



Case of the Month – March 2018

Concentrated Growth Factor – Novel Bone Regenerative Agent

Introduction

Periapical surgery is often a last resort to surgically maintain a tooth with a Periapical lesion that cannot be managed with conventional endodontic (re-)treatment. The main goal of apical surgery is to prevent bacterial leakage from the root-canal system into the periradicular tissues by placing a tight root-end filling following root-end resection and to completely eliminate cystic lining. As a result of periapical surgery an empty bony socket is formed, in order to reconstitute this lost bony tissue regeneration is carried out. One such an agent used to accelerate tissue regeneration and repair in dental and medical fields is Concentrated Growth Factor (CGF).

Case report

History and examination

A 22 year old male patient reported to the Department with the chief complaint of pain in upper front tooth region for past 3 months. History of presenting illness revealed trauma before 5 years. Intraoral examination showed brownish discoloration of 21 with Ellis class I fracture, 21 and 22 had tenderness on percussion. Electric pulp tester showed no response in 21 and 22 with grade I mobility. Gingival inflammation was present in relation to 22 without sinus opening (Fig 1A). On aspiration pus was collected in the syringe

Radiographic Examination

The IOPA radiographic examination revealed a large radiolucent lesion of size 2*2 cm with a well-defined border in the periapical area of 21 and 22 (Fig 1B). CBCT examination showed presence of periapical radiolucency in relation to 21 and 22 in sagittal, coronal, and axial planes with perforation of labial cortical plate (Fig 1C).

Provisional diagnosis

Pulpal necrosis in 21 and 22 with chronic periapical abscess

Treatment plan

Root canal treatment followed by periapical surgery in relation to 21 and 22



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Clinical procedure

Under rubber dam (GDC Marketing) isolation, straight line access cavity was prepared. Working length determined using no.15 size K file (MANI PRIME DENTAL PVT .LTD.) and chemo mechanical preparation was completed using standardized technique till 70 size K-files. Canals were irrigated with 3% sodium hypochlorite and 17% EDTA. Canals were dried with paper points. Calcium hydroxide (Metapex, Meta biomed Co.Ltd., Korea) intracanal medicament was placed for 2 weeks for two consecutive times but the symptom was persistent. Due to persistent periapical lesion surgical management was planned and on the day of surgery obturation was completed using Gutta Percha (Dentsply Maillefer, India) and AH plus jet sealer (Dentsply Maillefer) by lateral condensation technique (Fig 2A). Access was closed with cavit (3M ESPE).

Surgical procedure

Extra oral antisepsis and intra-oral antisepsis was performed with 5% povidone iodine solution and 0.2% chlorhexidine digluconate rinse respectively. The operative site was anaesthetized with 2% Lignocaine HCl with adrenaline (1:80,000) (Indoco remedies Ltd.) using Infra Orbital nerve block and infiltration techniques. A full thickness mucoperiosteal flap was reflected and care was taken to preserve interdental papillary tissue. After reflection of the flap and exposure of osseous defect, a thorough surgical debridement was done using bone curette (Fig 2B). Osseous margins were smoothed. Debridement was followed by copious irrigation with 0.9% normal saline. 3mm of root end was resected (Fig 2C) to remove apical delta and retrograde filling was done with Biodentine (septodont) (Fig 2D). The enucleated soft tissue sample was sent for biopsy.

CGF preparation

CGF was prepared after periapical curettage, just before its placement in the defect, in accordance with the protocol developed by Sacco (2006). 9 mL of blood was drawn into each sterile Vacuette tube (Greiner Bio-One, GmbH, Kremsmunster, Austria) silicon coated as a serum clot activator. These tubes were then immediately centrifuged in a special machine (Medifuge MF200, Silfradent srl, Forlì, Italy) (Fig 3A) using a program with the following characteristics: 30 seconds acceleration, 2 minutes at 2,700 rpm, 4 minutes at 2,400 rpm, 4 minutes 2,700 rpm, 3 minutes at 3,000 rpm and 36 seconds deceleration and stopped. At the end of the process, three blood fractions were identified: (1) the upper layer, representing the liquid phase of plasma named platelet poor plasma (PPP), (2) the lower layer, at the



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bottom of the tube, consisting in free red blood cells (RBC); (3) the middle layer, representing the solid CGF, interface between white and red part CGF was separated from red corpuscles base (preserving a small RBC layer) using sterile tweezers just after removal of PPP (platelet-poor plasma) and placed inside the bony socket(Fig 3B). A part of CGF was utilized for formation of CGF membrane which is used for covering exposed root surface in 21(Fig 3C&D).

