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Surgical Management of Furcation Involved-Mandibular Molar using Autologous Platelet-Rich Fibrin and Allograft: a Case Report

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Abstract
Periodontal disease involves destruction of bone often resulting in the exposure of furcation areas of posterior teeth. Furcation involvement is challenging for proper oral hygiene, clinical treatment, and may lead to poor prognosis. Numerous non-surgical as well as surgical options may be employed for treating teeth with furcation involvement. Bone grafts, collagen membranes and other regenerative materials either used alone or in combination has been considered to achieve periodontal regeneration. Combination of allograft and platelet-rich fibrin has shown great potential in enhancing tissue regeneration, angiogenesis, and wound healing. This case report describes the successful management of a mandibular molar with grade II furcation using platelet-rich fibrin in combination with demineralized freeze-dried bone allograft with 18 months follow-up period.

Key words*: Furcation, Furcation involvement, Platelet-rich fibrin, Demineralized freeze-dried bone allograft, Periodontal regeneration.*

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I. Introduction

Furcation is the anatomic area of a multi-rooted tooth where the roots diverge. Furcation involvement may be defined as the invasion of the bifurcation and trifurcation of the multirooted teeth affected by periodontal disease. The furcation has a complex anatomic morphology that may be difficult or impossible to maintain and debride by routine periodontal instrumentation.[1] Hence, it gets primarily affected by bacterial plaque. Other factors that predispose to furcation involvement include systemic factors such as diabetes, smoking; local anatomic and developmental factors like smaller width of the furcation entrance, short root trunk length, short roots, root concavities, cervical enamel projections, bifurcation ridges; enamel pearls, accessory pulpal canals, trauma from occlusion, vertical root fractures and iatrogenic factors like overhanging restorations and endodontic perforations. All these factors should be considered during the diagnosis, treatment planning and therapy of the patient with furcation defects.[2]

Glickman classified furcation involvement into four grades based on the amount of horizontal attachment loss. Grade II furcation involvement is cul-de- sac with a definite horizontal component. It can affect one or more of the furcations of the same tooth that do not communicate with each other because a portion of the alveolar bone remains attached to the tooth.[3] Treatment of furcation involvement offers a unique challenge from a prognostic and therapeutic perspective. According to the literature, numerous non-surgical as well as surgical options may be employed for treating teeth with furcation involvement. Bone replacement grafts, collagen membranes and biomimetic materials used alone or in combination has been considered to achieve periodontal regeneration in the furcation region.[4]

Platelet-rich fibrin (PRF) is a second-generation platelet concentrate, developed by Choukroun and co-workers in 2001. It is an autologous fibrin matrix enriched with leukocytes, platelets, cytokines and growth factors that has been demonstrated to facilitate tissue regeneration, angiogenesis, prevention of infection and wound healing.[5]

Demineralized freeze-dried bone allograft (DFDBA) has been successfully used to reconstruct intraosseous periodontal defects since 1975 mainly because of its osteoinductive ability. The demineralization process of the graft exposes the bone inductive proteins located in the bone matrix such as bone morphogenetic proteins which are capable of inducing mesenchymal cells to differentiate into osteoblasts in vivo. DFDBA also provides an osteoconductive surface for cell attachment.[2, 4]

II. Case Presentation

A 65-year old male presented with a chief complaint of pain and decay in the lower right back tooth since 1 month. Past medical history elicited that the patient was hypertensive for which he received Telmisartan (40 mg/day) for the last 2 years.1 month prior, the patient started experiencing localised, continuous, dull aching pain that aggravated on eating in the mandibular right first molar. The patient also noticed the presence of decay and gradual increase in the intensity of pain in the same tooth. Intraoral examination revealed fair oral hygiene, presence of generalised attrition and buccal cervical abrasions. On examination of mandibular right first molar showed the presence of severe occlusal and lingual decay, grade I mobility, 9mm periodontal pocket with presence of grade II furcation involvement on the lingual aspect (Figure1a-c). It was tender to horizontal and vertical percussion. Intraoral periapical radiograph revealed the presence of diffuse radiolucency in the periapical and furcation region (Figure 1 d). Based on the patient's history and clinical features, mandibular right first molar showed an endodontic as well as periodontal involvement.

