Treatment options of furcation involved teeth
Introduction - Prevalence

- furcation (is the area located between individual root cones) = locus minoris resistentiae

- 16,26 are the most often affected, 3X more than lower molars
- The vestibular furcation is the most commonly affected followed by MP and DP
- first molars usually have shorter root trunks as second molars
Etiology
Enamel pearls and enamel projections are derived from Hertwig’s epithelial root sheath under CEJ.

- **Enamel projections**: lack of connective tissue attachment

- **Enamel pearls**: occur in 1-10% especially at the furcation area of maxillary second and third molars. They are often isolated, containing enamel and dentin, in some of the cases they contain pulpal tissues as well.

Maxillary praemolars

- in 40% of the cases maxillary first praemolars have 2 roots with furcation in mesiodistal direction, difficulties in cleaning.
- In 78% of the cases concavity on buccal root.
- Furcation usually located in the middle or apical third of the root.
- Pseudofurcation often occurs, that makes the diagnosis and periodontal treatment particularly difficult.
- Average distance between CEJ and furcation ~ 8 mm.
Classification of furcation defects I.

- with Nabers-probe - curved, colour-coded and is marked in millimeters
- based on horizontal penetration (Hamp et al, 1975)
- **Degree 0**: the area of furcation is not accessible
- **Degree I**: horizontal loss of periodontal support not exceeding one third of the width of the tooth (or 3 mm)
- **Degree II**: horizontal loss of periodontal support exceeding one third of the width of the tooth (3 mm), but not encompassing the total width of the furcation
- **Degree III**: horizontal “through-and-through” destruction of the periodontal tissues in the furcation area

Classification of furcation defects

F0

Nabers-probe

F1
Classification of furcation defects

F2

F3
Classification of furcation defects II.

- **Based on horizontal and vertical bone loss** (Tarnow et al. 1984)
- between the roof of the furcation and the existing bone
- Considers the degree of both vertical and horizontal bone loss more effective in evaluating the prognosis
  - A: 1-3 mm
  - B: 4-6 mm
  - C: 7 mm <

Tarnow D, Fletscher P. Classification of the vertical component of furcation involvement. J.Periodontol 1984;55:283
Classification of furcation defects II.
Wisdom tooth extraction in early age

- eruption of mandibular wisdom teeth often result in crowding of 1. and 2. mandibular molars
- resulting in hyperocclusion in the curve of Spee (like a „spur wheel“)

early extraction of lower 8 is beneficial
Factors influencing treatment outcomes

- Anatomical factors (supernumerary roots)
- Spreading of the defect
- Trauma from occlusion (differential diagnosis)
- Plaque retentive factors
- Number of affected furcations within the tooth and the quadrant
- Processes in pulp
- Anatomical variations (enamel pearls, enamel projections, supernumerary roots)
- Tooth mobility
Differential diagnosis - Trauma from occlusion

- could **enhance susceptibility** of periodontium to plaque-induced infection
- The tooth may exhibit increased mobility!!
- Occlusal adjustment must always precede periodontal therapy!
- If the defect has **occlusal origin**, following occlusal correction, the defect could disappear within weeks
Differential diagnosis - Endo-periodontal lesion
Treatment options of furcation lesions

Grade I

- Scaling, root planning
- Furcation plasty
- Regeneration?
Furcation plasty

**Therapy**

1. the dissection and elevation of a soft tissue flap – to obtain access
2. Scaling, root planning, the removal of the inflammatory soft tissue from the furcation area
3. **Odontoplasty**: the removal of crown and root substance in the furcational area to eliminate the horizontal component of the defect and to widen the furcation entrance.
4. **Osteoplasty**: the recontouring of the alveolar bone crest in order to reduce the buccal-lingual dimension of a bone defect
5. the positioning and the suturing of the mucosal flaps at the level of the alveolar crest in order to cover the furcation entrance

Following healing a „papilla-like” tissue should close the entrance
Furcation plasty
Treatment options of furcation lesions

Class II.

- (Furcation plasty)
- Regeneration (GTR, EMD, xenografts, PRP)
- Tunnel preparation
- Root separation and resection (RSR)
- Extraction
Regenerative strategies- Furcation lesions

- Furcation class I: complete regeneration is possible
- Furcation class II: can be converted to furcation class I.
- Furcation class III: histologically regeneration was not proven in human
- the lingual site is limited!

Regenerative strategies: combined therapy is suggested, except EMD + GTR:

- EMD + Graft
- EMD + Graft + GTR
- rhPDGF + Graft

Enamel matrix proteins (Emdogain, Straumann, Basel, Switzerland) compared with GTR technique

- A multicenter randomized controlled clinical trial, with paired mandibular molars with buccal degree II furcation involvements (Jepsen et al. 2004):
  - Mean reduction in the open horizontal furcation depth of 2.8 mm for EMD treated sites and of 1.8 mm for GTR-treated defects
  - In addition the frequency of complete closed furcation defects was higher for EMD sites (8/45) than for GTR sites (3/45).
  - It was concluded that both treatment modalities resulted in significant clinical improvements although the EMD method provided (1) greater reduction of the furcation depths, (2) a smaller incidence of post-operative pain/swelling, and (3) less gingival recession (Meyle et al. 2004) as compared to GTR therapy.
Dr. Csifó-Nagy Boróka
EMD, control x-ray 12 months later
Regeneration - GTR technique

