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Case Report

Long Term Outcomes of Endodontic Microsurgery along with Sticky Bone in Managing Mucosal Fenestration and Necrosis Following Trauma: A Case Report

Nirvana Khalaf Mansour *[1]

***Correspondence to:** Nirvana Khalaf Mansour, Independent researcher, Private Clinic, Suez, Egypt.

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Abstract

Apical surgery, also known as apicoectomy or root-end surgery, is a valuable treatment option for cases where conventional root canal therapy has failed or is not feasible. However, this case report clarifies how a unique autologous platelet concentrate—injectable platelet-rich fibrin (i-PRF)—in conjunction with a bone graft can be used in surgical endodontic procedures to guarantee a prompt and effective recovery of the periapical region that has sustained periapical lesions, resulting in bone and mucosal fenestration with exposed root apices. The pre-existing condition in this case exhibits necrotic mandibular central incisors with a large apical lesion that results in complete buccal bone dehiscence/fenestration and subsequently root apices exposure, which presents a true challenge to a successful outcome. After comprehensive treatment planning and informed consent, microapical surgery and endodontic treatment for mandibular central incisors were performed with the application of sticky bone. A two-year follow-up cone beam CT report demonstrated full healing of the soft- and hard-tissue lesions. In such difficult circumstances, peri-radicular endodontic microsurgery and sticky bone combined with i-PRF may be utilised as a dependable therapy option for treating mucosal and bony fenestrations.

Keywords: *Endodontic microsurgery, Injectable- platelet rich fibrin, Mucosal fenestration, Sticky bone, Trauma.*

Introduction

Pulp necrosis, root canal obliteration, periapical pathosis, and root resorption are common complications of dento-alveolar trauma **(**1**)**. Pulp necrosis and chronic pulpo-periradicular inflammation with bone destruction may predispose to mucosal fenestrations **(**2**)**, which is a gingivo-osseous clinical condition caused by a limited loss of the mucosa and overlaying bone, exposing the root apex beneath to the oral cavity **(**3**)**. various factors such as thin/absent cortical plate, buccally inclined root, thin gingival phenotype, orthodontic movement, prominent root apex, and chronic pulpo-periradicular inflammation with bone destruction may predispose to this mucosal fenestration **(**4**)**.

When facing extensive periapical lesions, the use of autologous platelet concentrates in surgical endodontic procedures offers unquestionable promise **(**5**)**. Nonetheless, there are significant

drawbacks to using first-generation platelet concentrates, including the danger of coagulopathies, the need for anticoagulants, handling features, cost, and the fact that it also entails a tedious two-step centrifugation and purification process (6). To address the aforementioned limitations, platelet rich fibrin (PRF) was first developed by Dohan et al. for use in oral and maxillofacial surgery, which requires neither anticoagulant nor bovine thrombin. In the fibrin meshes, platelets are trapped, resulting in richer and thicker growth factor content, which promotes cell proliferation, migration, and tissue remodelling at a faster rate (7).

Injectable PRF (i-PRF) is a platelet concentrate in liquid form that can be polymerized with bone graft. I-PRF, being autogenous, decreases the chances of adverse reactions to the implanted materials, especially immune-mediated ones, as with other types of grafts, which qualifies it as a viable option in bone regeneration. It also allows the incorporation of graft without the use of anticoagulants or any additives, thereby forming a well-agglutinated "sticky bone." (8)

The surgical endodontics field has advanced significantly since its inception. Its origins may be traced back to Aetius's groundbreaking work on incision and drainage about 1500 years ago (9). The current surgical approach, however, recommends a narrower entry through the cortical bone in order to see, enucleate, and manage the resected root end, as opposed to the traditional apical surgical process where the osteotomy is naturally broad. This minimally invasive approach in endodontic surgery is mainly due to the invention of the microscope and microsurgical devices (10).