The mucoperiosteal flap was repositioned and sutured using 3-0 black silk. Patient was prescribed systemic antibiotics (Amoxicillin 500mg thrice daily, Metronidazole,400mg twice daily) , analgesics (Ibuprofen 400 mg thrice daily) and Ranitidine 150 mg thrice daily, for 3-5 days. Post-operative instruction was given to the patient. Re-evaluation for any acute signs of inflammation or infection was done at 24 hours post surgically. 7 days following surgery, the suture was removed and surgical site was irrigated with normal saline. Access cavity was restored with conventional GIC (GC FUJI IX). Patient was observed for any signs or symptoms of post-operative complications. At the end of 9 month CBCT scan was taken to evaluate periapical lesion healing.

Confirmatory diagnosis

Histopathological examination reveals the presence of infected Periapical cyst in relation to 21 and 22(Fig 4B).

Bone density evaluation using CBCT scan

Preoperative and 9 month postoperative bone density (Fig 4C) was evaluated with CBCT scan using Romexis software. The value recorded was obtained from sagittal section at the mid root level of the involved tooth calculating an average of 10 values at various points within the lesion in Hounsfield Units (HU).The results showed that bone density was significantly increased in the 9 month postoperative follow up (Fig 5)

Discussion

Regeneration is reproduction or reconstitution of lost or injured part without any scar tissue formation. For new bone regeneration, it requires three important components like autologous cells, scaffolds, and signaling molecules (4). In our case report we used concentrated growth factor (CGF) which is fibrin rich organic matrix which contains growth factors, platelets, leukocytes and CD34+ stem cells which help in regenerating new bone. This autologous preparation was introduced by Sacco in 2006. CGF is produced



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by centrifuging blood samples with a special centrifuge device (Medifuge, Silfradent srl, Italy), similar to PRF. Nevertheless, the different centrifugation speed permits the isolation of a much larger, denser and richer in growth factors fibrin matrix.

CGF releases various growth factors such as Platelet-derived growth factor (PDGF), Transforming growth factor- β 1 (TGF β 1) and β 2 (TGF- β 2), Fibroblast growth factor (FGF), Vascular endothelial growth factor (VEGF), Brain derived growth factor (BDGF) and Insulin-like growth factor (IGF) which stimulate cell proliferation, matrix remodeling and angiogenesis. Qin et al. (2016) proved that CGF could release TGF- β 1 over a sustained period of time (at least 13 days) (5) and Park et al (2016) showed that CGF contained approximately 1.5 times more VEGF than PRF which is responsible for accelerated bone formation(1). According to Sohn et al (2009) CGF seems to be more handfull and with more regenerative capability than the other previous presidia and concluded that healing of sinus lift intervention took just 4 months for bony healing (3). Usually 3 to 4 mm of red blood cells compartment present adjacent to CGF is also utilized for filling bony socket because it contain CD 34+ cells. According to Majka et al., (2001) CD34 + cells help in vascular maintenance, neovascularisation, and angiogenesis their by accelerating bone healing (2).

According to Park et al (2016) CGF showed a better new bone formation rate in bone defects than PRF. SEM examination revealed CGF contain fibrinogen structures that were thicker per unit area and had a more regular pattern when compared with the PRF(1), so in our case we utilized CGF for making membrane for root surface coverage.

