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Case Report

Bioceramics in surgical endodontics: A series of case report

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ABSTRACT:
Aim - The aim of case report is CBCT evaluation of periapical healing after using bioceramic based retrograde filling material i.e., Angelus Bio-C repair and Endosequence BC RRM.
Material and method - This report includes two cases of maxillary anterior teeth with periapical lesion. These cases were diagnosed using IOPA and CBCT. After careful diagnosis root canal treatment followed by apicoectomy was performed with placement of retrograde filling materials i.e Angelus Bio-C repair and Endosequence BC RRM. Long term followup was done to assess the periapical healing.
Conclusion – Bioceramic material have better healing and ability to induce biomineralization.
Keywords: Endosurgery; Apicoectomy; Angelus Bio C Repair; Endosequence BC RRM; CBCT

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INTRODUCTION

Endodontic surgery is a well-established and accepted surgical procedure for the preservation of teeth with periradicular pathosis. Apicoectomy was the classic term applied to the procedure, which may or may not have included the preparation and filling of the root-end cavity(!).

It involves the surgical management of a tooth with a periapical lesion which cannot be resolved by conventional endodontic treatment (2). This treatment approach involves the surgical removal of infected periradicular tissue, root-end resection, preparation of a cavity and, subsequently, placement of a root-end filling material. Retrograde filling aims at providing a hermetic seal minimising bacterial microleakage, preventing the root canal re-infection (3). The ultimate purpose of PeriradicuIar surgery is regeneration of the periapical tissues to a healthy state. The hermetic sealing of any potentially noxious agent within the physical confines of the root should prevent reinfection around the neoapex. To obtain this goal, it is generally accepted that 3 mm of the root-end be resected so that a root-end filling of adequate depth can be placed (1).

For many years, Materials like amalgam, glass-ionomer-cement or composite were used for root end filling. These materials were later replaced by newer materials like SuperEBA, IRM and MTA as they have good experimental and clinical documentation. These materials are biocompatible, good marginal adaptation and high compressive strength.

Recently bioceramic based materials have been used for this purpose. Bioceramic based materials used in our case report are Angelus BIO-C Repair and Endosequence BC RRM. They are bioceramic reparative materials that are available in syringe form (4). They are biocompatible, hydrophilic, insoluble, dimensionally stable and have high pH as well as adequate setting time.

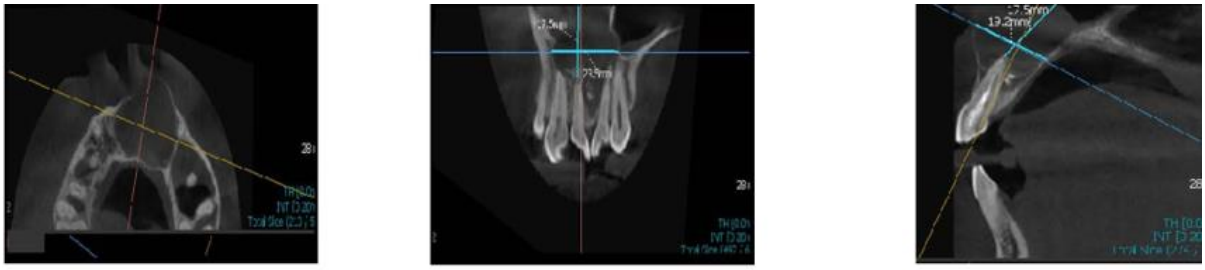
In our cases CBCT was used for diagnosis and a tool to access the periapical healing. CBCT is a dento maxillofacial imaging technique, which provides 3D reconstruction of teeth and their surrounding structures.

CBCT exposes an object to multiple cone-shaped beams to acquire volume of the object, and later serial section images are obtained in coronal, sagittal, and axial planes, making possible the 3D interpretation. Thus, the clinician can visualize morphologic features and pathologies from different 3D perspectives CBCT can be used for the assessment of periapical healing following root canal treatment and endodontic surgery (5).
The aim of case report is CBCT evaluation of periapical healing after using bioceramic based retrograde filling material i.e. Angelus Bio-C repair and Endosequence BC RRM.

Case Reports

Case 1. A 23-year-old male patient reported with the chief complaint of swelling in the upper front region 1 month ago. He had a history of trauma to upper anterior region 12 years back. The clinical examination revealed intraoral swelling in palatal region accompanied with discharge with respect to teeth 11and 21. The teeth were tender on percussion and nonvital with Ellis and Davey class 3 trauma #21. Palpation of left upper anterior region was painful.
Panoramic and periapical radiographic examination revealed a radiolucent circumscribed lesion around the periapical region of tooth #11,21 with faulty root canal treatment#21. cone beam computed tomography (CBCT) scan was indicated to obtain an accurate diagnosis of the lesion and its relationship with the adjacent teeth. CBCT examination revealed presence of periapical radiolucency with respect to 11 and 21 in sagittal, coronal, and axial planes and reconstructed three- dimensional image.

