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Case Report

Surgical treatment of apico-marginal defect associated with maxillary incisor teeth with a large periapical lesion using sticky bone & platelet rich fibrin membrane – A case report

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ABSTRACT

Apico-marginal defects are localized bony defects encompassing the total root length. The presence of apico-marginal defects has accounted for the failure of endodontic treatment in many cases. The best treatment option for such defect is to perform endodontic surgery using Guided Tissue Regeneration (GTR) membranes. Recently, platelet-rich fibrin (PRF), has been suggested as a better alternative to the conventional practice of using guided tissue regeneration (GTR) barrier membranes for the treatment of these defects. This case report presents clinical management of apico-marginal defect allied with extensive peri-radicular destruction in a maxillary central incisor subjected to periapical surgery using sticky bone and PRF as a barrier membrane. The patient was followed up for 1 year. Clinically, there was a reduction in probing pocket depth, and an increase in attached gingiva, and radiographically a resolution of periapical radiolucency and a significant amount of bone fill was evident.

1. Introduction

An apico-marginal defect presents as a total loss of buccal alveolar bone extending from the original alveolar crest to the tooth apex.[1] These defects are periradicular lesions accompanied by a periodontal breakdown with a reported incidence of 3.56% to 20%.[2,3] Periradicular surgery is a traditional treatment option in endodontics for the management of unhealed periapical pathologies, the prognosis of which is dependent on the location and the amount of bone adjacent to the root structures. Since healing takes place by repair rather than regeneration, an apico-marginal defect may hinder the normal healing process, by forming a long junction epithelium over the dehisced root surface.[4–6]

Guided tissue Regeneration (GTR) therapy has been validated to regenerate lost periodontium resulting from periodontal disease. It has also been introduced in endodontic surgeries as a concomitant treatment during the management of endodontic-periodontal lesions. Recently, the use of autologous products like platelet-rich fibrin (PRF), a second-generation platelet concentrate, is being suggested as a better alternative over the traditional use of GTR barrier membranes for the treatment of apico-marginal defects.[4] PRF as a barrier membrane has grabbed the attention of clinicians because it is autologous; is readily available; entails an easy chair-side preparation, enabling its wide application in dentistry, besides being affordable for the patient and the clinician, and without any visible

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risk of a rejection reaction (foreign body response). The 3-dimensional architecture of the fibrin matrix provides the PRF membrane with great strength and promotes wound healing via various growth factors.[7]

A newer concept of fabricating growth-factors-enriched bone graft matrix (also known as ''Sticky bone") using autologous fibrin glue was introduced in 2010 by Sohn DS et al.[8] Sticky bone provides stabilization of bone graft in the defect, and therefore, accelerates tissue healing and minimizes bone loss during healing period.[8] Sticky bone contains a much larger, denser, richer fibrin matrix enriched with growth factors than PRF and has both osteo-inductive and osteo-conductive character.

Although the diagnosis of apico-marginal defects is restricted to periradicular surgery and is made after reflection of the mucoperiosteal flap, radiographic and clinical data recorded before flap reflection are necessary for differential diagnosis. The present case report describes surgical management of apico-marginal defect associated with maxillary incisor teeth with large periapical lesions using sticky bone and PRF membrane.

2. Case Report

A 20-year-old systemically healthy non-smoker male reported to the Department of Conservative Dentistry & Endodontics of the Dental College & Hospital with a chief complaint of pain and purulent discharge about the upper left anterior teeth region for the last 3 months. The patient gave a history of trauma in the maxillary anterior region 8 to 9 years ago and a history of incomplete root canal treatment in teeth #21 and #22 about 9 months back. On intraoral examination, tooth #21 was found discolored (Figure 1a) and a draining sinus tract was present on the labial attached gingiva about #21. Both teeth #21 and #22 were tender on percussion and showed Grade-I mobility without any gingival recession. Periodontal findings revealed a deep pocket measuring 10 mm along the labial aspect of #21. Extraorally, no abnormality was detected.

An Intra-Oral Periapical (IOPA) radiograph of the affected teeth showed a well-defined peri radicular radiolucency, open apices, and prepared access cavities with radiopaque intracanal medicament about #21 and #22. Figure 1b and c depict the preoperative radiograph and the sinus tracing on the radiograph respectively. Cone Beam Computed Tomography (CBCT) evaluation of teeth # 21 and #22 revealed the presence of localized periapical bone loss with loss of facial cortical plate and marginal alveolar bone along the labial aspect of # 21 (Figure 1d-f) indicating a diagnosis of apical-marginal defect and a concurrent endodontic and periodontal disease in #21.[9] Treatment ensued after taking informed consent.