A written informed consent was taken from the patient after discussing the treatment plan. Meticulous scaling and root planing (SRP) was performed and the patient was educated and motivated for maintenance of proper oral hygiene. Endodontic treatment of the concerned tooth was carried out (Figure 1 e) and periodontal surgical procedure was performed after 4 weeks.

Surgical management

Extra-oral asepsis was done with 5% povidone- iodine solution and 0.2% chlorhexidine digluconate was used for intraoral antisepsis. Following local anaesthesia, full thickness mucoperiosteal flap was reflected on the buccal and lingual side extending at least one tooth mesial and distal to the tooth with furcation defect. Flap reflection revealed the presence of buccal and lingual furcation involvement with a deep contained circumferential defect lingually (Figure 2 a, b).

Preparation of platelet-rich fibrin

10 ml of venous blood was drawn in a tube without an anticoagulant and centrifuged immediately using a table-top centrifuge (Laboratory Remi Doctor Centrifuge, India) for 12 min at 3000 rpm. The resultant product consisted of following three layers: an uppermost layer of PPP (platelet poor plasma), PRF clot in the middle, RBC (red blood cells) at the bottom. PRF clot was then taken out of the test tube and was separated from the layer of RBCs by cutting with the help of scissors. PRF was then obtained in the form of the membrane by squeezing it between two sterilized gauze pieces and finely chopped and mixed with demineralized freeze-dried bone allograft (DFDBA) to form a coagulum.

After meticulous debridement and root planing, the defects were grafted with a coagulum of PRF and DFDBA (Figure 3 a, b) and covered by a layer of PRF membrane (Figure 3 c, d). Soft tissue flaps were repositioned and secured in place by interrupted suturing using 3–0 black silk suture (Figure 4 a). The surgical site was covered by a periodontal dressing (Coe-pak) (Figure 4 b). Post surgically, the patient was prescribed antibiotics (Amoxicillin 500mg 8 hourly) and analgesics (Ibuprofen 400 mg 8 hourly) for 7 days. Patients were instructed to rinse with 0.2% chlorhexidine gluconate (Twice daily for 2 weeks) and asked to refrain from tooth brushing, flossing, and interdental cleaning in the treated area for 4 weeks after surgery. After 7 days, periodontal dressing and sutures were removed. Healing following the procedure was uneventful. Recall appointments were then made at 7 days, 1, 3, 8 and 18 months after surgery. Meticulous oral hygiene maintenance protocol was reinforced during each follow-up visit. Postoperative follow-up at 1,3 and 8 months demonstrated quicker tissue healing, significant pocket reduction (3mm), clinical attachment gain, obliteration of the furcation entrance as well as radiographic bone fill (Figure 5 a-c). The tooth was rehabilitated with a fixed metal crown at 8 months post surgery. 18 month follow-up visit showed marked improvement in the attachment gain with considerable radiographic bone fill.

III. Discussion

The objective of furcation therapy is to facilitate maintenance, prevent further attachment loss and obliterate the furcation defects. The selection of therapeutic mode varies with the class of furcation involvement. Various treatment modalities have been proposed to treat molar furcation defects. These range from conservative therapy, such as scaling and root planing, odontoplasty to surgical treatment procedures, such as open flap debridement, osteoplasty and ostectomy, root amputation, hemisection, tunnelling and extraction.[2]

Regardless of the treatment method used, longitudinal studies have shown that molars are at higher risk for tooth loss than non-molar teeth.[6,7]

In furcal lesions, bone regeneration is often thought to be relatively futile. Regenerative procedures such as bone grafting, guided tissue regeneration, polypeptide growth factors, bone morphogenic proteins, tissue engineering have shown improved outcomes in the treatment of furcation defects.[8,9] Histological and clinical evidence of periodontal regeneration have been demonstrated in the treatment of maxillary facial or interproximal and mandibular facial or lingual grade II furcation defects.[10]

Clinically, successful regeneration of furcation sites is determined by the elimination or reduction of horizontal and vertical components of the lesion, but the conclusive evidence of true regeneration can only be achieved by histological means.[9,10] In the present case, combination therapy of PRF membrane and bone coagulum (PRF+ DFDBA) resulted in elimination of the circumferential defect, successful closure of furcations with adequate bone fill at 18 months follow-up visit. PRF offers the advantage of being autologous and least expensive. PRF membranes release large quantities of growth factors like platelet-derived growth factor (PDGF), vascular endothelial growth factor (VEGF), and transforming growth factor (TGF) for 7 to 14 days. The flexible fibrin network favours the entrapment of cytokines and cell migration which initiate wound healing and regeneration. In addition, the membranes have a protective function (inducing the periosteum) and serve as a competitive barrier, preventing epithelial migration, thus promoting new attachment formation (periodontal regeneration).[5] Dohan and colleagues showed a significant stimulation proliferation and differentiation of osteoblasts and bone marrow stromal cells when in contact with PRF.[11]

