Case Report

# Tunneling: A treatment modality for furcation involved teeth –A case report

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**ABSTRACT**

Treating molar teeth with furcation involvement presents a difficult challenge to the clinician though a number of differing treatment options are available. Of these the tunneling procedure has been studied least often. The tunneling procedure is designed to create access for cleansibility and maintenance within the furcal area of a molar tooth which has incurred severe attachment and bone loss due to periodontal disease. If perfect compliance with plaque control is maintained, it can prove as a less invasive, cost effective treatment modality.

**Key words**: grade ii, grade iii furcation involvement, tunneling procedure

## INTRODUCTION

Furcation areas present some of the greatest challenges to the success of periodontal therapy. Higher mortality and compromised prognoses for molars with furcal involvement have been reported in several retrospective studies of tooth loss. Additionally, reduced efficacy of periodontal therapy has been consistently found in multirooted teeth with furcal involvement, regardless of the treatment modality employed.

A furcation is defined as ''the anatomic area of a multirooted tooth where the roots diverge'', and furcation invasion refers to the ''pathologic resorption of bone within a furcation''. [1]

Prevalence of furcation involved molars is higher in maxilla than in mandible. From age of 30 years, 50% of 1st and 2nd molars in maxilla showed at least 1 furcation site with deep involvement. In mandible similar prevalence observed first after age of 40 years. Highest frequency is found at distal site of maxillary 1st molar (53%), whereas mesial aspects of maxillary 2nd molar showed lowest frequency (20%).[2]

The examination of teeth should include both periodontal probing and radiographic analysis. Clinical examination is done by using Naber's periodontal probe, explorer or a small curette.

Indices for furcation involvement are based on the horizontal measurement of attachment loss in the furcation,[3,4] or a combination of horizontal and vertical measurements,[5] or a combination of these findings with the localized configuration of the bony deformity.[6]

Glickman[3] classified furcation involvement into four grades; Grade I to Grade IV.

Grade I: Incipient lesion, no radiographic changes

Grade II: Cul de sac lesion, some amount of bone present in furcation, defects do not communicate, can be seen radiographically

Grade III: Bone is not attached to dome of furcation, furcation entrance covered by soft tissue

Grade IV: Soft tissue recession exposing furcation opening, probe passes through and through.

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Primary etiologic factor in development of furcation defects is bacterial plaque and inflammatory consequences that result from its long-term presence. Extent of attachment loss required to produce a furcation defect is variable and related to local anatomic factors (e.g., root trunk length, root morphology) and local developmental anomalies (e.g., cervical enamel projections).

Other factors include occlusal origin, pulpal pathology, combined lesions, iatrogenic factors, root fractures involving furcations and local anatomic factors.

Treatment of Furcation Defects

The objectives [7] of furcation therapy are:

1. The elimination of the microbial plaque from the exposed surfaces of the root complex.
2. The establishment of an anatomy of the affected surfaces that facilitates proper self-performed plaque control.

Different methods of therapy are:

- Nonsurgical periodontal therapy
- Open flap debridement
- Furcation plasty
- Regenerative techniques; GTR, bone grafts, EMD
- Root resection/ Hemisection
- Tunneling

Management of furcation-involved teeth is one of the more complex challenges in periodontal therapy and the anatomy of the furcation impedes accessibility for professional root debridement.[8] The selection of therapeutic mode varies with the grade of furcation involvement, the extent and configuration of bone loss, and other anatomic factors.

Furcation sites have repeatedly shown to respond less favourably to conventional periodontal treatment than flat surfaces.[9,10] and also molar furcation sites were more likely to lose further attachment than flat molar and non-molar surfaces during a 2-year postoperative period (21% versus 7% and 11%) [9] and (25% versus 10% and 7%).[10]

Reasons for compromised results in furcation areas include the lack of proper access for instrumentation due to furcation anatomy and, consequently, a persistence of pathogenic microbial flora.[11]

Resective therapy, with the aim of eliminating all plaque retaining factors, has been utilized in periodontal defects, with advanced horizontal bone loss and grade II or III furcation involvement[12]. Tunneling is one such technique that has been reported to create periodontal health and prevent further attachment loss at furcation-involved teeth.[13]

**Tunneling**

Tunnel preparation is the process of deliberately removing bone from the furcation to produce an open tunnel through the furcation.[14] The objective of this treatment is to obtain the possibility of cleaning the furcal area by the patient using an interdental brush.[15] It is usually performed in cases of advanced grade II or grade III furcation defects a technique used to treat advanced grade II and grade III furcation defects. The procedure converts a severe grade II or grade III furcation into a grade IV furcation which is cleansable by patient using interdental aids.

Following anatomical and clinical features of the molar should be present for the procedure to be a success:

- Divergent mesial and distal roots, to allow postsurgical furcal maintenance and cleaning [4,16]
- A short root trunk, which places the root fornix closer to the cementoenamel junction[13]. The root trunk should not be longer than 1/3 of total root length, i.e., approximately 4 mm based on figures by Paolantonio et al [17]
- Proximal bone support, to compensate for any osteoplasty, ostectomy or both when the clinician is establishing harmonious osseous topography in the furcal area (both buccal and lingual) [18]
- An adequate presurgical crown:root ratio, greater than 1:1
- Either no or minimal tooth mobility that could not be managed by minor occlusal adjustment

**Advantages**:

Absence of any need for endodontic therapy
Absence of any need for new crown fabrication
Reduced treatment time and cost
Retention of a native tooth for interarch and intraarch stability

**Complications**:

Only few molars have roots sufficiently long or widely divergent roots to allow tunneling. Soft tissues tend to rebound and obstruct the furcation.