Endodontic treatment with periodontal therapy (Phase I) was initiated in #21 and #22 abiding by the treatment protocols of Abbott, Salgado, and Oh et al.[9,10] Under rubber dam isolation, access cavities of #21 and #22 were re-established. The canals were cleaned and shaped up to an apical size of #120K file (Mani, Inc. Japan) for #21 and size #100K file for #22 using 3% sodium hypochlorite (Prime Dental Products Pvt. Ltd.) as irrigant. The canals were dried with paper points and calcium hydroxide(CH) paste (Ultracal^{TM}XS, Ultradent, South Jordan) was placed as an intracanal medicament and the access cavities of both teeth were temporized with zinc-oxide eugenol restoration (Caviton, GC Corporation) and the patient was advised to maintain proper oral hygiene. After 4 weeks it was found that the pocket concerning #21 was persistent although the draining sinus had healed. Intracanal medication was replaced with new CH medication in #21 & #22 and the patient was again recalled after 3 months for further evaluation, which revealed a persistent localized pocket of 10 mm about #21; with no reduction in the size of periapical radiolucency in relation to #21 and #22 found on radiographs. Hence, surgical intervention was planned.

One week before surgery, custom-made gutta-percha master cones were prepared for #21 and #22 and both the teeth were obturated with a cold lateral compaction technique using AH Plus sealer (Dentsply Maillefer, USA). The access cavities were sealed with glass ionomer cement (Fuji-II, GC Co., Tokyo, Japan). During surgery, under local anesthesia using 2% lidocaine with 1:80,000 epinephrine (Lignox 2% A, Indoco Remedies Ltd.) a full-thickness mucoperiosteal flap was elevated and apico-marginal defect in relation to #21 was found. Then bony window preparation was done, the cystic lining was enucleated and the tissue was sent for histopathological examination. Thorough scaling of the root surface of #21 was done with ultrasonic instruments. Then apical 3 mm of the roots of both #21 & #22 were resected and retro cavity preparation was performed using E10D ultrasonic tips (Guilin Woodpecker, China). The root end cavities of the teeth were filled with mineral trioxide aggregate (MTA) [MTA Angelus, Brazil] and were verified by IOPA radiograph.

To prepare sticky bone, 10 ml of venous blood was collected from the patient's antecubital vein and kept in a 10 ml non-coated test tube. Blood was centrifuged immediately without an anticoagulant in a centrifugation machine (Remi R8-C, India) at 2700 RPM for 2 minutes according to protocol by Sohn DS et al.[8] After centrifugation, the resultant product comprised of autologous fibrin glue (AFG) at the top of the tube, was collected in a syringe and mixed with hydroxyapatite crystals (SYBOGRAF-Plus, Eucare Pharmaceuticals Ltd, Chennai) and allowed for 5-10 minutes for polymerization to produce sticky bone. The prepared sticky bone was placed in apico-marginal and periapical osseous defects. Then PRF membrane was prepared from PRF gel from the patient's 10 ml of venous blood following the protocol of Dohan DM[11] and was used to cover the grafted area. The flap was repositioned and

