

**Furcation Involvement-An Insight**

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**Citation of this Article:** Dr. Hemalatha D. M., Dr. Anil Melath, Dr. Subair K, Swathi S, Swetha R, “Furcation Involvement-An Insight”, IJDSIR- April – 2024, Volume – 7, Issue - 2, P. No. 51 – 56.

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**Type of Publication:** Review Article

**Conflicts of Interest:** Nil

**Abstract**

Furcation involvement has treatment has been of paramount importance in periodontal treatment. Clear knowledge and understanding of furcation of multi-rooted teeth is imperative. This article gives information about, what this furcation involvement, how it is caused, and the anatomy of the tooth for a better understanding of the defect and to identify the exact area of involvement of the tooth. This review covers the extent from the anatomy, classification systems of furcation along with the treatment aspects of it.

**Keywords:** Periodontitis, furcation, diagnosis and treatment.

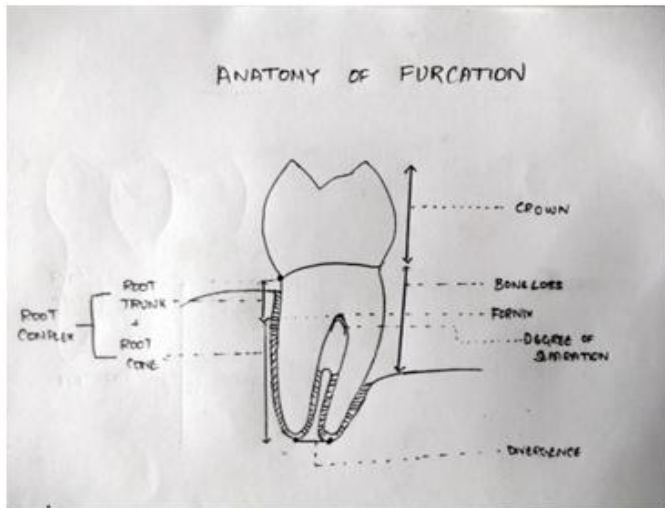
**Introduction**

Furcation involvement is also called furcation defect which is characterized by loss of bone and periodontal attachment in multi-rooted teeth where roots separate (furcation). This bone resorption is mainly due to microbial colonization in furcation areas and the unique anatomy of these areas. The most affected teeth are maxillary first premolars, maxillary and mandibular molars.[1] The possible etiology of furcation involvement are plaque-associated inflammation, trauma from occlusion, dental caries, vertical root fractures, and anatomical factors.

The main cause of this defect is microbial dental plaque. The colonies of microorganism are found on the outer

surface, like biofilm. This leads to inflammation and extension of this to the root surface causing bone resorption and furcation defect. Trauma from occlusion is also a cause in furcation involvement [5]. This is the suspected contributing factor in isolated furcation involvement cases. Lindhe and Svanberg in 1974 stated that trauma from occlusion with gingival inflammation implicated more bone loss.[2]

### Anatomy



The anatomy of the furcation, with concavities, enamel projections, and ridges, often below the gingival margin, favors further microbial accumulation leading to periodontal disease progression and eventually tooth loss. Root complex is defined as the portion of a tooth located apical to the cemento-enamel junction which is normally covered by root cementum. In case of multi-rooted teeth, the root complex is divided into root trunk which represents the undivided region of the root, extending from CEJ to the separation line (furcation) between two roots, and root cones which represent the divided region of the root complex or root, they vary in size and position and may be connected to or separated from other root cones.

Furcation entrance is the area between the undivided and divided part of the roots while the furcation fornix is the

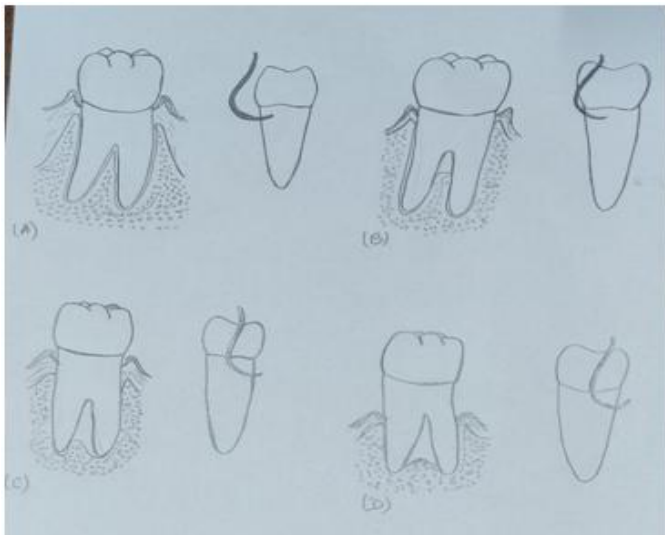
most coronal portion or roof of the furcation. The degree of separation is defined as the angle of separation between root cones while divergence is the distance between two roots. The coefficient of separation is the proportion between the length of root cones and the length of the root complex.