Demineralized freeze-dried bone allograft (DFDBA) has osteogenic potential due to the release of bone-inductive protein termed osteogenin or BMP-3 that enhances osseous regeneration. Its osteoconductive nature facilitates space maintenance, migration of osteoprogenitor cells, thus facilitating bone formation.[12]

Several studies have shown that guided tissue regeneration using membranes and bone allografts have resulted in improved attachment and bone level gains. The combination of PRF with bone graft has shown improved outcomes in furcation resolution.[13-15] Successful closure of furcation defect with adequate bone fill was also achieved in the present case report.

IV. Conclusion

Thorough understanding of tooth anatomy and etiologic factors ensures a correct diagnosis and effective management of furcation involvement. The challenge of treating furcation-involved teeth may be overcome by selection of appropriate choice of regenerative materials as well as pertinent treatment technique. Guided tissue regeneration procedure, using PRF membrane and coagulum of combination of PRF and DFDBA holds promise for increasing the success of periodontal regeneration in furcation defects.

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Figures

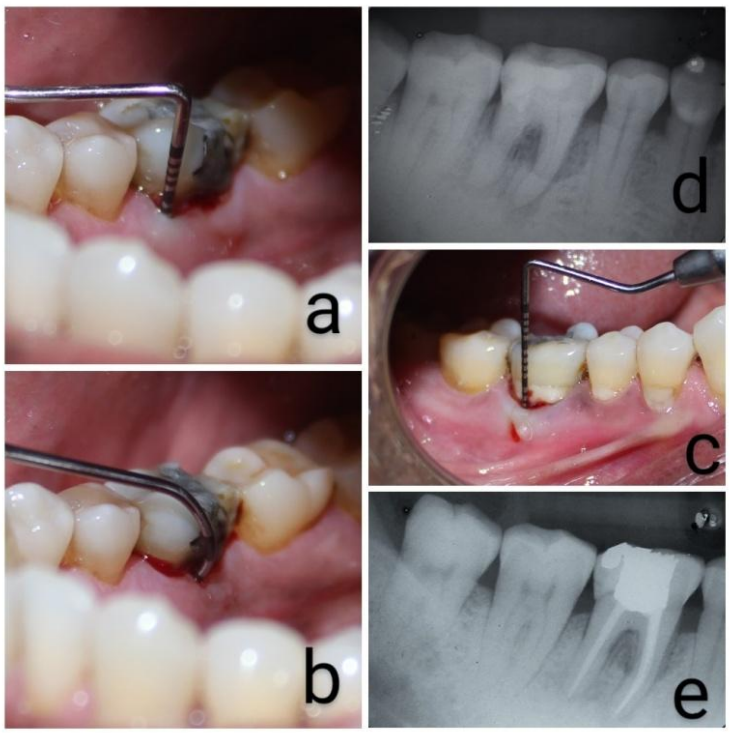

Figure 1: Preoperative view

a) Lingual probing depth (8mm)

b) Grade II furcation involvement

c) Buccal probing depth (2mm)