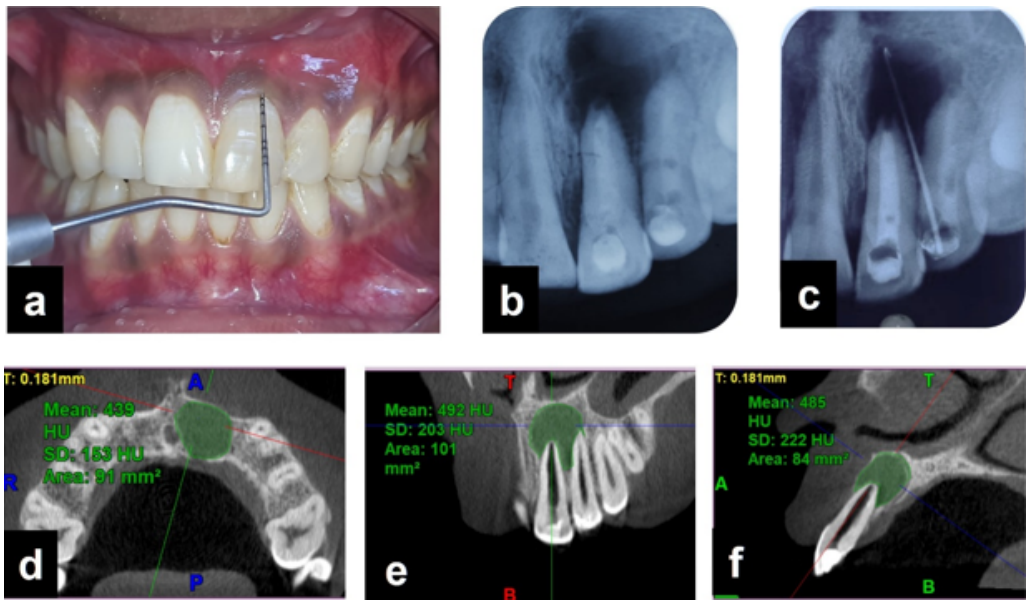

Figure 1: Pre-operative images: **a:** Clinical image showing measurement of pocket probing depth; **b:** Periapical radiograph; **c:** Sinus tracing with gutta-percha cone on the radiograph, **d:** cone-beam computed tomographic(CBCT) image-axial section; e: CBCT image-coronal section; **f:** CBCT image-sagittal section

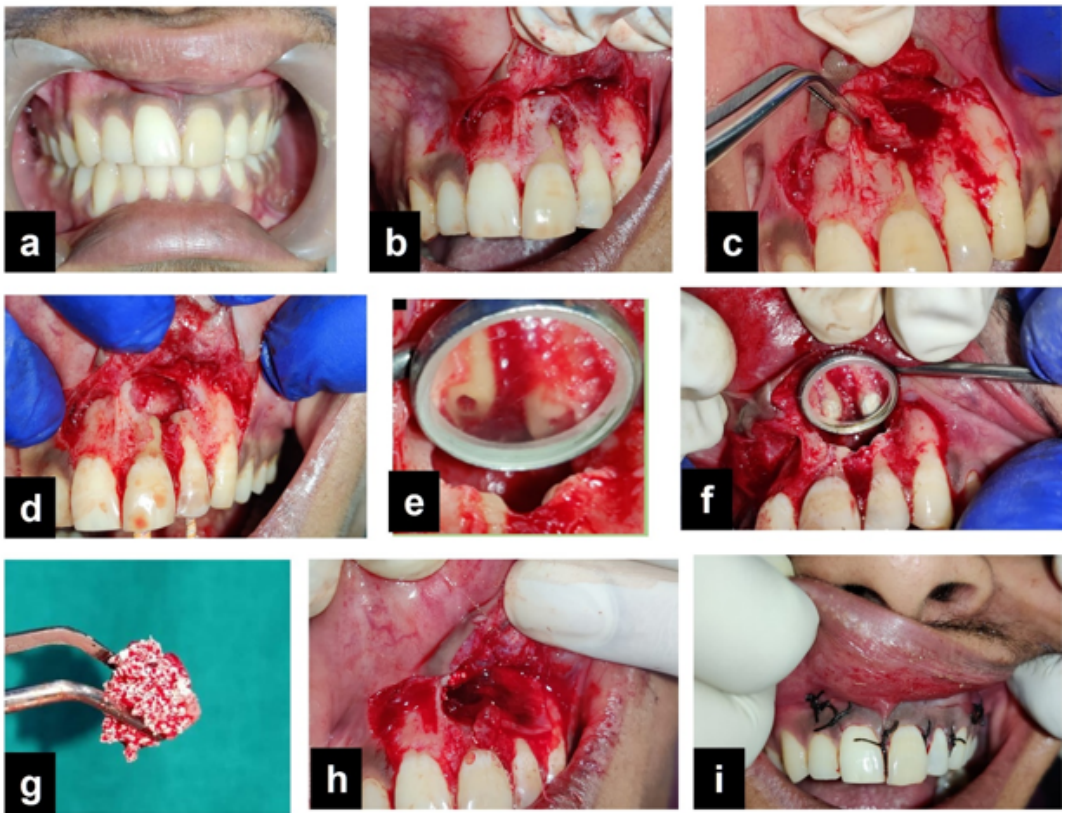

Figure 2: Surgical Procedural images showing: **a:** Pre-operative view; **b:** Elevation of the mucoperiosteal flap; **c:** cortical osteotomy and enucleation cyst; **d:** Apicectomy; **e:** Retrograde cavity preparation, f) retrograde restoration; **g:** Prepared sticky-bone; **h:** placement of sticky bone; **i:** sutures placed