**Root sensitivity:**

Pulp reaction: The procedure might provoke a pulp reaction as it exposes a large root surface area relative to the root length. Accessory root canals on the exposed root surface can connect periodontal and endodontic tissues. The frequency of accessory canals in the furcation area varies between 23% [19] and almost 60%.[20] However. Langeland et al.[21] demonstrated on extracted human teeth that, although pulpal inflammation can occur in the presence of periodontal disease from involved accessory canals, total pulpal necrosis apparently occurs only when main apical foramina are involved by bacterial plaque.

**Caries risk**: Molars subjected to tunnel preparation were reported to be at risk for root caries in the furcation area. However, root caries in this category of patients is thought to be only a minor problem as failures after tunnel preparation fall within the range of other treatment alternatives.[13] Topical application of fluoride or chlorhexidine varnishes is mandatory to overcome caries development in the furcation areas.

## CASE REPORTS

A 45 year old male patient was referred to the Periodontics Unit of Bir Hospital for periodontal treatment. On examination the patient had generalized recession and mobility of teeth. He had mild gingivitis at the time of examination and his oral hygiene status was fair. Clinical and radiographic examination showed grade III furcation involvement in upper first and second molars. In the left lower first molar (36), there was a grade III furcation involvement and tooth was undergoing root canal treatment (Fig.1)

Non surgical periodontal therapy was started. At reevaluation, only furcation sites were bleeding on probing. Open flap debridement was planned for pockets greater than 5 mm. Tunneling procedures was planned for left lower first molar.

**Procedure**

For the tunnel preparation apically displaced flap was raised on buccal side and gingivectomy performed on lingual side (Fig. 2) . Following the reflection of buccal and lingual mucosal flaps, the granulation tissue in the defect was removed and the root surfaces were scaled and planed. The furcation area was widened by the removal of some of the inter-radicular bone (Fig 3). The alveolar bone crest is recontoured; some of the interdental bone, mesial and distal to the tooth in the region, is also removed to obtain a flat outline of the bone. Following hard tissue resection enough space had been established in the furcation region to allow access for cleaning devices to be used during self-performed plaque control measures. The flaps were apically positioned to the surgically established interradicular and interproximal bone level (Fig. 4). Periodontal packs placed (Fig. 5). Sutures were removed after 1 week (Fig. 6).

Fig. 1

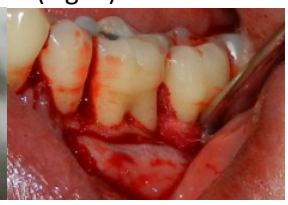

Fig. 2

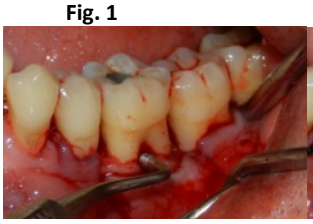

Fig. 3

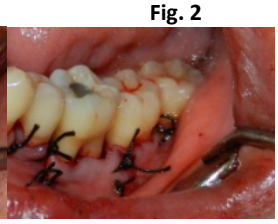

Fig. 4

Fig. 5

Fig. 6

Patient was advised to use interdental brush through the prepared tunnel. Patient was recalled every 2 weeks for the 1st month to observe his oral hygiene practice.


**Fig.7 Post op after 1 month Fig.8 Post op after 24 months**

## DISCUSSION

The clinician's decision to choose one treatment plan over another when confronted with a advanced grade II and grade III furcation invasion of a mandibular molar is influenced by many factors. The tunneling technique presents some advantages in comparison to the other treatment alternatives for furcation involvements. Nevertheless, the treatment approach depends on the grade of furcation involvement, periodontal disease, bone loss in the furcation lateral and apical to the defect, and tooth mobility.

The radiographic examination showed that the mesial root on 36 had 50% of remaining bone and the distal root had 1/3 rd of total bone height and significant amount of bone loss in the furcation area. It had a short root trunk and a wide diameter of the furcation entrance which are mandatory for proper postoperative plaque control management by the patient. The patient had started root canal therapy for the tooth due to history of severe pain. Clinically the tooth was grade I mobile. We observed that the patient had fair oral hygiene status and if motivated he could maintain a high standard of oral hygiene. Looking into all the above factors we planned for a tunneling procedure for the tooth no.36.

Tunneling, however, does have several disadvantages as well like potential development of root caries and sensitivity.

Hamp and colleagues [4] in a five-year study in which they treated 310 furcated teeth, found that four of seven tunneled teeth developed caries. On the other hand, in a retrospective study of 156 tunneled maxillary and mandibular teeth, Hellden and colleagues[22] found that 75 percent of the teeth were caries-free after 8.9 years. Little and colleagues[23] found that 84 percent of tunneled molars (five maxillary and 13 mandibular) were caries-free at six years after treatment.

Vandersall[24] presented a case report of a 23-year observation period of the tunneling treatment approach and stated that with frequent (three- to six-month) supportive periodontal treatments, along with the use of fluoride rinses or gels and dentifrices by a patient with meticulous oral hygiene, root caries in tunneled mandibular molars very well may be less a problem than earlier perceived. The patient has become well adapted to the tunnel and has maintained excellent oral hygiene and is enjoying full functional occlusion. Patient is on recall for every six months for supportive periodontal therapy and his plaque and bleeding scores are very low.

## CONCLUSION

Treating molar teeth with severe furcation involvement presents a difficult challenge to the clinician though a number of treatment options are available. Tunnel preparation of furcation-involved molars is a treatment alternative worth considering. Tunneling, in a properly selected patient who is motivated to perform careful oral hygiene, can result in comfortable, functional, healthy retention of the affected tooth, with a minimal commitment of time and money.

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