Annals of R.S.C.B., Vol. 24, Issue 1, 2020, pp. 239 - 247
Received 18April2020; accepted 23June2020

# A Comprehensive Reviewcurrent Trends and Future Perspectives In Management Of Furcation Defects

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**ABSTRACT**

Furcation is a complex anatomical structure which when invaded cam be a sign of advanced periodontal disease. It mainly occurs due to a bacterial etiology but can also be attributed to a traumatic occlusion and pulpal pathologies. The management of furcation lesions requires a comprehensive diagnosis, and good clinical treatment skills. Initial lesions can be managed with a thorough non-surgical therapy whereas advanced lesions may require surgical procedures such as hemisection or radisection. This paper reviews all the aspects of periodontal furcation involvement and the management aspects.

**Keywords: Furcation, multirooted, hemisection,radisection,tunnelling**

## I. Introduction

Inflammatory periodontal disease, if unabated, ultimately progresses to attachment loss sufficient to affect the bifurcation or trifurcation of multirooted teeth. The furcation is an area of complex anatomic morphology that may be difficult or impossible to debride by routine periodontal instrumentation. The presence of furcation involvement is a clinical finding that can lead to a diagnosis of advanced periodontitis and potentially to a less favorable prognosis for the affected tooth or teeth.Thus furcation involvement presents both diagnostic and therapeutic dilemmas. The furcation lesion has been defined as 'the pathologic resorption of bone in the anatomic area of a multirooted tooth where the roots diverge'". [1]

## II. Incidence and prevalence

In periodontitis patients greater than 40 years of age, all second molars have furcation involvement. The maxillary molars are most commonly affected followed by the mandibular molars and maxillary premolars. Prevalence in maxillary and mandibular molars range from 25% to 52% and from 16% to 35%, respectively.[2]Svardstrom & Wennstrom in 1996 reported that, from the age of 30 years onward, about 50% of molars in the maxilla show at least 1 furcation site with deep involvement, while in the mandible a similar prevalence was first observed after the age of 40. [3]Also, greater severity of furcation involvement in seen in smokers.[4]

## III. Etiologic Factors

The etiologic factors include bacterial plaque and the inflammatory consequences that result from its long-term presence- primary factor, the extent of attachment loss required to produce a furcation defect is related to local anatomic factors (e.g., root trunk length, root morphology) and local developmental anomalies (e.g., cervical enamel projections [ceps]).Studies indicate that prevalence and severity of furcation involvement increase with age.Dental caries and pulpal death may also affect a tooth with furcation involvement or even the area of the furcation.

## IV. Diagnosis of furcation defects

**Clinical examination** Careful probing has to be performed to determine the presence and extent of furcation involvement,the position of the attachment relative to the furca and extent and configuration of the furcation defect.Probing the furcation is of important diagnostic value. Mesial-palatal furcation entrance of the maxillary first molar is located closer to the palatal third of the tooth. Hence probing is done from palatal aspect. Distal-palatal furcation is in the middle portion of the tooth, hence can be probed from buccal and palatal aspects. In case of the mandibular molars, the distal concavity of the mesial root is more pronounced than that of the distal root.[5]Furcation fornix is inclined in the bucco-lingual direction with lingual entrance more apical than buccal entrance.[5]Nabers probe is usually used to enter and measure difficult to access furcal areas. Transgingival sounding may further define the anatomy of the furcation defect. The goals of probing areto identify and classify the extent of furcation involvement and to identify factors that may have contributed to the development of the furcation defect or that could affect treatment outcome.

### Furcation bone sounding:

This method is a trans-gingival probing technique that is used, under anaesthesia, to plot the morphological outline of the furcation defect.[6]The average difference between furcation bone sounding measurements and surgical measurements is 0.4 to 0.5 mm. [7]Additionally, in another study Suh et al. (2002) reported vertical and horizontal open bone levels to be 0.9 to 1.1 mm deeper than probing bone levels.[8]

### Perioscope

It is introduced subgingivally to visualize furcation. It consists of re-usable fiber optic endoscope which fits onto the periodontal probes & ultrasonic instruments that have been designed to accept it.[9]

## V. Surgical measurements

Various methods have been proposed for direct measurements following surgical exposure of the furcation defect, which gives the most accurate values. It can be done using open bone measurements with probes or by impression methods. Furcation measurements is obtained by taking an impression of the furcation area, Luder et al. (1998) and the volume of the furcation defect measured using a Leitz stereomicroscope.[10]

**VI. Radiographic diagnosis**

Traditionally, radiographic assessments in conjunction with clinical probing have been the chief diagnostic methods for detecting and characterizing furcation involvement. Slightest radiographic change should be investigated clinically such as diminished radio density and whenever there is marked bone loss in relation to a single molar root, it may be assumed that the furcation is also involved. Furcation arrow can be detected at class II furcations and they are predictive only 70% of the time.