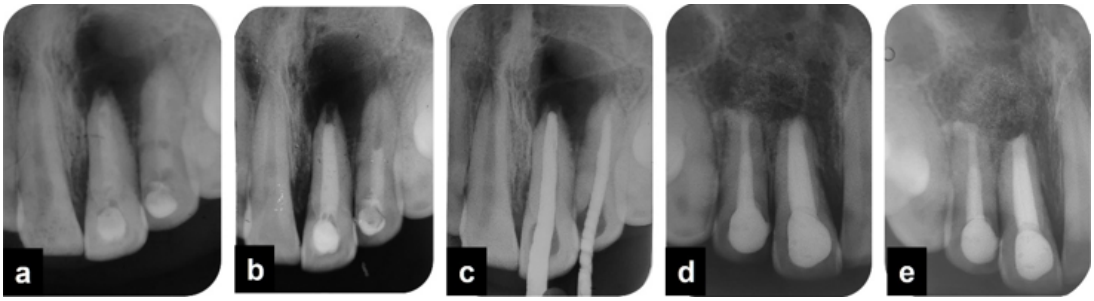

Figure 3: Periapical radiographs showing; **a:** Pre-operative view; **b:** Calcium hydroxide medicament placement; **c:** Master-cone trial; **d:** Post-obturation view; **e:** Apicoectomy and retrograde restoration

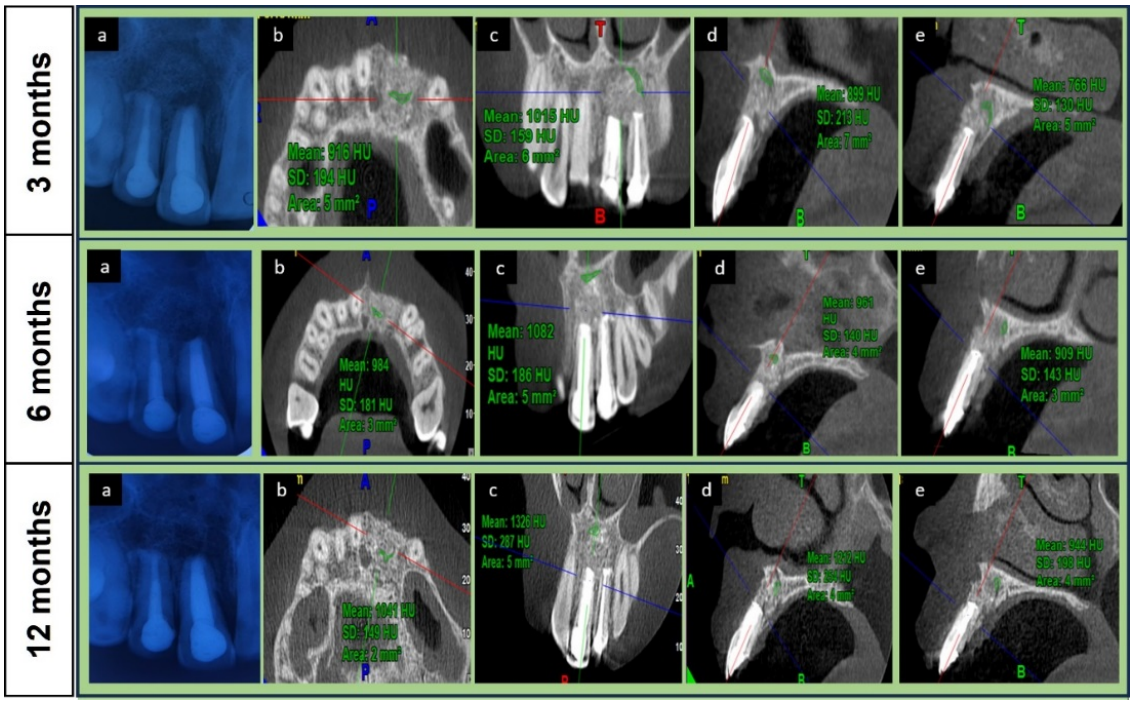

Figure 4: Post-operative images at 3,6 and 12 months: **a:** Periapical radiograph of tooth #21,#22; **b:** CBCT image-axial section of #21; **c:** CBCT image-coronal section of #21, #22; **d:** CBCT image-sagittal section of #21; **e:** CBCT image-sagittal section of #22

Table 1: Represents gradual increase in bone density [Hounsfield Units(HU)] and a decrease in radiolucent area (mm2)

Time points	Parameters	Axial	Coronal	Sagittal	Average Value	% Gain in Bone density	% Reduction in lesion size
Pre-operative	Bone Density	439	492	485	472		
	Lesion Size	91	101	84	92		
3rd Month	Bone Density	916	1015	832.5	922	95.3	93
	Lesion Size	5	6	6	5.6		
6th Month	Bone Density	984	1082	961	1009	1137	95.6
	Lesion Size	3	5	4	4		
12th Month	Bone Density	1041	1326	1078	1149	143.4	96.8
	Lesion Size	2	5	3.5	2.9		

sutured with 3-0 black silk sutures and a post-operative IOPA radiograph was taken. Figure 2 illustrates the clinical images of the surgical procedures and Figure 3 depicts the procedural peri-apical radiographs. The patient was instructed regarding oral hygiene measures and antibiotics and analgesics were prescribed.