This case report details the treatment of a patient who presented with necrosis of two mandibular central incisors as a result of trauma 10 years ago, and how a combination of apicoectomy and injectable platelet-rich fibrin (i-PRF) with sticky bone was used to achieve a successful outcome. A comprehensive search of the literature revealed no papers addressing the use of sticky bone in endodontic microsurgical procedures, highlighting the case report's uniqueness in that field.

Case Description

A 34-year-old female patient referred to my clinic with chief complaint of discoloration of the lower central incisors (teeth number #31 and #41, according to the Federation Dentaire Internationale (FDI) dental numbering system) and perforation of the gum for long duration. Past dental history revealed a

traumatic motor cycle accident 10 years ago which involved the mandibular central incisors for which no dental treatment was sought for immediately after trauma. Recently, as the discoloration gradually worsened, the patient sought dental treatment to restore esthetics and treat the gum perforation.

Intraoral clinical examination showed pathological migration of tooth #32 with no debilitating symptoms, discoloration of mandibular two centrals with mucosal fenestration and exposed root apex of tooth #41. Both 31 and 41 responded negatively to the cold pulp test by soaking a cotton pellet in ethyl chloride and immediately placed on the tested teeth at the labio-incisal edge (ENDO ICE, COLTENE/Whaledent, USA) and elicited mild tenderness on percussion. On digital radiographic examination (Vatech, Scientific zone, Korea), periapical radiolucency was evident in 31, 41 (Figure 1a). Cone-beam computed tomography (CBCT) (Vatech, Pax-i3D Smart, Korea) was taken at standardized settings (90 kV, 6 mA, 5 cm × 5 cm, 18 s) to assess the information on periapical lesion extent and the proximity to anatomic structures. The preoperative measurements of the lesion extent were viewed in different planes; the sagittal section; coronal section, and axial section (Figure 1b).

According to the CBCT-periapical index scoring system (11), the lesion for this case was graded as 4D. The score 4 indicates that the diameter of the periapical lesion is > 4-8 mm, and D represents destruction of the periapical cortical bone in the buccal region.

On the basis of the above findings, the differential diagnosis could be a chronic periapical abscess, periapical cyst, and periapical granuloma in teeth #31 and #41. Root canal therapy was supposed to be as the first line of treatment in relation to 31 and 41 prior to periapical surgery followed by the adding of a combination of i-PRF with bone graft (sticky bone) to fill the defective site of the mandible. The patient was informed about the risks and benefits of the procedure and a written consent was taken.

After administration of local anesthesia (2% lignocaine in 1: 200,000 dilution adrenaline, Neon Laboratories Ltd.) and rubber dam isolation, an access cavity was adjusted in #31 and #41 with an Endo access bur (Dentsply Maillefer, Switzerland), because the case was referred to my clinic after the access was opened from my colleague buccally due to severe limited mouth opening of the patient. The working length was adjusted radiographically and electronically using an apex locator (3D, Geosoft, Russia). Cleaning and shaping were initiated with manual #10 C file and apical preparation was performed manually till size 15 C file in teeth #41 and #31 (Perfect endo, Shenzhen Perfect

Medical Instrument, China) to open any canal obliteration and negotiate the canals, then mechanical preparation was completed till size 40 taper 4 using V Blue rotary file (Perfect endo, Shenzhen Perfect Medical Instrument, China) to the full working length. Between each instrument change, the root canal was irrigated with 5ml of Dual Rinse HEDP solution. According to the manufacturer's instructions [12], a Dual Rinse HEDP-based solution was made by mixing 10 mL of 3% NaOCl with one capsule of Dual Rinse etidronic acid (HEDP) powder (Medcem, GmbH, Vienna, Austria) using a syringe with a 28gauge side vented needle. The depth of the irrigation needle was always 2 mm from the apex

The root canal was dried using sterile paper points. Then bioceramic sealer (NeoSealer Flo, Avalon Biomed, Texas, US) was injected into the root canal and then obturated one day before the surgery with the gutta percha cone taper four (Meta Biomed, Korea) corresponding to the master file applying a single cone technique. Finally, the access cavity was restored with resin modified glass ionomer followed be composite resin on the same appointment.