The topography of furcation of maxillary and mandibular molars was described by Svärðström and Wennström. The first and second maxillary molars have three roots – mesiobuccal, distobuccal, and palatal. Here the distobuccal and palatal roots are circular whereas the distal surface of the mesiobuccal root has a concavity of about 0.3mm deep giving it a characteristic hourglass shape. The mandibular molars have two roots where the distal is circular and the mesial has an hourglass shape. The entrance to the furcation in extracted teeth is found to be <1mm and <0.75mm in half of the examined molars.

Cervical enamel projections are also often found in molars, especially in Asian populations. They facilitate plaque accumulation and prevent connective tissue attachment, thus contributing to etiology of furcation lesions. Enamel pearls are ectopic globules consisting mostly of enamel and a core of dentin, which adhere to the furcation area. They affect 1-10% of molars which potentially contribute to periodontal furcation pathology.[1]

### Classification

There are different types of classification for furcation involvement. One of the first proposed classifications was the one by **Glickman**, which is the most widely used classification:



**Grade I** involvement: The periodontal pocket is supra-bony with involvement of soft tissues, there is also slight bone loss in the furcation area. IT is also called as incipient or early lesion. (A)

**Grade II** involvement: The bone is destroyed but a portion of the alveolar bone and periodontal ligament remain intact, thus allowing only partial penetration of the probe into the furcation area. (B)

**Grade III** involvement: The inter-radicular bone is completely absent but the facial and lingual orifices of the furcation are occluded by the gingival tissue. Therefore, the furcation cannot be seen clinically but it is essentially a through and through tunnel. (C)

**Grade IV** involvement: The inter-radicular bone underneath the roof of the furcation is completely destroyed. Gingival tissue has receded apically so that the furcation is clinically visible. (D)

In 1975, **Hamp, Nyman and Lindhe** proposed a classification referring to horizontal attachment loss:

**Degree I:** Horizontal attachment loss < 3mm of the total width of the furcation area.

**Degree II:** Horizontal attachment loss > 3mm but not encompassing the total width of the furcation area.

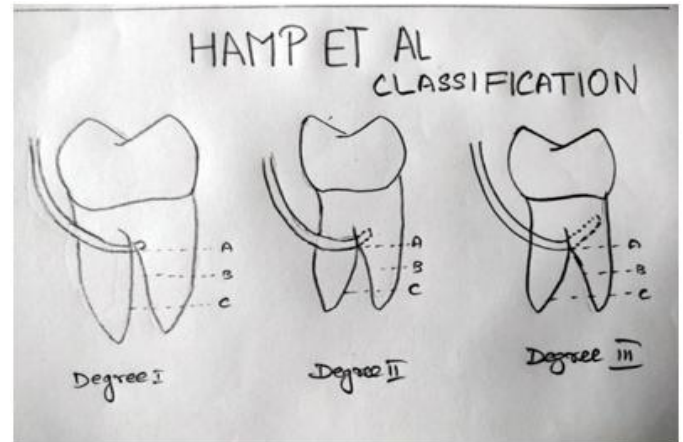
**Degree III:** "Through and through" destruction of the periodontal tissue in the furcation area.

Later on, a sub-classification referring to vertical bone loss was introduced:

**Subclass A:** Vertical bone loss of 3mm or less.

**Subclass B:** Vertical bone loss of 4 to 6mm.

**Subclass C:** vertical bone loss of 7mm or more.[3]



### Clinical Diagnosis of furcation Involvement

Furcation involvement is best detected using radiographs and probing techniques. The most common and accurate probe used is **Naber's probe No.1 and No.2**. The detection technique is by moving the tip of the probe to the presumed location of furcation and the probe is curved into the furcation entrance. [1]



### Radiographic Diagnosis of Furcation Involvement

IOPA and OPG are used in the radiographic analysis of furcation. When the radiograph of maxillary molars were analyzed for furcation involvement, a small triangular radiographic shadow can be seen over the mesial or distal roots in the proximal furcal areas which is commonly mentioned as furcation arrows. Cone beam computed tomography (CBCT) has been validated *in vivo* for the assessment of furcation involvement of

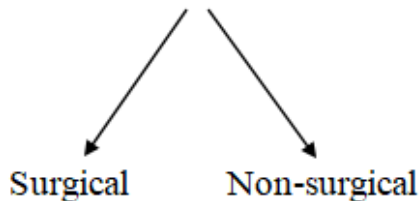
maxillary molars. The three-dimensional findings show the surrounding bony support of each maxillary molar root, fusion or proximity of roots, periapical lesions, and root perforations.

