

Surgical Management of Mandibular Central Incisors and Treatment of Bone Defects with Synthetic Hydroxyapatite Granules and Platelet Rich Fibrin (PRF): A Case Report

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Abstract: *Dental traumatic injuries may affect the teeth and alveolar bone directly or indirectly. Endodontic surgical procedures are major considerations in the management of endodontically involved roots and associated periradicular structures. The regeneration of bone following destruction by a pathological process is an important factor in success following treatment. Bone grafting which is one of the methods used to address these issues has experienced an increased level of demand.*

Keywords: Synthetic Hydroxyapatite granules, Platelet - rich fibrin, Bone defects, periapical surgery, Bone regeneration.

1. Introduction

Surgery is an essential part of endodontics and helps us retain natural teeth as long as possible. Periapical surgery is part of endodontic surgery. The aim of periapical surgery is the treatment of apical periodontitis after depleting the possibilities of orthograde nonsurgical endodontics or due to failure or inability to perform such an approach. [1]

Epidemiology of Periapical Lesions

- Asymptomatic or chronic apical periodontitis
- Persistent intra - radicular infection
- Intraradicular infection (actinomycosis). [2]
- Foreign body reaction caused by a root obturating material, accumulation of endogenous cholesterol crystals. [3]
- True cystic lesions and tissue formed post - treatment (scar). [4]

Histological studies indicate that the frequency of lesions varies: periapical granulomas - 9% - 83.8%; cysts - 6% - 55%, periapical abscesses - 28% - 35%. [5]

In some studies, more periapical granulomas are found, while in others, cysts are equal to them ranging from 40% to 48%. [6]

The main objective of any endodontic surgery is to create a perfect seal between root canal space and periodontium thereby aiding the regeneration of periapical tissues; including a complete repair of osseous defects.

A bony defect is defined as any space in or near bone that ultimately needs to be filled with new bone. Bonye (1973)

suggested that the ideal reconstructive material to replace bone should facilitate revascularization, osteogenesis and osteoinduction. Studies have shown that a mechanical barrier such as a membrane or bone graft over the bone defect can prevent the oral epithelium and gingival connective tissue from growing into these defects.

The bone regeneration following periapical surgery can be facilitated by placing bone graft into the periapical defect. Different types of bone grafts are available for dental surgical procedure. These include autografts, allografts, xenografts, and alloplasts.

The ideal bone replacement material should be clinically and biologically inert, noncarcinogenic, and easily manoeuvrable to suit the osseous defect and dimensionally stable. [7] Calcium - based ceramic materials like calcium hydroxyapatite (HA) and tricalcium phosphate (TCP) had been used popularly for alveolar ridge reconstruction and in periodontal bony defects. [8]

Purpose of this case report is to present a clinical case, in which periapical surgery of Mandibular Central Incisors was done followed by repair of Bone Defects with combination of Synthetic Hydroxyapatite Granules with Platelet Rich Fibrin (PRF).

2. Case Report

A 36 years old female visit to the Department of Conservative dentistry and Endodontics with the chief complaint of pain in lower front tooth region since 2weeks and gave history of trauma 1 month back. The pain was continuous and throbbing in nature. The medical history was not significant. Patient had undergone for root canal treatment irt 31, 41 two weeks back. Clinical and

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radiographic examinations were performed initially. Teeth were mobile and tender on percussion irt 31, 41. On vitality examination, teeth were non vital.

On radiographic examination, IOPA revealed previous root canal treatment in 31, 41. The obturation is short of the radiographic apex. The roots are associated with periapical radiolucency. Orthopantomogram revealed periapical radiolucency and bone loss associated with 31, 41. The final diagnosis was made pulpal necrosis with apical periodontitis irt 31, 41.



(a)



(b)

Figure 1: Pre - Operative (a) IOPA (b) Orthopentomogram



Figure 2: Pre - Operative Clinical Picture

The final treatment plan of combined approach of orthograde endodontic re - treatment for 31, 41 followed by periapical surgery and treatment of bone defects with synthetic hydroxyapatite granules and platelet rich fibrinwas

decided. The patient was informed about the procedure and consent was taken.

In the first appointment, Buccal infiltration anesthesia was administered, Endodontic access was prepared and older gutta perchas located. Gutta percha inside the root canal was retrieved with the help of Hedstrom files and canal were irrigated with 2.5% sodium hypochlorite followed by normal saline then Ca (OH) ₂ intracanal medicament placed for one week. Patient was prescribed antibiotics and 500 mg of amoxicillin thrice a day for five days and combination of 100 mg of aceclofenac and 15 mg of serratiopeptidase twice a day for five days. The patient was recalled after 1 week.

In the second appointment, working length was determined and canals were cleaned chemo - mechanically, master cone was taken followed by the obturation. (Figures 3 and 4).



Figure 3: Working Length



Figure 4: Obturation

Before performing the endodontic surgery, semi - rigid splinting was done. The patient was advised to undergo blood investigations to rule out bleeding disorders. Complete blood picture and coagulation studies report were normal.

Under local anaesthesia, a full thickness mucoperiosteal flap was elevated. A large soft lesion was seen involving the root apices of 31, 41 (Figure 5) The lesion was circumferentially separated from the bony crypt and the teeth. Using Gracey curettes, the granulation tissue in the apical and lateral root surfaces of the mandibular central incisors were curetted.