The patient was recalled at 3, 6, 9, and 12 months for evaluation. At 12 months follow-up, the patient was asymptomatic, the sinus tract was closed and the probing depth was reduced to 2 mm about #21. IOPAR and CBCT scan made at 12 months follow-up showed bone fill in the osseous defect with complete resolution of the periapical radiolucency about #21 and #22 (Figure 4). CBCT evaluation (Table 1) revealed there was a gradual increase in bone density [Hounsfield Units(HU)] and a decrease in the area of periapical bony defect. It was found that the percent increase in bone density was 95.3, 113.7, and 143.4 in the 3^{rd}, 6^{th}, and 12^{th} months respectively and in the same time interval, the decrease in the radiolucent area was found to be 93, 95.6, 96.8 percent respectively.

3. Discussion

The aim of peri-radicular surgery comprises the elimination of the infection and regeneration of the lost periodontal tissues. Moreover, the destruction of marginal bone found in apico-marginal defects considerably reduces the treatment success rates.[12–14] A similar presentation in this case posed significant challenges to achieving a successful treatment outcome.

Literature has documented various biomaterials for GTR like resorbable / non-resorbable membranes, periosteal grafts, and various bone grafts, with successful outcomes.[15–17] However, certain associated disadvantages, such as affordability, the chances of contamination on exposure to oral fluids, and the need for additional surgery (for non-resorbable membranes only) have limited its usage.[18] Hence in the present case sticky bone as a graft material was used and PRF was used as a membrane to cover the grafted site.

The "sticky bone" is a homogenous product comprising a mineral scaffold for bone cells vital for bone formation. It also contains growth factors necessary for the stimulation of differentiation or migration of cells.[19] Sticky bone is advantageous because of its better adaptability over various shapes of the bony defect; prevention of the micro and macro movement of grafted bone thus maintaining the volume of augmentation during the healing period, accelerating soft tissue and bone healing by releasing growth factors. Moreover, the kit doesn't require any biochemical additives like PRP (Platelet rich plasma) and PRGF (Plasma rich in growth factors).[8]

The use of a physical barrier has been suggested to prevent epithelial down growth over the denuded root surface of apico-marginal defect.[20] We selected PRF because it has osteo-inductive properties and also preparation of PRF is quite an easy, fast, and simplified process as it does not require any biochemical modification during preparation, unlike PRP. PRF is a byproduct of a patient's blood, so chances of disease transmission are rare. It also acts like a competition barrier and accelerates wound closure and mucosal healing due to fibrin bandage and growth factor release.[18] PRF membrane can serve as an interposition matrix with biological properties such as promoting neo-angiogenesis and preventing necrosis and shrinkage of the surgical flap.[21] It also functions as fibrin glue exhibiting space-maintaining abilities and holding the flap in a stable position.[21]

Most of the reports published in the literature have used periapical radiographs to evaluate bony changes associated with the involved tooth except Rachana et al. who have used CT.[21] Also, Rajput et al. who had used CBCT for initial evaluation.[22] But in the present case with IOPA, CBCT has been used not only for initial evaluation but also for post-operative follow-up. At 12 months, radiographic assessment criteria were used to access pre and post-operative IOPA and CBCT that satisfied the criteria of complete healing. Thus, the result of this case report suggests that a combination of sticky bone and PRF barrier membrane promotes bone healing and bone growth in apico-marginal and periapical bone defects.

Similar case reports presented by Dhiman et al.[23] and Jayalakshmi KB et al.[24] concluded that the use of PRF along with bone graft might hasten bone regeneration in apico-marginal defects. Sureshbabu et al.[25] concluded that the combination use of sticky bone along with an autologous barrier membrane promotes rapid bone healing and bone regeneration in large periapical defects. However, histological studies are needed to authenticate actual bone regeneration.

4. Conclusion

The present case report has described the successful management of apico-marginal defect by applying principles of GTR with the use of growth factors-enriched bone graft matrix (sticky bone) and PRF as a barrier membrane. However, further long-term follow-up is required to validate the obtained results.

5. Source of Funding

None.

6. Conflict of Interest

None,

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