**VII. Role of CBCT**

Various authors have reported that furcation involvement can be differentiated into Class I, II and III furcations clearly with both CT and CBCT.[11] Image quality of the CBCT scans were superior to the CT scans. In comparison with intraoral radiographs, studies have shown a significant advantage of CBCT very reliable tool for detecting incipient furcation involvement.[12] CBCT measurements are also a reliable alternative to surgical measurements.[13]

**VIII. Classification**

There are various classification systems being proposed for furcation involvement. The widely used among them are the Glickman (1953)[14]and Tarnow and Fletcher classification (1984).[15]

**Glickman Classification, 1953**

Glickman classified furcations in 4 grades where Grade I incipient Furcation is an early lesion. The pocket is suprabony, involving the soft tissue. There is slight bone loss in the furcation area. Radiographic change is not usual since bone loss is minimal. A periodontal probe will detect root outline or may sink into a shallow V-shaped notch into the crestal area.The level of bone loss allows for the insertion of the periodontal probe into the concavity of the root trunk.Grade II Cul-de-sacdefect bone is destroyed in one or more aspects of the furcation, but a portion of the alveolar bone and periodontal ligament remain intact, permitting only partial penetration of the probe into the furcation.Radiographs may or may not reveal this type of furcation.In Grade III Communicating or Through & Through Furcation. The probe penetrates completely from one side to the other side characterized by severe bone destruction in the furcation area. It is clearly shown in the radiographs as a radiolucent area in between the roots, especially in the lower

molarsGrade IVsimulates grade III, but the gingival tissues recede apically so that furcation is clearly visible.

**Tarnow and fletcher, 1984**

They measure the vertical component of furcation, and is measured as a distance from furcation roof to level of crestal bone present. They are divided into 3 subclasses which includes **SUB-CLASS A**1-3 mm, **SUB-CLASS B** 4-6 mm and **SUB-CLASS C** ≥ 7 mm.

**IX. Management**

**Objectives of treatment**

The objectives of treatment includeelimination of the microbial plaque from the exposed surfaces of the root complex, establishment of an anatomy of the affected surfaces that facilitates proper self-performed plaque control,to obliterate furcation defects to reduce periodontal maintenance problem, to arrest progression of disease and to restore compromised dentition by regeneration of functional attachment apparatus.

**X. Nonsurgical Therapy**

**Oral Hygiene Procedures**

Nonsurgical therapy is a very effective way of producing a satisfactory stable result. Once furcation breakdown has begun, the clinical result is always somewhat compromised. Both surgical and nonsurgical therapies have been shown to work effectively over time.Non-surgical therapy, a combination of oral hygiene instruction and scaling and root planing, has provided excellent results in some patients. Obtaining access to the furcation requires a combination of the awareness of the furcation by the patient and an oral hygiene tool that facilitates that access. Many tools, including rubber tips, periodontal aids, both specific and general toothbrushes, and other aids have been used over time for access to the patient.

**Scaling and Root Planing**

Bower in 1979 concluded that 58% of furcations will not be entered by typically using curettes.[5] Hence DeMarco curettes, diamond files, Quentin furcation curettes, and Mini Five Gracey Curettes can be used for planning furcation areas. Svardstrom and Wennstrom(2000) furcations could be maintained using nonaggressive techniques over a 10-year period in patients who were participants in consistent maintenance.[16]Other studies also illustrate that maintenance therapy is useful for patients to facilitate furcation cleanliness. Ribeiro and colleagues(2009) demonstrated that nonsurgical therapy can effectively treat class II furcation involvements,but using povidone-iodine did not provide additional benefits to subgingival instrumentation.[17]

**Surgical vs Non-surgical Access**

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Fleischer et al. (1989), found surgical access and operator experience were found to increase the efficacy of calculus removal in furcation areas, although total calculus removal was rare with any of the examined approaches.[18]Wylam et al. (1993), found no statistical difference with respect to the effectiveness of calculus removal in furcations between non-surgical (93.2% residual plaque and calculus) and surgical access (91.1%).[19]

## XI. Surgical Therapy

The main aim of surgical therapy is to provide access for the patient to the furcation area in order to maintain good oral hygiene. Surgical therapy can be done by osseous resectionor regeneration.

### Furcationplasty

Furcationplasty is a resectivetreatment modality which should lead to the elimination of the inter-radicular defect. Tooth substance is removed (odontoplasty) and the alveolar bone crest is remodelled (osteoplasty) at the level of the furcation entrance.

