Case Report

Management of Furcal Perforation with Advanced Furcation Defect by a Minimally Invasive Tunnel Technique

Abstract

A perforation in the furcation area is a potential risk factor for extension of pulpal inflammation into the periodontium and formation of advanced furcation defect with severe loss of clinical attachment and interradicular bone. Furthermore, the management of such furcal perforation is difficult due to poor accessibility, visibility, and regenerative potential. The development of such advanced furcation defects further compromises the prognosis of the treatment as they preclude effective plaque control and maintenance by the patient. Therefore, the management of advanced furcation defects remains an enigmatic and challenging task for the clinician. This case report describes a minimally invasive approach for the treatment of a furcal perforation by a conservative tunnel preparation. The present case report aims to highlight the importance of surgical tunnel preparation as an alternative to conventional flap procedure to repair furcal perforation with advanced furcation defects.

Keywords: *Furcal perforation, furcation, periodontal surgery, periodontitis, resective osseous surgery, tunnel preparation*

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Introduction

Furcal perforations are significant iatrogenic complications resulting from endodontic treatment culminating in failure of treatment. Perforations may occur during the preparation of access cavities, postspace preparation, or as a result of the extension of internal resorption into the periradicular tissues.[1,2] Common factors that influence the outcome of perforated teeth include the size of the perforation, time of repair, level and location of the perforation, the presence of periodontal disease, and preendodontic pulp vitality status.[3] The repair of perforation in furcation space is quite challenging due to poor visibility and accessibility at the furcation fornix. However, the development of furcal perforation is intimidating as the perforation in the furcal space provides an easy pathway for extension of pulpal inflammation into the periodontium. The spread of inflammation in the furcation area is associated with the formation of loss of osseous and periodontal support that if left untreated may result in complete loss of the tooth.[1-4]

Furthermore, the formed furcation defect acts as a niche for plaque accumulation and precludes effective plaque control by the patient.[1] Therefore, treatment of furcal perforation is important not only to control the progression of the periodontal disease process but also to provide an area that can be easily maintained by the patient. The repair of perforation in the furcation area depends on the type and extent of furcation defect, location, size and time of the perforation, the mobility of the associated tooth, patient level of motivation, and compliance. If the perforation is associated with Grade 1 to Grade 2 furcation defect, a conventional flap can be raised to gain access to the site for repair along with correction of the osseous defect with resective or regeneration procedure. However, at sites with inadequate keratinized gingiva and advanced furcation defect, conventional regenerative procedures involving bone grafting and membrane placement along with perforation repair would be futile. In such clinical situations, poor regeneration of the furcation defect along with persistent pulpal inflammation and secondary infection is often observed despite sound endodontic and periodontal therapy. The poor regeneration at the furcation area compromises the treatment outcome as the furcation defect continues to act as a

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potential site for plaque accumulation to act as a potential niche for plaque accumulation and precludes effective plaque control by the patient. In such clinical situations, a minimally invasive tunnel preparation is an effective treatment modality compared to conventional surgical procedures for perforation repair and maintenance.

Tunneling is a conservative approach that involves minimal ostectomy and osteoplasty of the interradicular bone to create a tunnel in comparison to other techniques. Furthermore, the prognosis of the advanced regenerative surgical procedure such as hemisection, root resection, guided bone regeneration using bone graft, and barrier membranes for treating grade 3 and grade 4 furcation defects is questionable. There is an increased probability of the tooth becoming mobile after hemisection and bicuspidization of mandibular molar since there is a reduction in the occlusal table and overall pressure increases. The prognosis of the regenerative technique is questionable in advanced Grade 3 and Grade 4 furcation defects, especially in mandibular molar since the amount of attached gingiva is not sufficient to place the flap coronally and achieve primary closure. This often exposes the graft and barrier membrane and inhibits guided bone regeneration due to contamination of the site and loss of the graft material. Therefore, tunneling is a more suitable and conservative approach to treat advanced furcation defects, especially in the mandibular molar region. It could also prove to be of value in geriatric and systemically compromised patient where the bone regeneration and healing capacity is poor. Tunneling favors placement of the interdental brush for plaque control and also provide superior access to furcation area for perforation repair by converting a Grade 3 furcation to Grade 4 furcation. Very few case reports highlight the importance and adequately describe the indication of the conservative tunnel preparation over conventional surgical procedures for the treatment of furcation defects.[1-6] This case report aims to explain and highlight the importance of the minimally invasive tunnel technique for teeth with advanced furcation defects. The procedures followed were in accordance with the ethical standards on human experimentation and with the Helsinki Declaration of 1975, as revised in 2000.