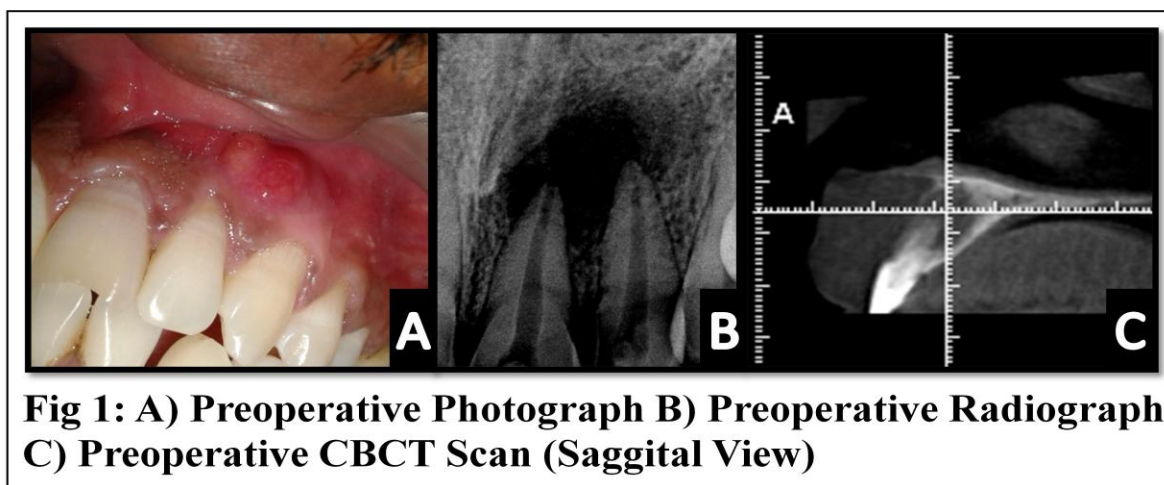
Conclusion

Various agents had been used in the past for regeneration of bone but platelet concentrates offered excellent bone formation. The result of present case report suggests that CGF improved clinical outcome of periapical surgery better than that of its predecessors. Hence CGF act like a powerful bio-scaffold with an integrated reservoir of growth factors promoting excellent regeneration of bone.

References

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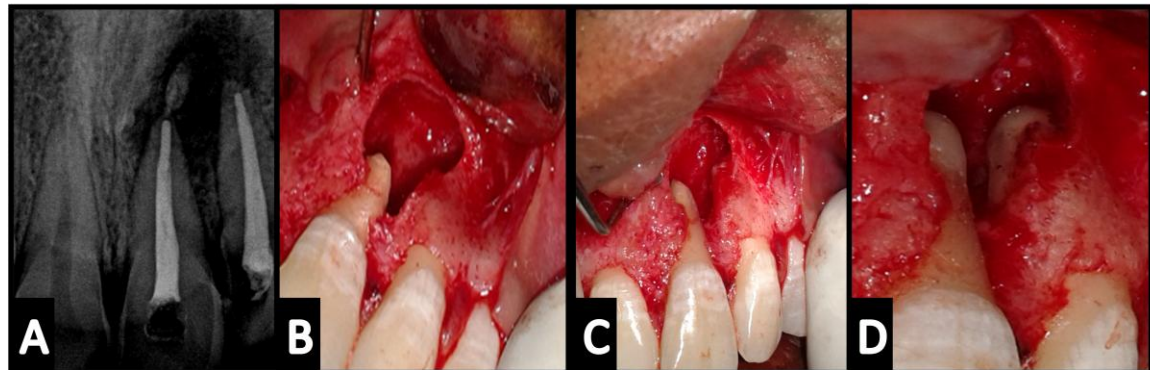


Fig 2: A) Obturated 21 22 B) Lesion Curettage Done C) Root End Resected In 21 22 D) Retrograde Filling Done In 21 22 Using Biodentine (septodont)

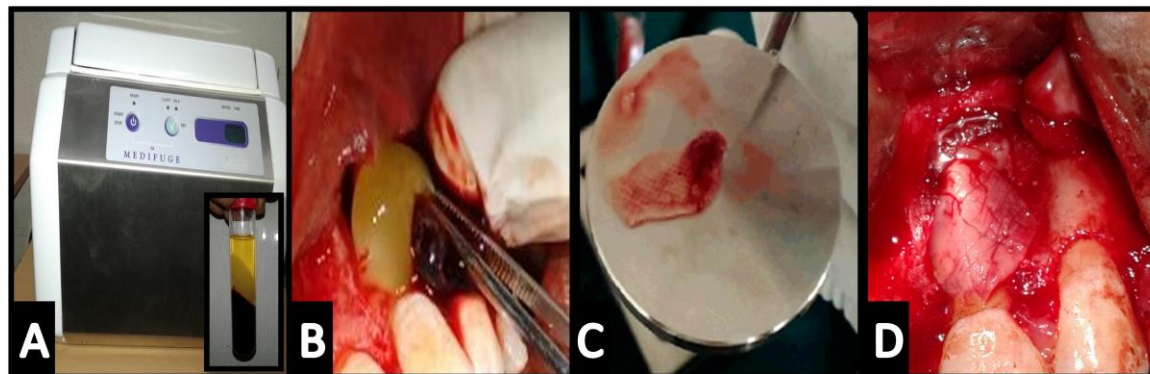


Fig 3: A) Medifuge (MF200, Silfradent srl, Forlì, Italy) for CGF preparation B) CGF placed in bony socket C) CGF membrane prepared D) membrane placed over exposed root surface