During surgery under dental operating microscope DOM (Zumax, China) with magnification 1.2x and after achieving a profound anesthesia, crevicular and vertical releasing incisions were given then a reflection of a full-thickness flap. Diseased granulation tissue surrounding the root apices was thoroughly removed using ultrasonic piezo scalpel (US4, SOGA, Shenzhen Soga technology co., Ltd, China), the following parameters were set: 120 VA, working frequency 30KHZ, with physiological saline for cooling, revealing the extent of bone loss. Apicoectomy was done by removing 3 mm from the root apex of #31 and #41 using piezoelectric device tips XM-NINJA (SOGA, Shenzhen Soga technology co., Ltd, China), then retro-grade cavity preparation was performed using ultrasonic tips (UE2) and retrograde filling was done with Mineral Trioxide Aggregate (MTA Angelus® Brazil). The surgical site was prepared to receive the prepared sticky bone. 10 mL of blood was collected from the median cubital vein in 10ml glass-coated plastic tubes (Vacutainer; Allschwil, Switzerland) and immediately centrifuged at 400g (700 rpm) and at room temperature for 3 minutes using a centrifuge (Boca-Raton, FL, EUA). The top yellow fluid (i-PRF) liquid phase was pulled through a plastic syringe as close to the red cells as feasible immediately after centrifugation. Demineralized bone graft (DM Bone Graft, Meta Biomed, Korea) was mixed with the fibrin liquid to form sticky bone. Subsequent to placement of sticky bone, the flap was approximated with Synthetic non-absorbable sutures (POLYESTER BRAIDED, Shanghai, China) (Figure 2), with another small suture at the site of the fenestration.

Postoperative instructions were given to the patient, following which medications were prescribed, amoxicillin (Misr co., October Pharma S.A.E, Egypt) (500 mg × 3/day for 5 days) and ibuprofen (Brufen, Abbott, Egypt) (400 mg × 3/day for 3 days) and supplemental 0.2% chlorhexidine mouthwash. 10–12 days post-surgery, sutures were removed. Patients were followed monthly for three months and then at six months, yearly after that. CBCT scans were also taken at the last follow-up (2 years).