### Tunnelling

Tunnel preparation is a technique used to treat deep Degree II and Degree III furcation defects in mandibular molars.This type of resective therapy can be offered at mandibular molars which have a short root trunk, a wide separation angle, and long divergence between the mesial and distal root. The surgery involves exposure and management of the entire furcation area by apically repositioning the flap in the affected molar. Hellden et al found a 93.3% success rate in tunnelling procedures.[20]

### Root Resection

It is indicated in multirooted teeth with class II to IV furcation involvement**.**Root resection may be performed on vital teeth or endodontically treated teeth. It is preferable to have endodontic therapy completed before resection of a root or roots.[21] It is mainly indicated in severe vertical bone loss on one root of a multirooted tooth not amenable for regeneration, furcation involvement not treatable / maintainable, periodontally involved abutment with hopeless one root, vertical or horizontal root fracture and when endodontic therapy is impossible on one root of multirooted tooth. Contraindications include advanced bone loss around more than one root with unfavorable crown-root ratio, fused roots that cannot be separated, if remaining root(s) would be inadequate to serve as prosthetic abutment, poor socio-economic conditions and inadequate oral hygiene maintenance.

The most commonly resected root is distobuccal of maxillary first molar due to less surface area and divergence. Mesiobuccal is usually retained as they have more surface area and a hour glass shape,in alignment with premolar and centrally located.In case of mandibular molar furcation involvementseparate and maintain both the roots (bicuspidisation) or separate and remove mesial or distal root.

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## XII. Hemisection

Hemisection is the splitting of a two-rooted tooth into two separate portions. Hemisection is most likely to be performed on mandibular molars with buccal and lingual class II or III furcation involvements.In case of root resection, molars with advanced bone loss in the interradicular and interproximal areas are not indicated for hemisection. After sectioning of the teeth, one or both roots can be retained.

## Root Resection or Hemisection Procedure

The root resection procedure involvesafter appropriate local anesthesia, a full-thickness mucoperiosteal flap is elevated. The flap should provide adequate access for visualization and instrumentation and minimize surgical trauma.After debridement, resection of the root begins with the exposure of the furcation on the root to be removed.The removal of a small amount of facial or palatal bone may be required to provide access for elevation and facilitate root removal. A cut is then directed from just apical to the contact point of the tooth, through the tooth, and to the facial and distal orifices of the furcation.This cut is made with a high-speed, surgical-length fissure or crosscut fissure carbide bur. A vertically oriented cut is made faciolingually through the buccal and lingual developmental grooves of the tooth, through the pulp chamber, and through the furcation. After sectioning, the root is elevated from its socket**.** Removal of the root provides visibility to the furcation aspects of the remaining roots and simplifies the debridement of the furcation with hand, rotary, or ultrasonic instruments. After resection, the flaps are then approximated to cover any grafted tissues or slightly cover the bony margins around the tooth.Sutures are then placed to maintain the position of the flaps. The area may or may not be covered with a surgical dressing.

## XIII. Regeneration

Furcation defects with associated three-walled or two-walled intrabony defects are suitable for regenerative procedures. These vertical bony defects respond satisfactorily to a variety of surgical procedures such as bone grafts and guided tissue regeneration membranes.Tsao and associates found that lesions that were grafted had greater vertical fill than areas treated with open flap debridement alone.Bowers and colleagues concluded that furcation bone grafting using various membranes can improve the clinical status of these lesions.

## XIV. Restorative treatment of furcation involvement

The goal was to improve plaque control by eliminating the automatic niches within the furcation where bacteria can accumulate.Klingsberg et al(1981)advocated the use of polymeric reinforced zinc oxide-Eugenol (IRM) & reported clinical success for up to 5 years.[22]Kalkwart and Reinhardt(1988) reported in their clinics progressive bone loss around ZOE material and increased plaque retention.[23]Van Swol et al.(1993) utilized amalgam restoration to fill grade-II furcation invasions. But on 1 year radiographic follow-up, noted radiolucency at the base of the

restoration.[24]Dragoo(1997) demonstrated histologic evidence that both epithelium and connective tissue can adhere to the resin ionomer when placed in a subgingival environment.[25]

## XV. Extraction

It is mainly indicated in through-and-through furcation defects (classes III and IV) and advanced attachment loss, individuals who cannot or will not perform adequate plaque controlhigh level of caries activity, who will not commit to a suitable maintenance program, who have socioeconomic factors that may preclude more complex therapies, root perforation and inability to achieve regeneration.

## XVI. Prognosis

With proper tooth selection,treatment and restoration a success rate of 85-100% is possible.[26]It is based on morphology of the bone deformity, root anatomy tooth morphology, chronicity of the destructive process, clinical crown to clinical root ratio, mobility and therapists knowledge and skill. Grade I & II furcation have good prognosis, Grade III (early stage) havefair prognosis and Grade III (advanced) & IV havepoor prognosis. Prognosis is poor for short, tapered roots and relatively large crowns.Because of disproportionate crown to root ratio and reduced root surface available for periodontal support, the periodontium is more susceptible to injury by occlusal forces.

## XVII. Conclusion

The successful management of periodontal destruction in the Furcal region, requires a comprehensive understanding of the difficulties in instrumentation of the area as well as in keeping the region free of plaque. The key to long-term success in management of furcation defects appears to be (1) thorough diagnosis, (2) selection of patients with good oral hygiene, (3) excellence in nonsurgical therapy, and (4) careful surgical and restorative management.

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