Fig. 1 :- pre operative CBCT showing faulty RCT w.r.t. 21 with large periapical lesion involving 11, 21



(a) (b) (c)

Fig 2: axial crossection, coronal and sagittal crossection images depicting the size of lesion with involvement of buccal cortical plate.

MANAGEMENT

Root Canal retreatment was performed #21 and root canal treatment #11 was performed using step back technique. After access preparation, working length was taken using Ingle's method. Canal was enlarged till MAF size 60 to full working length. Canal was irrigated with 5.25% sodium hypochlorite and normal saline. The root canal was then dried using paper points. The root canals were obturated using gutta percha using AH plus sealer following cold lateral condensation technique. This was followed by apicoectomy and placement of Endosequence BC RRM as retrograde material during which biopsy specimens were taken for histopathologic examination. Histopathologic Examination: it revealed stratified squamous cystic lining having underlying connective tissue stroma. fibrocellular connective tissue stroma shows chronic inflammatory cell infiltrate like lymphocytes, plasma cells and foamy macrophages. Overall features suggesting chronic inflammatory cystic lesion.

Follow-Up and Outcomes - Sutures were removed one week after surgery. Ten days later, the patient had no postoperative intercurrences and an intraoral evaluation was performed to investigate any hematoma or oedema. No exudate was observed or related. follow-up sessions were performed after 1month, 3months, 5 months, 7 months and 9 months. Size of the radiolucency was measured each time and compared with preoperative radiograph. The patient progression was evaluated by CBCT images and a bone neoformation was observed at the periapical area of tooth #21 and #22.