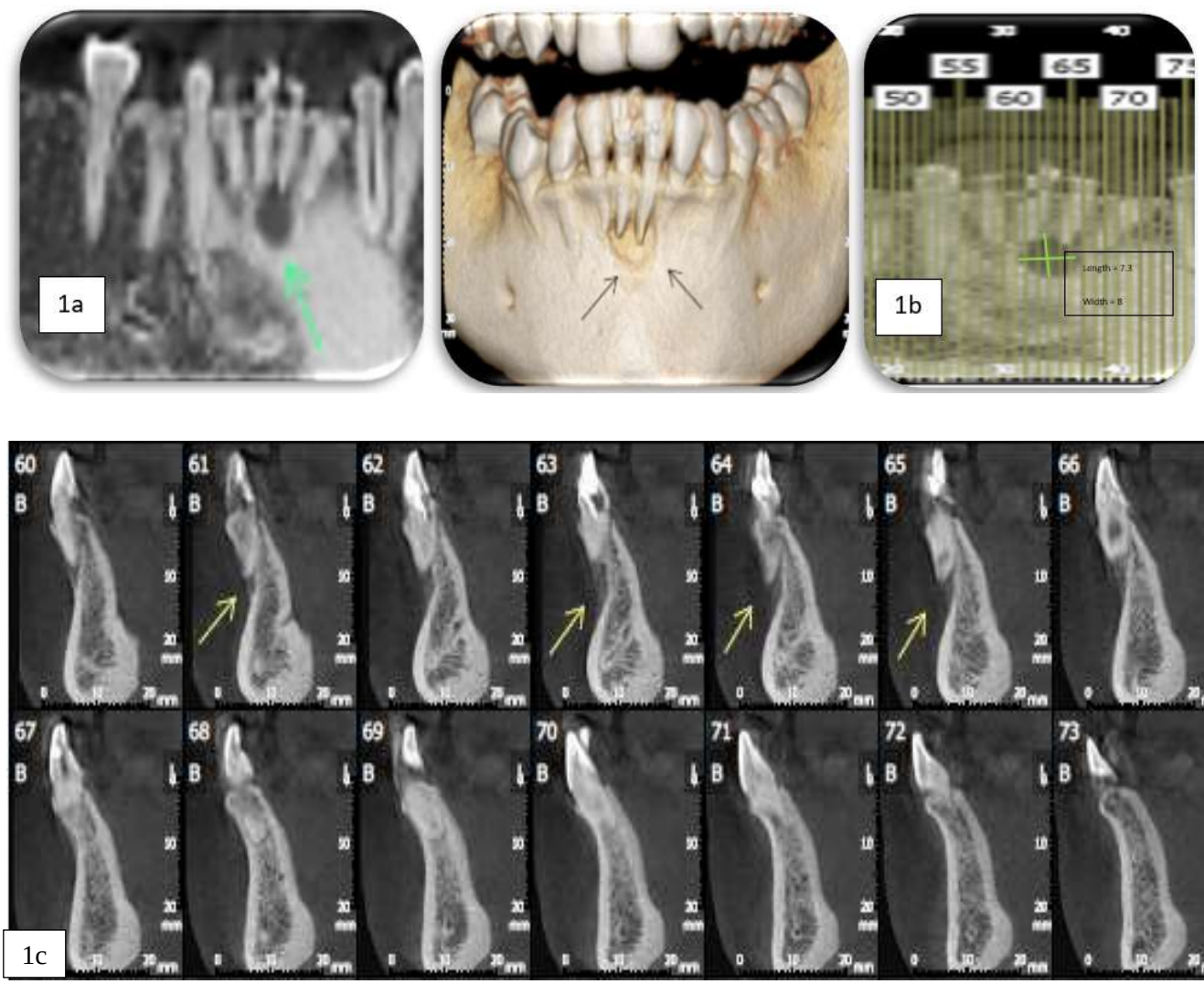


Figure 1a: Preoperative radiograph image showing periapical lesion involoving the apices of teeth no. #31 and #41. **Figure 1b:** cone beam computed tomography images.