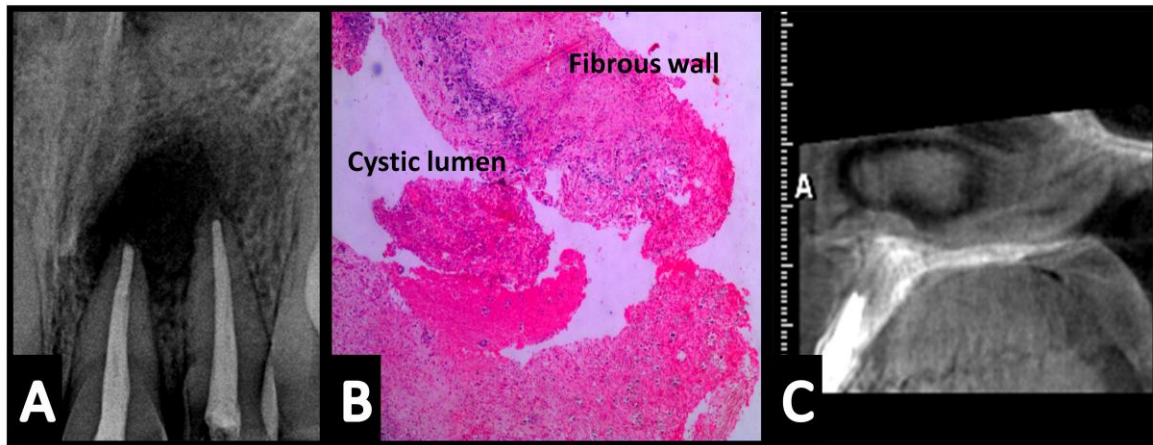


Fig 4: A) Immediate Postoperative Radiograph B) Histopathological Image Of Periapical Cyst C) Postoperative CBCT Scan - 9 month follow up (Saggital View)



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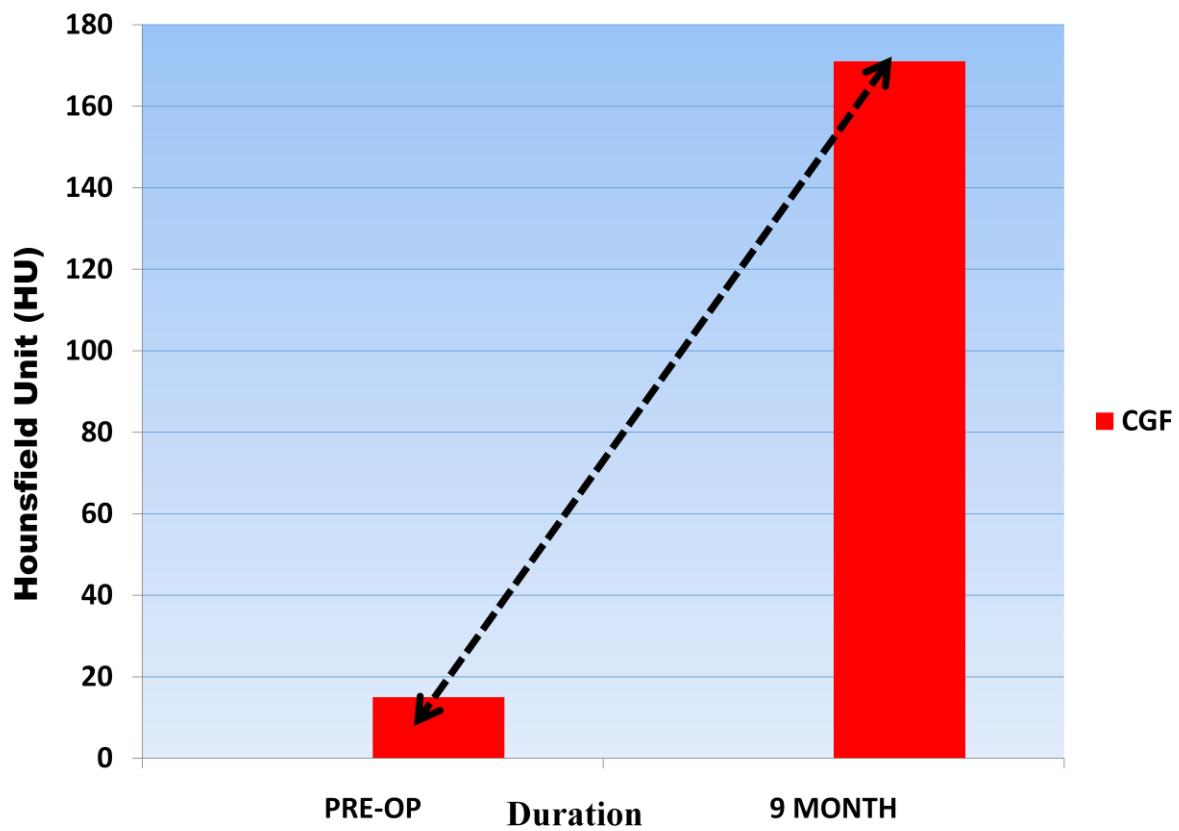


Fig (5)