Figure 5: Flap Elevation

For the histopathological examination, the granulation tissue was fixed in 10% buffered formalin. The surgical site was washed with sterile saline solution after the complete removal of the lesion.

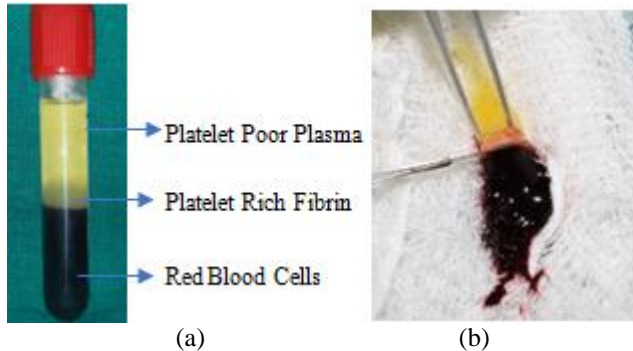


Figure 6: (a) & (b) Preparation of PRF Membrane



Figure 7: (a) G - Bone Synthetic Hydroxyapatite Granules (B) Mixing of Hydroxyapatite Granules with PRF (C) Placement of Combination on Defect Site (D) Placement of GTR Membrane

PRF membrane preparation was performed by using the procedure described by Dohan D M *et al.* 30 minutes before the clinical procedure. 8.5 ml of whole blood was drawn by venepuncture of the antecubital vein. Blood was collected in a 10 ml sterile glass tube without anticoagulant and immediately centrifuged at 3000 revolutions per minute (rpm) for 10 minutes. The resultant product consisted of three layers: topmost layer consisting of acellular platelet poor plasma, PRF clot in the middle and Red Blood Cells at the bottom.

The PRF clot was retrieved and fluids were squeezed out to obtain a PRF membrane. [Figure 6 (a & b)] As the extension of the defect was large, Synthetic Hydroxyapatite Granules mixed with Platelet Rich Fibrin (PRF) was placed on defect

site followed by GTR (Guided Tissue Regeneration) membrane. [Figure 7 (a b c & d)] The mucoperiosteal flap was sutured in place. (Figure 8)



Figure 8: Placement of suture

The granulation tissue was sent for histopathological examination, the findings were suggestive of cystic capsule. Suture removal was done after 1 week. Patient was asymptomatic after one month follow - up.



Figure 9: Follow - Up after 1 Month

3. Discussion

Persistent chronic infection can lead to formation of a periapical cyst. Periapical cysts commonly occur in the mandible and may appear as unilocular or multilocular radiolucency on radiographs. Cystic lesions of the mandible can result in bone remodeling which weakens the bone, leading to functional changes and predisposing the patient to infection and pathologic fracture. [9]

The goal of periapical surgery is the predictable regeneration of periapical tissues including a complete repair of the osseous defects. Inadequate bone healing is caused by in growth of connective tissue into the bone space, preventing osteogenesis. In order to prevent this soft tissue in growth, bone substitute can be used to fill the bony space. [8]

Different types of bone grafts are available for dental surgical procedures like autograft, allograft, xenograft and alloplasts. Traditionally autografts have been used more frequently as the first choice, as they do not provoke immune reaction that causes rejection.

Limitations of allografts, these are immunologically incompatible with the recipient and have a potential to transfer certain diseases. These potential problems have led to the growing interest in the development of alternative bone substitutes. [7]

G - Bone Synthetic Granules are of synthetic Calcium Hydroxyapatite in low crystalline form. It is a mixture of hydroxyapatite, tricalcium phosphate and other forms of calcium such as calcium carbonate and bi calcium phosphate. The average particle Size of G - Bone Synthetic Hydroxyapatite granules is 0.1 - 0.4 mm.

These granules and blocks are made of Multiphasic Calcium Hydroxyapatite in low crystalline form. The body absorbs it faster. It is derived from chemical synthesis. It does not carry any risk of transmission of any disease because it is made from pure chemical synthesis. It is available in form of granules, blocks, dowels, spheres and plugs. [10]

Therefore, the combination of hydroxyapatite granules and PRF is expected to provide positive benefits for bone grafting on bone defects. Meanwhile, PRF may aid bone grafting by providing growth factors and cytokines. [11, 12] This combination is intended to speed up bone grafting and potentially solve difficulties with bone defect therapy. [13]

Guided tissue regeneration (GTR) is a surgical technique which has been gaining popularity in dentistry. Its aim is to reconstruct the periodontium by helping alveolar bone regeneration and collagen fibre insertion into the newly formed cementum. GTR does this by stabilising the blood clot which allows wound healing by primary intention and protects the defect from gingival ingrowth. [14, 15]

4. Conclusion

Surgery may be undertaken after unsuccessful retreatment, or when retreatment is impossible or has an unfavourable prognosis. The preservation of natural teeth should be our goal since they still cannot be equally replaced by existing artificial materials and technologies. The bone regeneration following periapical surgery can be facilitated by using bone graft. Hydroxyapatite is found to be very effective alloplastic material.

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