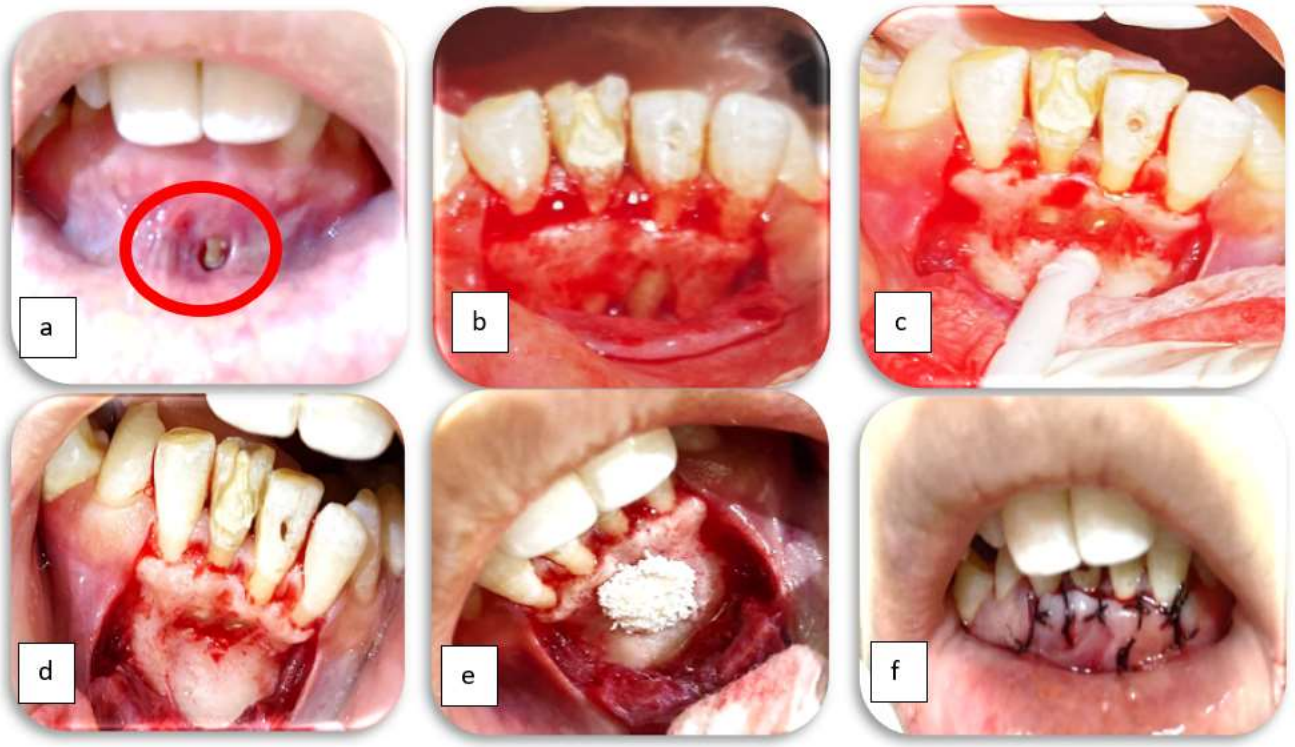
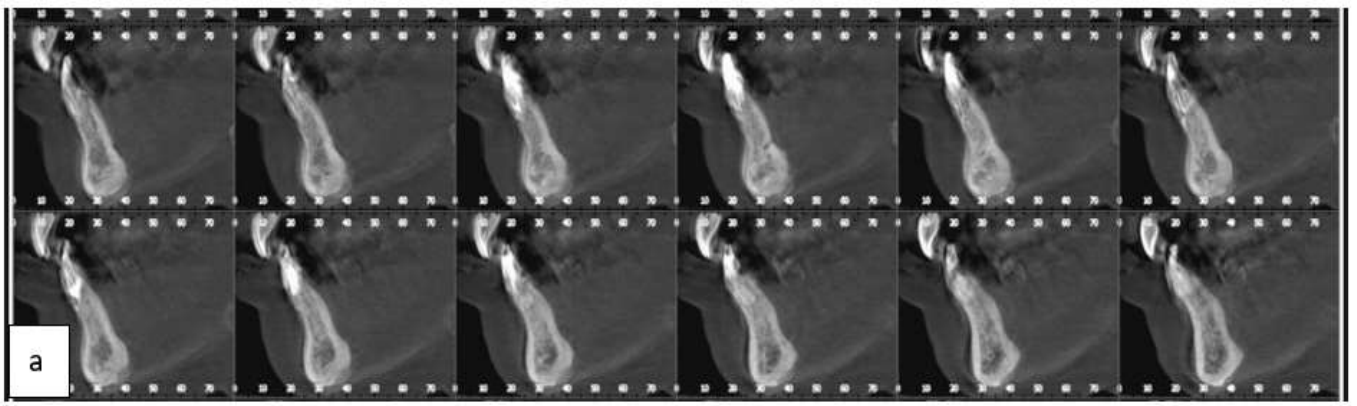


