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Research Paper

Role of CGF as a Scaffold in Direct Pulp Capping Combined with MTA: A Case Report

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Abstract:
Background*: Irreversible pulpitis is commonly treated with root canal therapy; however, it is invasive and may compromise tooth structure. Vital pulp therapy using bioactive materials offers a conservative alternative aimed at preserving pulp vitality.*
Case Presentation*: A patient diagnosed with symptomatic reversible pulpitis underwent CGF-assisted pulpotomy. Autologous concentrated growth factor (CGF) was prepared from 10 mL of blood and placed over the pulp tissue following hemostasis, followed by a 2 mm layer of mineral trioxide aggregate (MTA). The tooth was temporarily restored and later permanently restored with composite. Clinical and radiographic follow-ups at 15 days, 1 month, and 2 months showed the tooth to be asymptomatic, with normal periodontal ligament space and positive pulp sensibility.*
Discussion*: CGF acts as a biological scaffold, promoting regeneration through growth factor release and modulation of inflammation. It supports stem cell recruitment and reparative dentinogenesis, contributing to favorable healing outcomes.*
Conclusion*: CGF-assisted pulpotomy represents a promising, minimally invasive approach for preserving pulp vitality and enhancing regenerative healing in vital pulp therapy.*
Keywords: *CGF (concentrated growth factor), Direct Pulp Capping, MTA (mineral trioxide aggregate), Vital Pulp Therapy, Regeneration, Class II Caries*

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I. INTRODUCTION:

Irreversible pulpitis is traditionally treated with root canal therapy, though it is invasive and may weaken tooth structure [1]. Vital pulp therapy offers a conservative alternative for preserving pulp vitality [5]. CGF, an advanced platelet-derived biomaterial, possesses a dense fibrin matrix and enables sustained release of growth factors such as PDGF, TGF-β, and VEGF, promoting angiogenesis, cell proliferation, and tissue regeneration[1][10,11]. Its autologous nature and ability to modulate inflammation make it a promising scaffold in regenerative endodontics[8]. This case report demonstrates the successful management of a deep Class II lesion using CGF and MTA for direct pulp capping.

II. CASE REPORT:

A patient reported to the Department of Conservative Dentistry and Endodontics with the chief complaint of sensitivity in the lower left back teeth region for the past 2–3 months. The pain was intermittent and elicited by thermal stimuli, subsiding on removal of the stimulus. Clinical examination revealed a deep Class II carious lesion in the mandibular left first molar. The tooth was non-tender to percussion, and no swelling or sinus tract was present. Radiographic examination showed deep caries approximating the pulp without periapical changes.

Based on history, clinical findings, and pulp sensibility testing (early positive response), a diagnosis of symptomatic reversible pulpitis was made, and CGF-assisted pulpotomy was planned. After obtaining informed consent, local anaesthesia was administered using an inferior alveolar nerve block with 2% lidocaine and

adrenaline (1:80,000), followed by rubber dam isolation. Caries excavation was performed using a sterile #3 round diamond bur under water coolant, resulting in pulp exposure.

Approximately 10 mL of venous blood was collected without anticoagulant and centrifuged using a variable speed protocol (30 seconds acceleration, 2 minutes at 2,700 rpm, 4 minutes at 2,400 rpm, 4 minutes at 2,700 rpm, 3 minutes at 3,000 rpm, and 33 seconds deceleration). This resulted in four distinct layers: (a) a top acellular plasma layer, (b) a fibrin clot rich in platelet concentrates (CGF), (c) a liquid phase containing white blood cells and stem cells, and (d) a bottom layer of red blood cells. The CGF layer was isolated and compressed into a membrane.

After achieving haemostasis, the CGF membrane was placed over the exposed pulp tissue, followed by placement of a 2 mm layer of MTA. The cavity was temporarily restored with glass ionomer cement. The patient was recalled after 7 days, at which time the tooth was asymptomatic, and a permanent composite restoration was placed.

Follow-up evaluations at 15 days, 1 month, and 2 months revealed no clinical symptoms. Radiographic assessment showed a normal periodontal ligament space, and the tooth responded positively to pulp sensibility tests, indicating successful preservation of pulp vitality.

III. Discussion:

Inflammation plays a pivotal role in the repair of the dentin–pulp complex, serving as an essential biological response to injury and initiating reparative dentinogenesis. Following pulpal insult, a cascade of cellular and molecular events is triggered, leading to the recruitment of stem/progenitor cells that differentiate into odontoblast-like cells responsible for tertiary dentin formation and dentin bridge development [9]. Growth factors such as transforming growth factor-beta (TGF-β), platelet-derived growth factor (PDGF), and vascular endothelial growth factor (VEGF), which are sequestered within the dentin matrix, are released during carious insult or operative procedures, thereby regulating angiogenesis, neurogenesis, and tissue repair [9].