Case Report

A 68-year-old male patient reported with the chief complaint of chronic, dull, localized, intermittent pain in the left mandibular first molar for the past 1 month. The pain aggravated on chewing hard food. There was no history of any radiation of pain. However, the patient gave an account of occasional enlargement of the left submandibular lymph node and mild fever. On examination, clinical probing depth of 8 mm on the buccal surface of the left mandibular first molar along with Grade 3 furcation defect was noted. The tooth had been root canal treated 3 years back and had been restored with a complete metal crow [Figure 1a]. The patient was systemically healthy and did not report any oral abusive habits such as smoking, tobacco or betel nut chewing, or alcohol consumption. An intraoral periapical radiograph revealed incomplete obturation of the mesiobuccal root with a broken endodontic file in the root canal along with extrusion of the gutta-percha and furcal perforation [Figure 1b]. The IOPA of the concerned tooth revealed the presence of a broken endodontic file and furcal perforation with extruded gutta percha.

Nonsurgical periodontal therapy with complete full-mouth scaling and root surface debridement was initiated. The crown and amalgam core was removed [Figure 1c]. The access opening was enlarged and the gutta-percha that was extruding from the perforation was removed. The perforation was sealed internally using mineral trioxide aggregate [Figure 1d-f]. The broken H-file was retrieved from the root canal using an instrument removal system. The biomechanical preparation was then accomplished by a step-back technique using 2% sodium hypochlorite and 17% ethylenediaminetetraacetic acid. Obturation was completed, and core build was done with amalgam [Figure 1g]. The radiograph at 4 months revealed a significant reduction in the periapical radiolucency at the apex of the tooth [Figure 1h]. The gingiva showed no signs of inflammation or bleeding on probing. However, Grade 3 furcation with the horizontal probing depth of 8 mm was persistent and precluded effective plaque control in the furcation area [Figure 1i]. Since regeneration of bone in Grade 3 furcation defect was difficult, the surgical resection of the lone remaining lingual cortical plate to create a “tunnel” was planned. The procedure was explained to the patient and a written informed consent was taken.

Surgical procedure for tunneling

Following administration of the local anesthetic agent, a full-thickness mucoperiosteal flap was reflected on the buccal aspect with #35, #36, and #37. An external bevel gingivectomy was done on the lingual aspect of #36 to expose the furcation area [Figure 2a]. After thorough root surface debridement, osteoplasty and ostectomy were performed using a pear-shaped carbide bur at low-speed and copious saline irrigation in the interradicular bone. The amount of bone removed should correspond to the space required to pass an interdental brush through the furcation region to ensure adequate plaque control [Figure 2b and c]. Care was taken to ensure that a smooth and positive architecture without any bony spicules, sharp bony margins or ledges remained in the furcal space. The flap was subsequently positioned apically and sutured using 3–0 black silk sutures [Figure 2d]. The patient was instructed not to brush in the operated area for 15 days. The patient was advised to use an interproximal brush in the tunnel area along with 0.12% chlorhexidine digluconate mouthwash for 4–6 weeks after surgery. Daily use of mouthwash with 0.025% sodium fluoride and tooth brushing with fluoride containing dentifrices was advised.