Figure (2): Preoperative clinical and surgical procedure. Preoperative clinical photograph showing mucosal fenestration **(a)**. Flap elevation and cystic enucleation **(b)**, Apicoectomy **(c)**, and retrograde filling **(**MTA**) (d)**. Placement of sticky bone **(e)**. Sutures placed **(f)**

Figure 3a



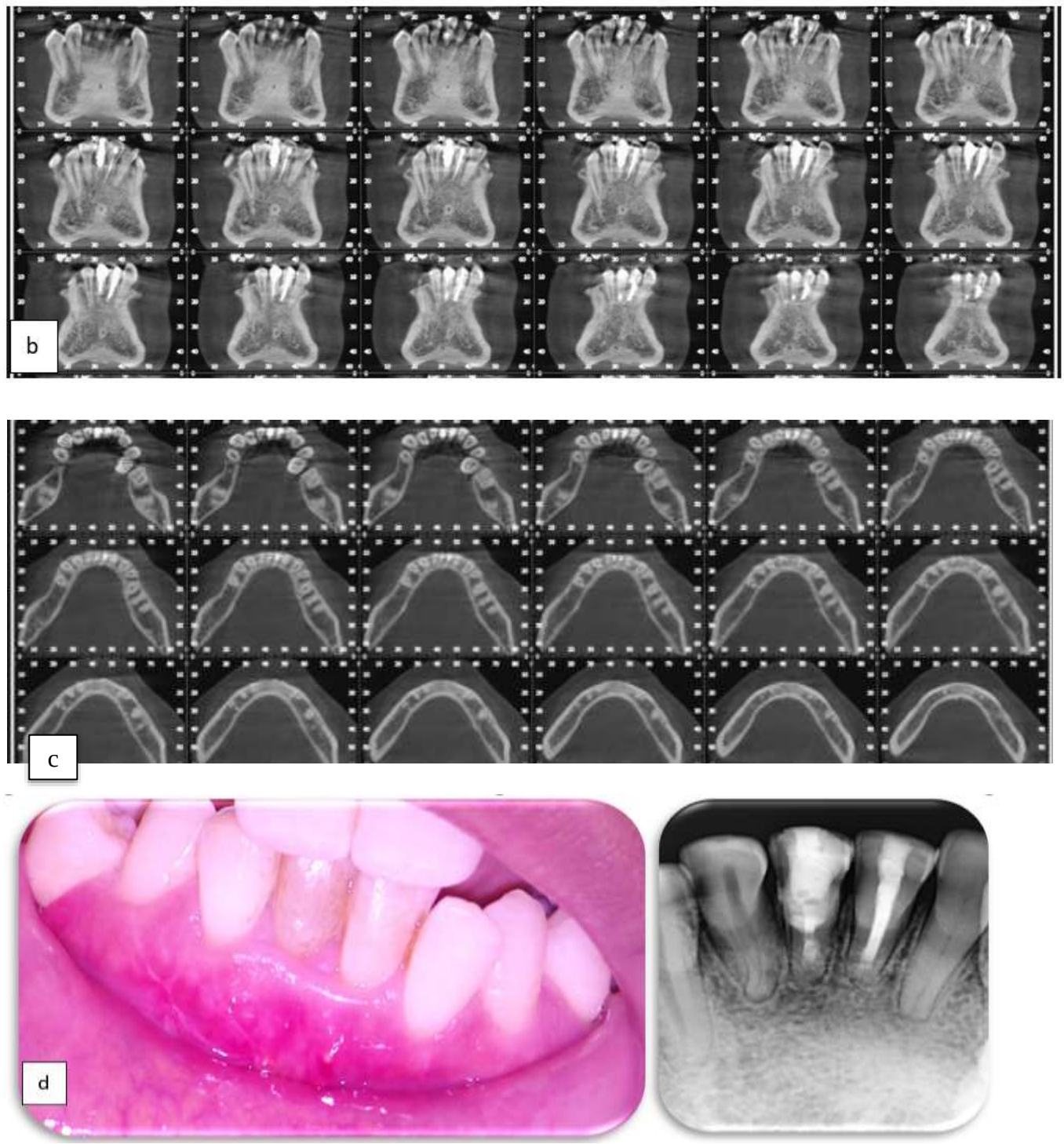


Figure (3): Clinical and Postoperative cone-beam computed tomography showing complete healing the lesion in sagittal slice **(a).** Cone-beam C.T showing the lesion in coronal section **(b)**. Postoperative cone-beam C.T showing the lesion in axial section **(c)**. Clinical image showing complete healing of mucosal fenestration after three months **(d)**.