The success of vital pulp therapy is multifactorial and depends on several clinical parameters, including the preoperative pulpal status, bacterial control, ability to achieve adequate haemostasis, quality of coronal seal, caries location, and patient age [5]. In recent years, minimally invasive approaches such as pulpotomy and direct pulp capping have gained considerable attention as alternatives to conventional root canal therapy, especially with the introduction of bioactive materials that enhance healing outcomes [6]. Mineral trioxide aggregate (MTA), a tricalcium silicate-based material, has been widely used due to its superior sealing ability, biocompatibility, and capacity to stimulate hard tissue formation.

Scaffold-based regenerative strategies have further revolutionized vital pulp therapy. CGF a third-generation platelet concentrate, is characterized by a dense fibrin network that facilitates sustained and controlled release of growth factors, thereby promoting cell proliferation, angiogenesis, and differentiation [10]. Its autologous origin minimizes the risk of immunological reactions and enhances its clinical applicability. Additionally, CGF has been shown to interact with inflamed dental pulp stem cells and modulate the inflammatory response by initially upregulating proinflammatory cytokines such as interleukin-6 (IL-6), interleukin-8 (IL-8), and tumour necrosis factor-alpha (TNF-α), which play a crucial role in the recruitment of immune cells and stem cells to the site of injury [8]. This initial inflammatory phase is essential for initiating the healing process and is followed by a gradual reduction in inflammation, creating a favourable microenvironment for tissue regeneration.

Previous studies have demonstrated the effectiveness of platelet-derived scaffolds such as platelet-rich fibrin (PRF) in pulpotomy procedures, with favourable clinical outcomes and high success rates at follow-up [7]. These findings support the concept that biologically driven approaches can preserve pulp vitality even in cases with significant inflammation. In the present case, the combined use of CGF and MTA likely contributed to successful clinical and radiographic outcomes by providing both a biological scaffold and a bioactive sealing material. The CGF membrane not only acted as a reservoir of growth factors but also served as a physical barrier, while MTA ensured an effective seal and stimulated hard tissue formation.

Despite the promising outcomes, long-term clinical studies with larger sample sizes are required to further validate the efficacy and predictability of CGF-assisted vital pulp therapy in mature permanent teeth. Nevertheless, the present case highlights the potential of CGF as an effective adjunct in regenerative endodontic procedures and supports its use as a minimally invasive alternative to conventional treatment modalities.[7]

IV. Conclusion:

Scaffold-based pulpotomy represents a biologically driven approach for managing inflamed pulp. The synergistic use of CGF and MTA enhances regenerative potential and promotes favorable healing outcomes. This minimally invasive strategy may serve as a viable alternative to conventional root canal therapy, warranting further clinical evaluation.

Figures:

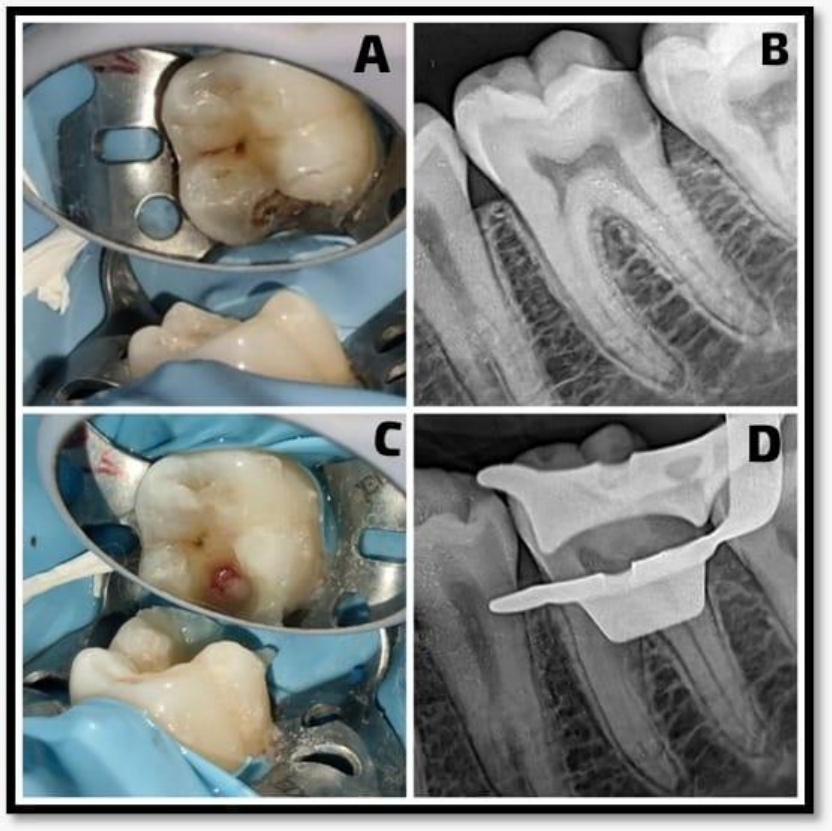
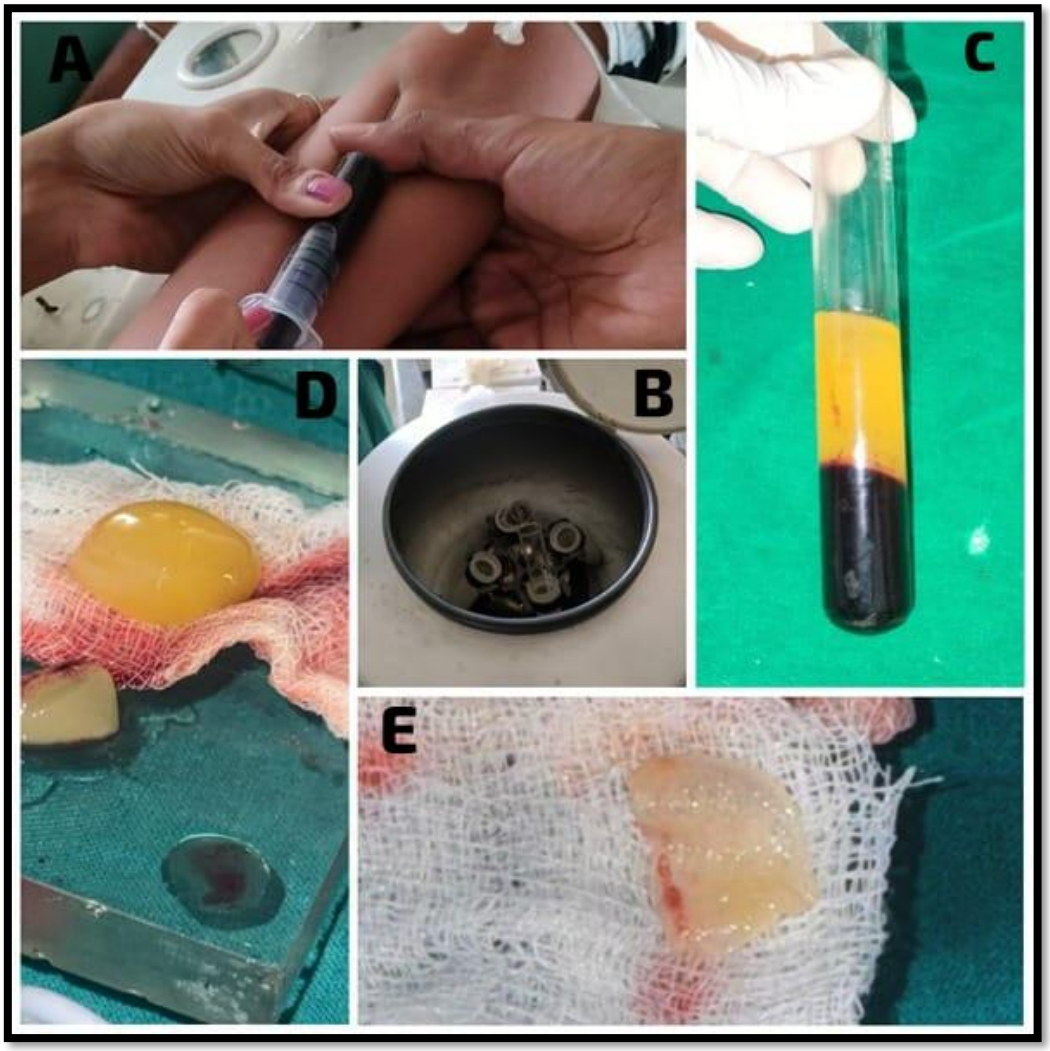


Figure 1: A: Pre operative clinical image B: Pre - optative radiographic image C: Clinical image of caries excavation and pulp exposure D: Radiographic image of caries excavation