#### **Risk of tooth loss**

Plaque removal inside the furcation is a difficult task for both the patient and the clinician. Therefore it is assumed that teeth affected by furcation is more exposed to bacterial challenge and has a higher risk of tooth loss.[1]

#### **Treatment**

Treatment of furcation involvement is done by two methods:



#### **Non-surgical treatment:**

Root surface debridement and self-performed oral hygiene are very challenging in furcation involved teeth due to limited access to small furcation entrance and difficult to reach root concavities present in inter-radicular areas.

- Ultrasonic scalers: More effective than hand instruments. They have smaller tips designed to reach narrow and deep furcation areas
- Diamond-coated ultrasonic and sonic scalers: Effective but more aggressive, removing cementum and dentine.
- Slimline furcation-customized ultrasonic tips and micro-mini curettes: Recommended for professional furcation development.

Good oral hygiene also plays an important role in maintaining furcation. Pointed end tufted powered brush is more effective for removing plaque in the furcation

areas. In the case of inter-proximal furcation, inter-dental brushes can be used when compared to floss. [1]

#### **Surgical treatment**

Surgical treatment includes:

- Access flap surgery/Open flap debridement
- Resective furcation surgery
- Root resection/amputation
- Hemisection and trisection
- Root separation
- Tunneling

In cases of class II furcation, favorable outcomes on regeneration with bone grafts have been established. In case of respective procedure selection it is based on two strategies:

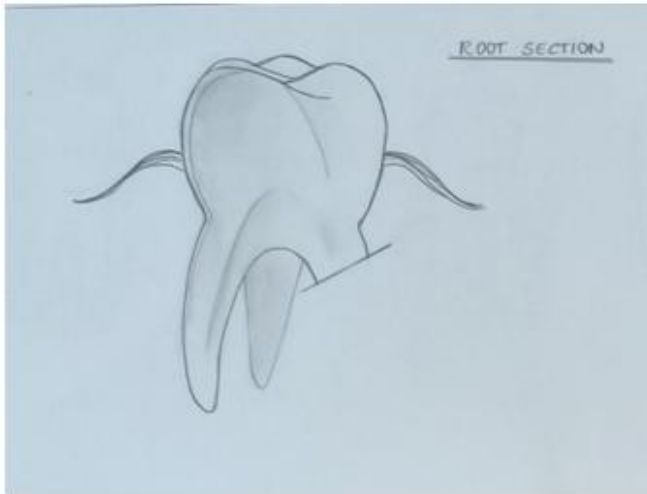
- Elimination of the niche created by FI by removal of roots.
- Providing access for individual and professional hygiene to the involved furcation.

#### **Root resection/amputation**

Removal of the root of multirooted tooth regardless of how the crown is treated. Mainly done in maxillary molars.[6]

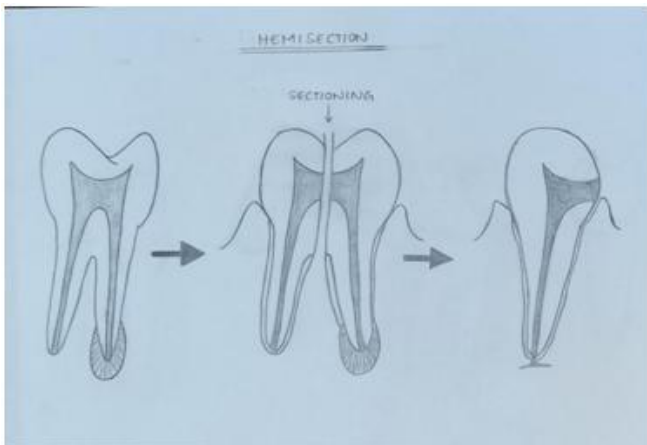
However, the mandibular molar which are indicated for this procedure are connected by a crown block or a bridge to neighboring teeth the leverage of eccentric occlusal forces is compensated.

And if teeth that has to undergo resection is restored by adhesive composite techniques after root canal treatment the root canal of the root to be resected should be enlarged in the coronal third which is then to be restored with composite using dental adhesive. [1]



### Hemisection

Hemisection is simultaneous removal of tooth with the respective part of the crown from a two rooted tooth. Hemisection is preferred in teeth that beyond FI exhibit defects substantially deteriorating the prognosis of one root compared with the other. It often creates a gap that needs a prosthodontic treatment. [1]



### Tunneling

This technique allows the patient access to the furcation area to keep teeth vital. The technique is appropriate particularly for mandibular molar with a mesial and distal root and a buccal and lingual furcation entrance. This is used in class II and class III defects. Resecting the alveolar bone the furcation area is enlarged, so that oral hygiene aid get access. [6]



### Conclusion

Successful treatment of furcation involvement can be established by the correct diagnosis, treatment and maintenance. The regular post-op visits reduces risk of recurrence and enhances the prognosis of the involved tooth.

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