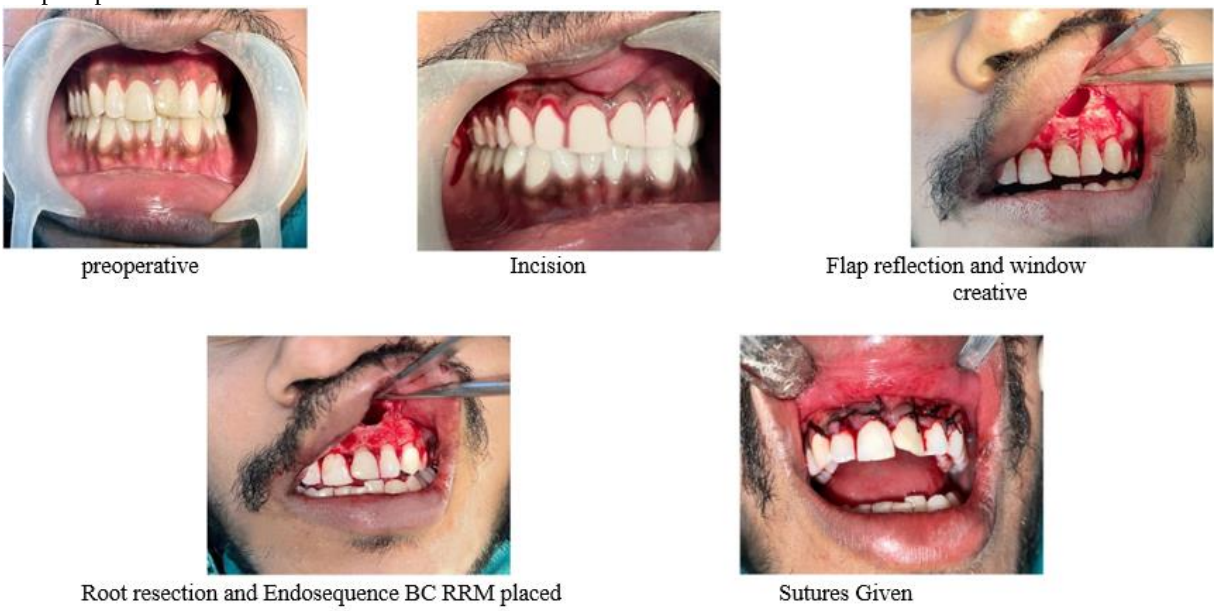


Fig. 3 :- surgical procedure for the case

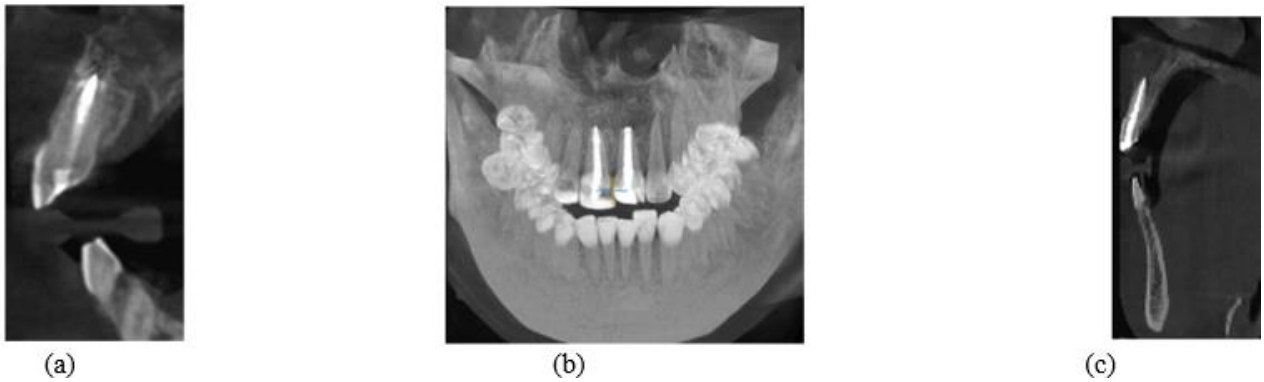


Fig 4: follow up showing healing of periapical lesion after 12months of Apicoectomy

CASE 2: A 22-year-old male patient reported with the chief complaint of pus discharge from upper front region of since 4-5 years. The clinical examination revealed discolored fractured crown fracture with respect to tooth 21. Teeth 21 was nonvital with Ellis and Davey class 3 trauma. The IOPA radiographic examination revealed large radiolucent lesion #21,11,22. CBCT examination revealed presence of periapical radiolucency with respect to 21,22,11 in sagittal, coronal, and axial planes and reconstructed three-dimensional image.

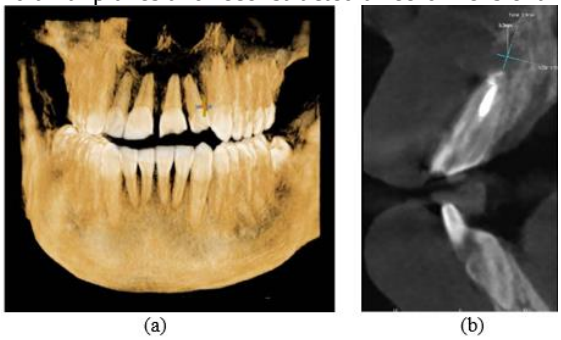


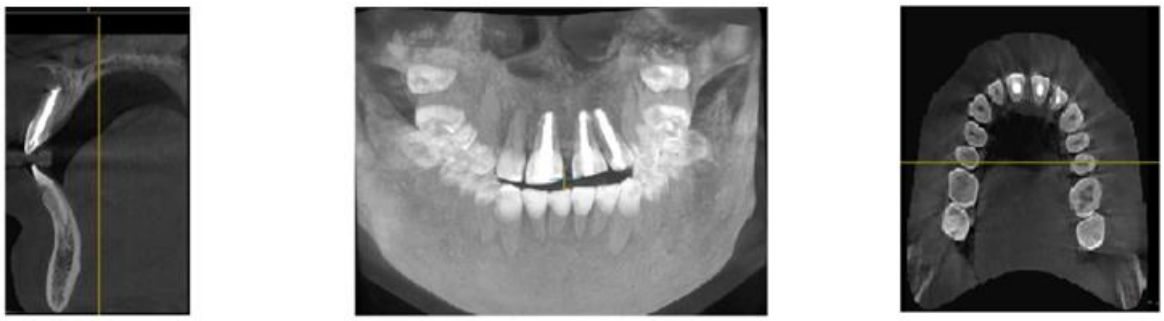
Fig 5 : Preoperative CBCT showing the extent and size of periapical lesion

Management- Root canal treatment #21,11,21 was performed using step back technique. After access preparation, working length was taken using Ingle's method. Canal was enlarged till MAF size 60 to full working length. Canal was irrigated with 5.25% sodium hypochlorite and normal saline. The root canal was then dried using paper points. The root canals were obturated using gutta percha using AH plus sealer following cold lateral condensation technique. This was followed by apicoectomy and placement of Angelus BIO-C repair as retrograde material during which biopsy specimens were taken for histopathologic examination.