- using the barrier membranes prevents the apical migration of epithelium
- may allow (guide) periodontal ligament cells to repopulate the detached root surface (Gotlow et al. 1986).
- Technique sensitive procedure → early exposure of the membrane and the fornix
- The predictability of this treatment outcome improves following GTR therapy if
  - the *interproximal* bone is located at a level which is close to the CEJ of the approximal surface ("key-hole type")
GTR-technique – non resorbable membrane

a buccal degree II furcation-involved mandibular first molar.

removal of the membrane 6 weeks later

1 year later

Regeneration - combined therapy I:
GTR-technika + xenograft + EMD

Dr. Nagy Pál
Regeneration - combined therapy I:
GTR-technika + xenograft + EMD

6 months later
Regeneration - combined therapy II:
GTR-technique + xenograft + EMD
Application of Bio-oss, Bio-Gide membrane and EMD in the defect
Application of Bio-oss, Bio-Gide membrane and EMD in the defect
Regeneration – combined therapy III: Xenograft + EMD+ SCTG

Regeneration - combined therapy III:
Xenograft + EMD+ SCTG

Baseline → 1 year later → 2 year later
Treatment options of furcation lesions

Class III

- Tunnel preparation
- Root separation (premolarisation = bicuspidation)
- Root resection (RSR)
- Extraction
Tunnel preparation

- Used to treat deep degree II and degree III furcation defects
- Includes the surgical exposure and management of entire furcation area of the affected molar
- Mostly at mandibular molars!!!
- Can be offered at molars which have a short root trunk, wide separation angle and long divergence between the roots
- Following the reflection of the flap, the granulation tissue in the defect is removed
- Hard tissue resection (osteoplasty) – to allow access for cleaning devices
- The flaps are apically positioned
- for patient with very good manual skill!!!
- Postoperativ: often root sensitivity => local fluoride varnish (Hamp et al,1975)
- Disadvantage: risk for root caries and root resorption (Feres et al. 2006.)
- Advantage: not needed endodontic treatment

Tunnel preparation


Dr. El-Hage Jade Bence
Prosthetic rehabilitation 6 months later
Root separation and resection (RSR) - hemisection

- Radical, if there isn’t other option for save of the tooth
- **Before the treatment**: lege artis root canal treatment
- 2 steps: separation and extraction
- temporary prosthetics solutions with occlusal correction
- 2-3 months observation period – until the end of the early healing
- definitive prosthetic solution 8-12 months later after the treatment
Aspects - anatomy important!

- The length of the root trunk (short root trunk may be favourable for RSR)
- The divergence between the root cones (small divergence => problem with the separation, orthodontic movement?, odontoplasty)
- The length and the shape of the root cones (small, short root => prosthetic solution?)
- Fusion between root cones, pseudofurcation (maxillary praemolars)
- Amount of remaining support around individual roots (long-term prognosis)
- Stability of individual roots (following root separation)
- Access for oral hygiene devices (suitable?)
Root resection
Separation and removal of DB root (#26)

1 year later
Premolarisation (bicuspidyization)

Premolarisation: combination of tunnelisation and hemisection. None of the roots are removed, both of them take part separately in the prosthetic rehabilitation. If the roots are too close to each other orthodontic treatment can be applied to create space between them.

(Carnevale et al. 1991, 1998)
Separation (bicuspiderization) and resection

Premolarization at first molar and root resection at second molar
Aspects of the prosthetic rehabilitation at the periodontological compromised teeth

Dissection and premolarization, Prosthetic solution: removable telescopic splint

CASE – premolarisation and final prosthetic restauration of the tooth No. 36

Dr. Bányai Miklós
premolarisation and final prosthetic restauration of the tooth No. 36
Root resection

CASE: dissection and resection of buccal roots at teeth No. 16,26
Regenerative surgery with GTR-technique at upper left quadrant: Bio-Gide+ Bio-Oss and autologous bone (and dissection of tooth No. 26)


Definitive prosthetic rehabilitation
Compared to initial x-ray status
Treatment options of furcation involved teeth

Prosthetic rehabilitation of furcation involved teeth
• keeping in mind furcation entry
• Concavity of the marginal area
• Furcation entry should be cleansable!!!
CASE: DB root resection of tooth No. 26
- Root resection (hemisection)
- Tunnel preparation
- Premolarization (bicuspidity)

CASE: 26: root resection: DB premolarization: MB and P roots

Dr. Nagy Pál
Root resection (hemisection)  
Tunnel preparation  
Premolarization (bicuspization)

CASE: 26: root resection: DB, premolarization: MB and P roots  

RTG  
1 year later
26: DB root resection, premolarization of MB and P roots,
27: P root resektion and tunnelization of MB and DB roots
Key factors in the design of the framework in case of dissected/premolarized roots:

- Concavity of the framework at the marginal area!
- Margin of the crown should be metal or zirconia
- The connector parts of the framework should be curved and left uncovered (without ceramic)

26: DB root resection, premolarization of MB and P roots,
27: P root resektion and tunnelization of MB and DB roots
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Extraction
Thank you for your attention!