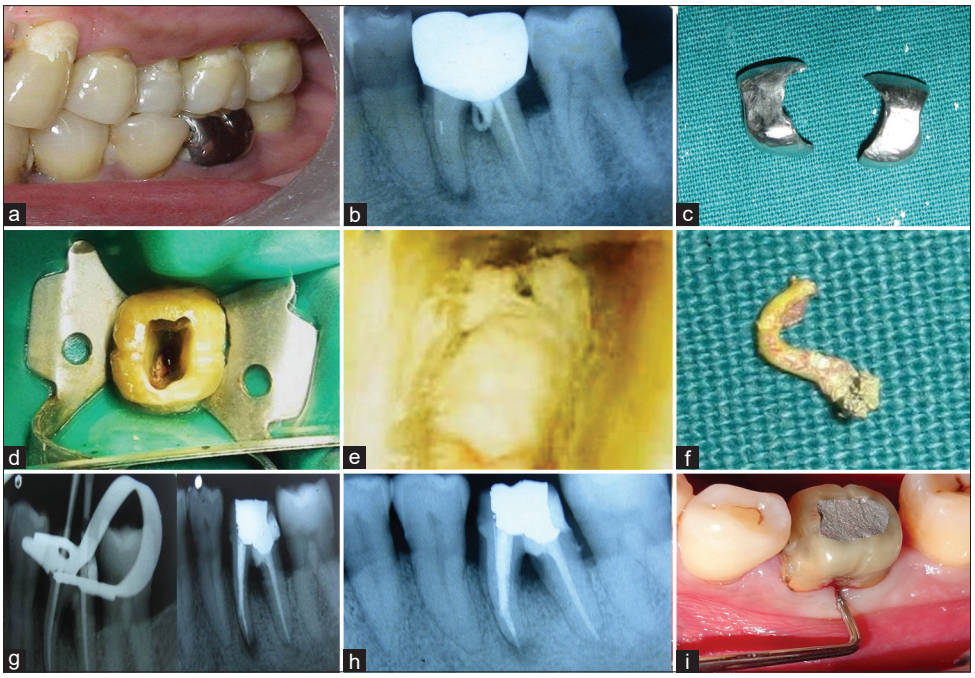

Figure 1: (a) Gingival tissues at the first dental visit. (b) Preoperative radiograph reveals a broken endodontic file and perforation of the furcal space with extrusion gutta-percha. (c) The metallic crown is removed by sectioning it into two halves. (d) Access cavity prepared. (e) The perforation is sealed with mineral trioxide aggregate. (f) Gutta-percha removed from the furcal perforation. (g) Biomechanical cleaning and shaping of the canals followed by obturation and core build. (h) Three months after postobturation showing periapical healing. (i) Persistent probing depth in the furcation area

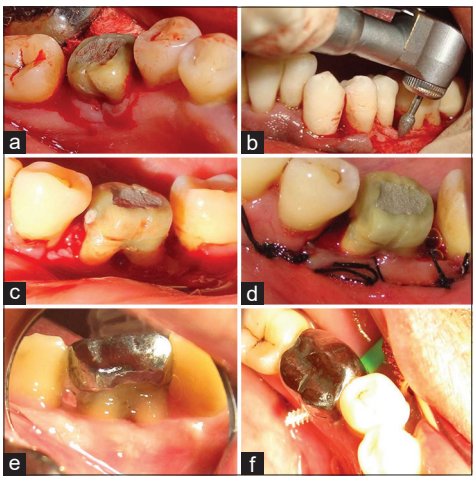

Figure 2: (a) Gingivectomy of lingual gingival tissue. (b) Full-thickness flap reflection with osteoplasty of the buccal and interradicular bone. (c) Tunnel created in the interradicular area. (d) Flap apically positioned and sutured. (e) Fifteen days postoperative after crown placed. (f) Healthy gingival tissue maintained in the furcation tunnel by an interdental brush even at 6 months

The patient was recalled 15-day postoperatively for suture removal and subsequently at 1, 3, and 6 months [Figure 2e]. Follow-up visits showed complete healing of the furcal perforation, with a significant reduction in clinical probing depth and maintenance of good plaque control by the patient with an interdental brush. The periodontal health of the tissues could be maintained even after 6 months of the tunnel preparation and supportive periodontal therapy [Figure 2f].

Discussion

One of the main aims of treating endodontic perforation is to provide an immediate repair and seal for the established communication between the pulp and the periodontium. The restoration of the perforation is of paramount importance to reduce the bacterial contamination in the furcal defect and pulpal tissues and to deter the inflammatory process in the defect area for better posttreatment healing. Amongst the tremendous advancement in the surgical procedures and materials for treating furcal perforations, the role of conservative technique like "tunneling" is often neglected or ignored.

Tunneling provides a one-step minimally invasive procedure to treat both furcal perforation and advanced furcation defect with good accessibility, visibility, and effective plaque control. This minimally invasive technique can be attempted even in elderly and geriatric populations and in patients with systemic diseases where invasive surgical procedures are often contraindicated. Moreover, since the "native" tooth structure is retained, the tunneling also favors good interarch and intraarch stability and precludes pathologic migration of the neighboring teeth.[6-10] The technique also increases the width of attached gingiva as the flap is positioned apically after the completion of the procedure.[2-5,11,12]

However, several factors need to be taken into consideration while preparing a furcation tunnel. A thorough clinical and radiographic evaluation of the osseous topography and tooth morphology along with pulp vitality is mandatory

before a tunnel preparation. Along with the location and size of perforation, the extent of vertical and horizontal bone loss, the length of the root trunk, root divergence, root fusion, root concavity, remaining osseous support, width of attached gingiva, amount gingival recession, crown/root ratio, and tooth mobility should be evaluated.[10-15] A tooth with a short root trunk and root fornix closer to the cementoenamel junction along with good proximal bone support, divergent mesial and distal roots, and an adequate presurgical crown to root ratio (greater than 1:1) are ideal candidates for tunneling.[2,12-15] With a good supportive periodontal care and patients' compliance, the success rates of tunnel preparation are comparable to many advanced resective and regenerative surgery procedure.[9] Tunneling is reported to have success rates of 85.7 to 93.3 from 1 to 8 years. Long-term follow-up studies have shown that the survival rate for molar teeth with furcation defects is 43.1%–96% after flap surgery, 42.9%–92.9% after tunneling procedures, 62%–100% after amputation(s) and hemisections, and 83.3%–100% subsequent to guided tissue regeneration.[13-15]

Conclusion

Although numerous treatment options are available for treating furcal perforation with advanced furcation defect, the minimally invasive tunnel technique is better than conventional regenerative procedures for geriatric and systemically compromised patients. Tunneling is a promising and a conservative alternative to conventional flap procedure for gaining access to the furcation and favor good plaque control by the patient.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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