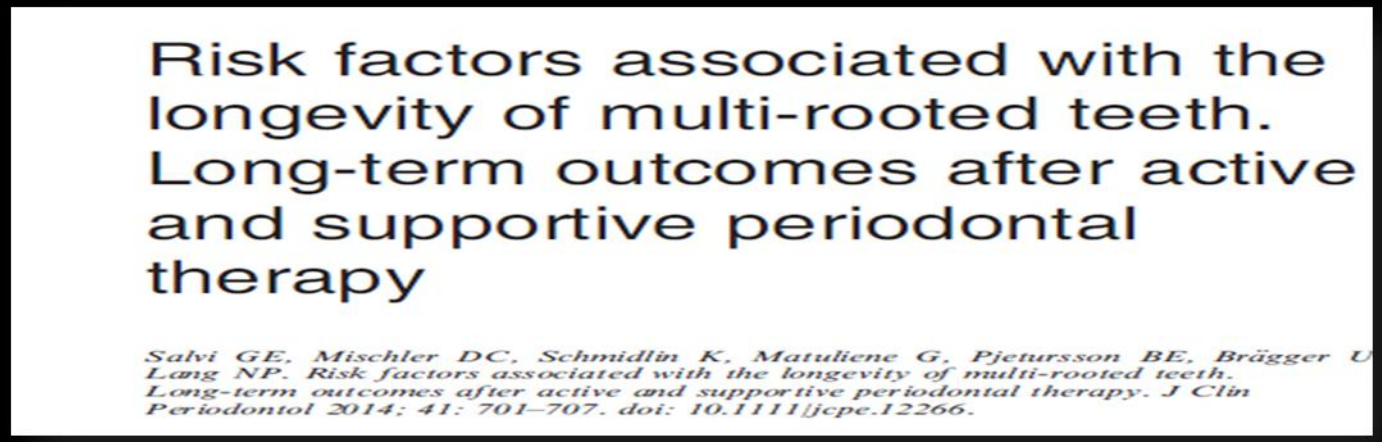
Evid Based Dent. 2010;11(2):38-9.

The prevalence and alterations of furcation involvements 13 to 16 years after periodontal treatment

Conclusion

- Molars with furcation involvements are more frequently lost than non furcation involved molars.
- The risk of losing an initially furcated molar increased with the degree of furcation involvement
- However, two thirds are still in function 13 to 16 years after treatment which indicate that molars with furcation involvements might survive long after periodontal treatment.

Karl-Johan Johansson,et al Swed Dent J 2013 ;37(2):87-95

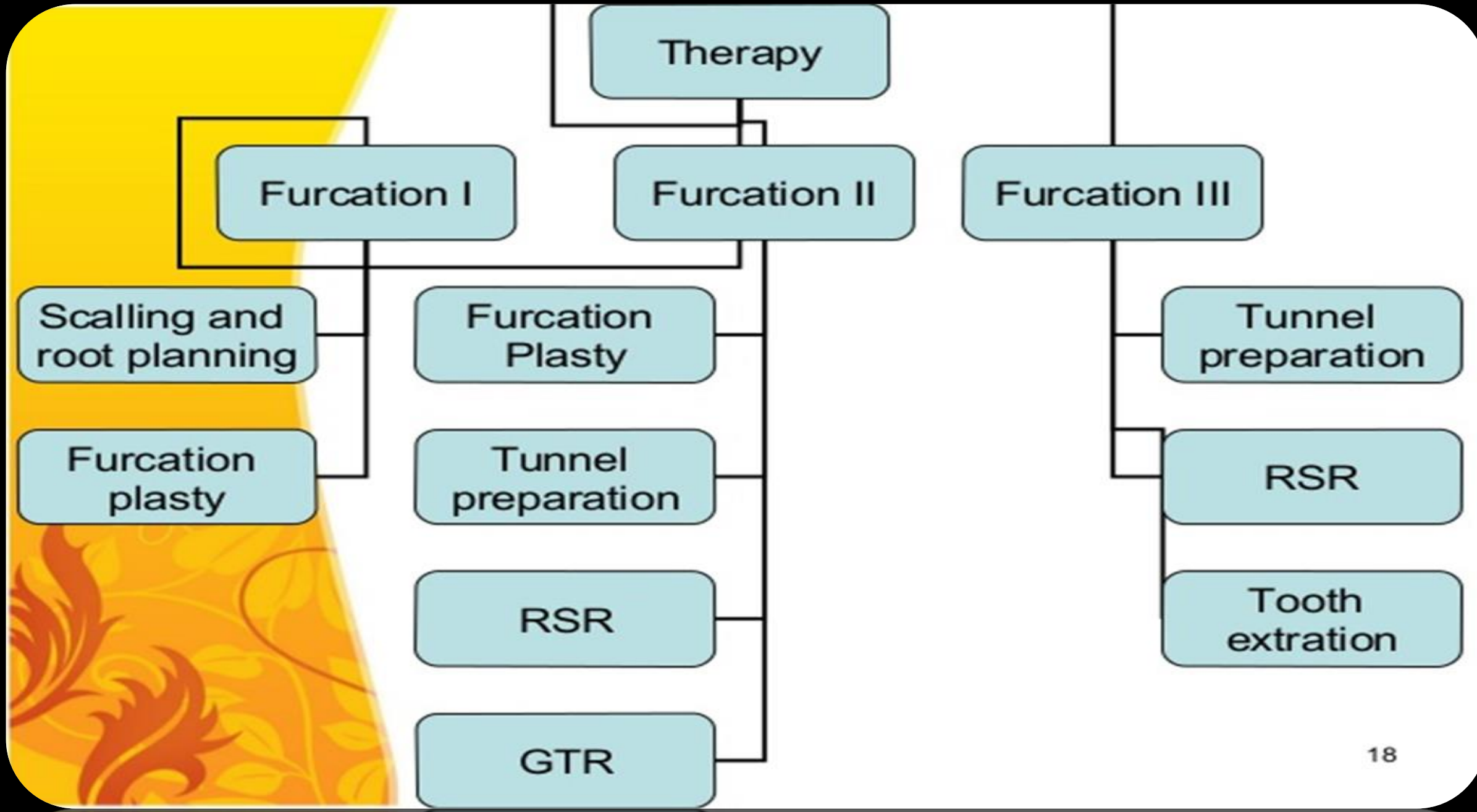


- *Class I furcation involvement was not a significant risk factor, compared to no furcation involvement*

- *Risk factors for multi-rooted tooth loss in subjects treated for periodontitis and enrolled into a maintenance program were class II and III furcation involvement, smoking and a lack of compliance*

- *Non-smokers and former smokers did not differ with respect to multi-rooted tooth loss*

- *Tooth loss was less frequent in the mandible than the maxilla*


Therapy
Furcation I
Furcation II
Furcation III
Scalling and root planning
Furcation plasty
Furcation Plasty
Tunnel preparation
RSR
GTR
Tunnel preparation
RSR
Tooth extration

The key to successful treatment of furcation involved teeth are the same as for any other periodontal problem

Early diagnosis

Thorough treatment plan

Good oral hygiene by the patient

Careful technical execution

Well designed & implemented maintenance phase

Thank u.....