Follow-up and Outcomes

The patient was followed up after one week, three months, 6 months, one year and two years. At each follow-up, the wound was inspected, and the patient was asked about any signs of infection or discomfort.

Complete coverage of the fenestration site was noted clinically after three months (Figure 3d), no adverse events were noticed and the patient was asymptomatic. The postoperative CBCT at 2-year follow-up revealed a thorough complete healing at #31 and #41 region with bone regeneration at the defective site, which suggesting successful outcome (Figure 3a, b, c).

Discussion

The case presented highlights the importance of prompt diagnosis and treatment of traumatized teeth. Mechanical trauma may be the predominant etiological reason for mucosal fenestration, inducing damage of the underlying buccal cortex and mucosa via sinus development. Although most cases of apical fenestration are asymptomatic (13), they may manifest with suppuration from the defect and mucosal collar inflammation with plaque accumulation (14). When the root surface is exposed, microorganisms colonize it wildly, causing disease development and preventing further mucosal reformation (15). Treatment of mucosal fenestrations that affecting permanent teeth is clinically demanding and necessitates a more challenging treatment technique. The use of endodontic microsurgery in this case ensured precise root end resection and meticulous debridement of the defect, resulting in more rapid healing and less post-operative discomfort. As well using of MTA as a root-end filling material displayed great short- and long-term success, this is because its unique properties, as perfect sealing ability, biocompatibility, and cementogenic potential to promote periapical tissue healing towards regeneration (16).

In 2014, by adjusting spin centrifugation forces, injectable platelet-rich fibrin (i-PRF) was developed. The blood centrifuged in non-glass centrifugation tubes at lower centrifugation speeds and less time resulted in a flowable PRF called i-PRF (17). It promotes both hard and soft tissue regeneration by progenitor-specific processes such as cellular movement through its fibrin scaffold, growth factor production which releases continuously over 10–14 days, hemostasis, and angiogenesis, and its non-

immunogenic effect (9).

In 2020, the effect of mixing bone graft materials with i-PRF producing sticky bone was assessed on cell characteristics of human osteoblasts. As reported by the authors (18), the human osteoblast proliferation, attachment, viability, and expression of differentiation and proliferation markers significantly increased in the i-PRF mixed with bone substitute material (BSM) compared to BSM without I-PRF.

These case report in the literature which describe the utilization of sticky bone in periapical microsurgery. Even though it had unfavorable prognostic factors, the follow-up has affirmed the encouraging effect of i-PRF and sticky bone, which have shortened the healing time of extensive periapical lesions and treat mucosal fenestration as a result of trauma. This finding corroborates with the outcome of the case reports by Rajula et al. and Karwa et al. that also showed the successful angiogenic potential sticky bone in the management of mucosal fenestrations (19, 20)

In summary, the current case report demonstrated remarkable outcomes for periapical healing, which can likely be attributed to the incorporation of i-PRF and bone grafts to generate sticky bone, hence inducing a prompt repair and regenerative process.

Conclusion

The combination of endodontic microsurgery and injectable PRP with sticky bone can be an effective treatment for necrotic teeth with mucosal fenestration and exposed root apices to enhance the bone regeneration and allowing rapid healing. A well-designed randomized clinical trial is recommended to comprehend the long-term risks and benefits of using sticky bone in regenerative endodontics.

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