- *Figure 2:* A: 10 mL of blood was collected B: Blood was centrifuged without anticoagulant C: Four layers comprising of (a) top of the acellular plasma layer, (b) fibrin clot containing platelet concentrates as a middle layer, (c) liquid phase containing white blood cells and stem cells, and (d) bottom layer of red blood cells was obtained. D: The fibrin clot was separated from the red blood cell layer using a sterile tweezer. E: uniform fibrin layer is obtained by compressing clot between 2 gauze pieces

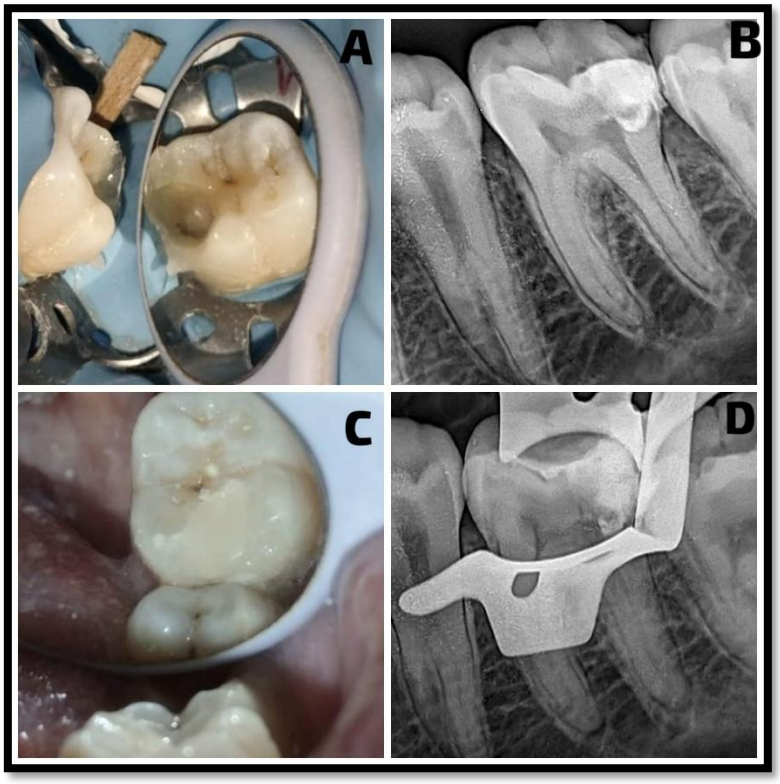


Figure 3: A. pre-endo wall build -up B. radiographic image of C.G.F and M.T.A follow by light cure G.I.C Clinical image of temporization dome with light cure G.I.C Radiographic image of final composite restoration

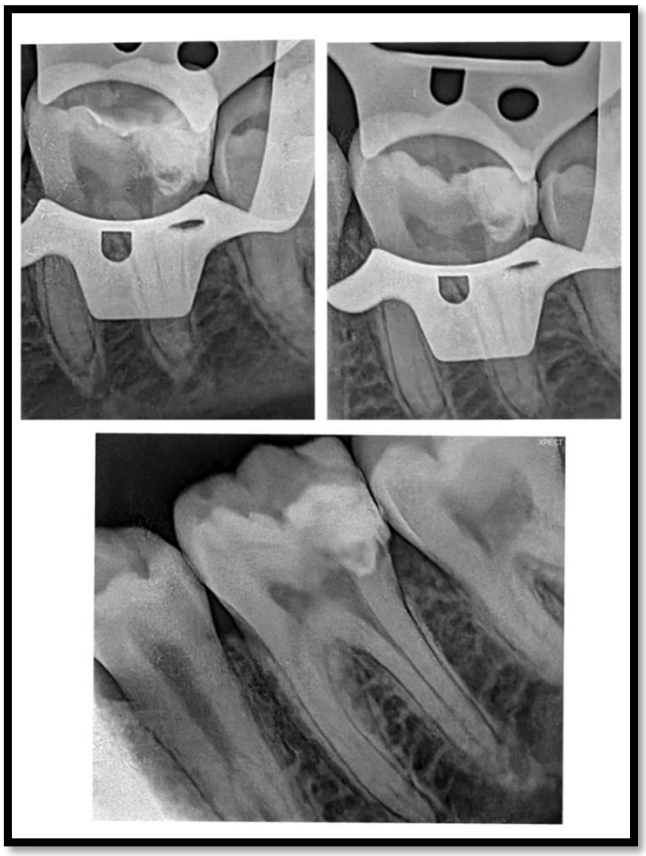


FIGURE 4: A: after 1 month follow up B: after 2 month follow up

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