d) Radiographic view at baseline

e) Radiographic view after endodontic treatment

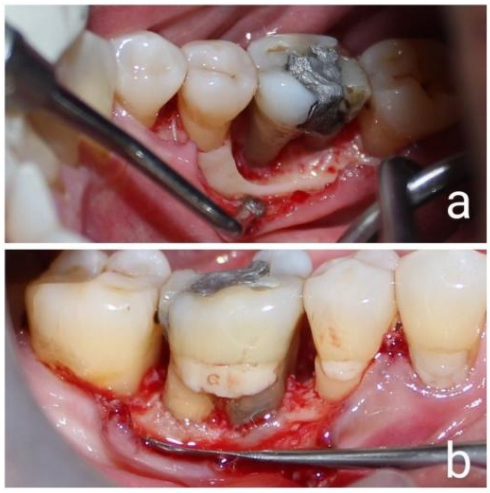

Figure 2: Intra-operative view

a) Circumferential defect and grade II furcation lingually

b) Grade II furcation buccally

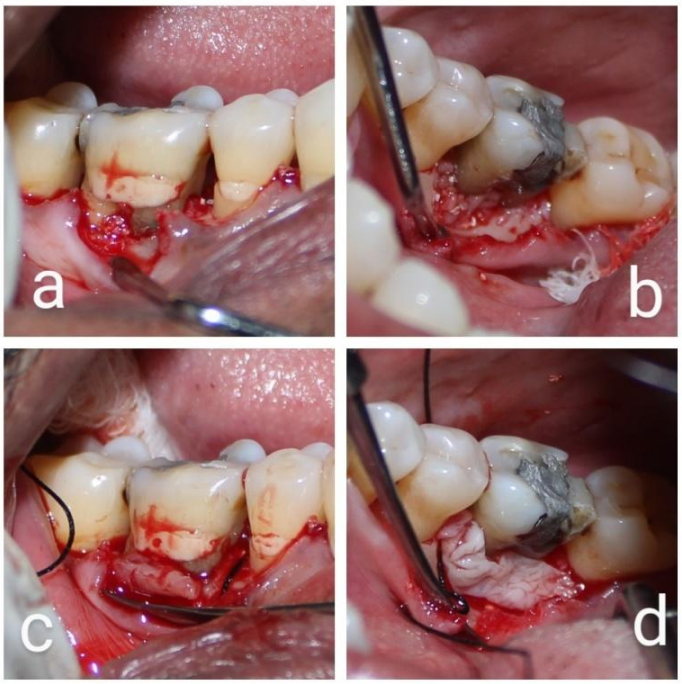

Figure 3: Intra-operative view

Placement of PRF and DFDBA in the
a) Buccal furcation
b) Lingual furcation and circumferential defect

PRF membrane placement in the
c) Buccal furcation
d) Lingual furcation and circumferential defect

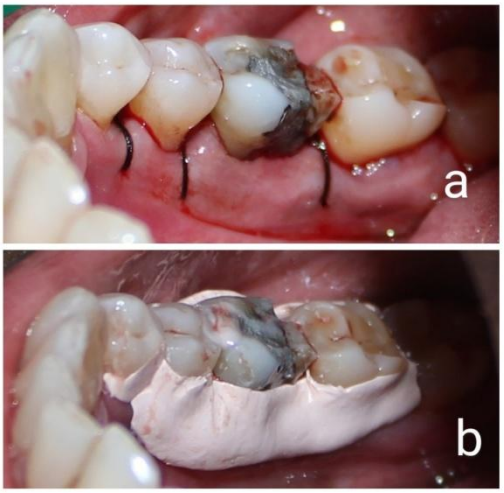

Figure 4: Immediate postoperative view

a) Interrupted sutures placed
b) Periodontal dressing placed

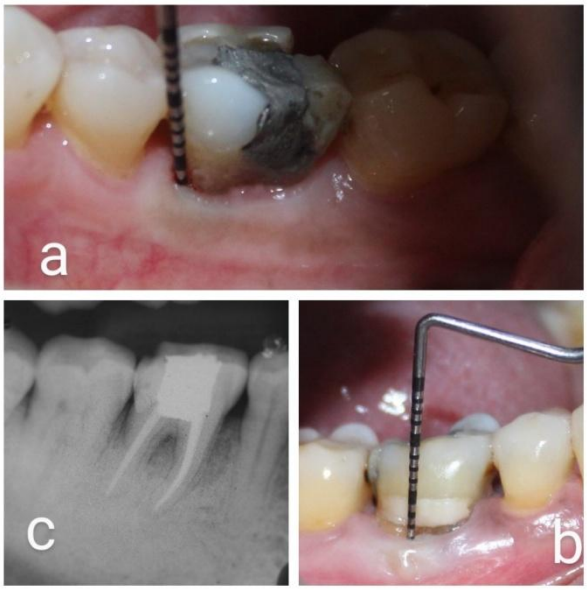

Figure 5: Eight months postoperative view

a) Lingual probing depth (3mm)
b) Buccal probing depth (1mm)
c) Radiographic view

Figure 6: 18 months postoperative buccal and radiographic view

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