Histopathologic Examination: Histopathologic examination done in the case revealed fibrous connective tissue which was inflamed, dense aggregate of chronic inflammatory cells, dilated and congested blood vessels and hemorrhagic foci, many Russell bodies, and few giant cells. No evidence of epithelium was present in the given sections. Oral pathologist diagnosed the specimen as periapical granuloma.

Fig 5: Surgical procedure for case 2

Follow-up: Sutures were removed one week after surgery. Ten days later, the patient had no postoperative intercurrences and an intraoral evaluation was performed to investigate any hematoma or oedema. No exudate was observed or related. follow-up sessions were performed after 1month, 3months, 5 months, 7 months and 9 months. Size of the radiolucency was measured each time and compared with preoperative radiograph. The patient progression was evaluated by CBCT images and a bone neoformation was observed at the periapical area of tooth #21 and 22.



(a) (b) (c)

Fig 6: images of different crossection showing periapical healing after 12months of apicoectomy

Discussion

Periapical surgery has been indicated for the treatment of teeth with periapical lesions when periapical disease persists despite orthograde root canal treatment. The success rate of this surgical procedure is largely attributable to the preparation of a retrograde cavity that allows correct marginal adaptation of the material in all three dimensions of space - securing correct sealing of the root canal and avoiding microleakage into the periapical tissues(6). Selection of the root-end filling material influences the final outcome of the procedure, since its main objective is to seal the apical region. The material used therefore should afford radiopacity, biocompatibility, antimicrobial activity, bioactivity and solubility, low cytotoxicity, good marginal sealing and adhesion to root dentin, compression resistance as well as dimensional stability, proper setting time, and biomimetic properties under static and functional conditions. Multiple retrograde filling materials have been used in periapical surgery such as silver amalgam, gutta-percha, zinc oxide eugenol (Super EBA®), glass ionomer, IRM. Mineral trioxide aggregate stands out among all these materials. Recently many bioceramic based materials came into light. Bioceramics refers to the combination of calcium silicate and calcium phosphate that is applicable for biomedical or dental use. These are available as premixed product to provide the clinician with a homogeneous and consistent material. Material used in these cases are Endosequence BC RRM and Angelus Bio C repair. Endosequence BC RRM produced with nanosphere (1×10^{-3} mm in its greatest diameter) particles that allow the material to enter into the dentinal tubules and interact with the moisture present in the dentin. This creates a mechanical bond on setting. This eliminates the potential for shrinkage of the root-end filling material, rendering the material with exceptional dimensional stability. EndoSequence RRM putty and ProRoot MTA have demonstrated similar antimicrobial efficacy against clinical Isolates of E. faecalis. (Lovato et al).[7] According Amer Z et al,cytotoxicity of EndoSequence Root Repair Material and MTA are compairable(9) . Endosequence BC RRM showed cell viability similar to that of MTA. Endosequence has better handling characterstics as compared to that of MTA. Recently available mechanically mixed products are consistent and more efficient. Bioceramic materials are highly radiopaque material resulting in easy identification in radiographs. A high alkaline pH is partially responsible for its antibacterial nature. The bioceramic materials are said to reach a pH of 12.8 during the time of placement. During a 7-day period, the pH steadily decreases. This property of bioceramic root repair material is implied to provide superior biocompatibility characteristics. Other bioceramic material used was Bio-C Repair It is bioceramic reparative material. It is available in syringe form. It consists of calcium silicate, calcium oxide, iron oxide, silicon dioxide and a dispersing agent. It contains carbon (34.81%) and oxygen (34.51%), with a lower concentration of calcium compared to the other biomaterials. Due to this characteristic composition, it may be associated with a higher capacity for tissue repair. According to the study (Campi LB et al., 2023) Bio-C Repair, in comparison with White MTA and Biodentine had adequate radiopacity above 3mm Al, solubility less than 3%, dimensional expansion, and low volumetric change. In addition, Bio-C Repair promoted an alkaline pH and presented bioactivity and biocompatibility similar to MTA and Biodentine, showing potential for use as a repair material(10).

CONCLUSION

Good qualiy apical seal is mendatory for successful endosurgery for which various retrograde material are being usedover ages . Recent advances in retrograde material i.e bioceramic material have better healing and ability to induce biomineralization. These materials are highly biocompatible and have good biomineralization capacity.
This was also concluded CBCT scan may provide a better, more accurate, and faster method to differentially diagnose large periapical lesion as compared to conventional IOPA radiographs.

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