

Nonsurgical treatment for large periapical lesion using regenerative endodontic approach

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Abstract

Trauma to immature permanent teeth can lead to thin dentinal walls, open apices, and large periapical lesions that limit conventional endodontic treatment. This case involved a maxillary anterior tooth with a coronal fracture and a CBCT PAI 5E lesion during Cvek’s stages 2–3 of root development. A regenerative approach using triple antibiotic paste followed by i-PRF achieved progressive periapical healing and apical closure. The tooth was restored with composite, demonstrating the

effectiveness of i-PRF–assisted regeneration in preserving compromised immature teeth.

Keywords: Maxillary Anterior Tooth, Dental Traumatic Injuries

Introduction

Dental traumatic injuries are more prevalent among children aged 7-12years. The most affected teeth are the upper maxillary central incisors that are erupting and have a periodontal ligament with minimal resistance to an extrusive force. Maxillary central incisors erupt at the age of 7-8 years with complete crown formation but with

2/3rd of the root formation, which completes at the age of 10 years¹. It has been reported that approximately 35% of all trauma occur before the age of 9, i.e., usually before full incisor root development, where the effects of traumatic injury can be very destructive.² Malocclusion, particularly increased overjet and maxillary incisor protrusion, is a well-established risk factor for traumatic dental injuries in the permanent dentition. According to Andreasen et al., teeth with pronounced labial inclination and insufficient lip coverage are more exposed to direct impact during falls or collisions.

Tooth eruption and root formation occur simultaneously but not synchronously, with eruption beginning before root completion. Root development is directed by Hertwig's Epithelial Root Sheath (HERS), which induces odontoblast formation for radicular dentin, while the dental follicle provides cells for periodontal support. As dentin thickens, the root matures and the apex closes. Trauma or infection can disrupt HERS, halting dentin formation and root maturation, resulting in thin dentinal walls, open apices, and higher risk of fracture and infection—conditions that often require regenerative therapies to restore structure and promote continued development.

Conventional endodontic treatment is often limited due to difficulties in achieving adequate drainage, apical

sealing, and the high risk of root fracture. While surgical intervention may allow direct access for debridement, it comes with significant drawbacks—including delayed bone healing, scar formation, loss of alveolar profile, and increased risk of esthetic compromise due to contour and volume loss, particularly when the buccal cortical plate is deficient. The nonsurgical management of large periapical lesions is particularly challenging in teeth with open apices, thin dentinal walls, and structurally compromised roots.

In contrast, regenerative techniques offer a minimally invasive alternative. Injectable platelet-rich fibrin (i-PRF) delivers growth factors that promote periapical healing, stimulate osteogenesis, and reinforce thin radicular walls. Its injectable nature allows precise placement in large lesions, supporting true biological regeneration and improving long-term outcomes while preserving tooth structure. This strategy not only preserves tooth structure but also facilitates more predictable long-term outcomes by promoting true tissue regeneration over repair.

The following is an overview of root and dentin formation stages, associated fracture risk at each stage, trauma-related changes, and appropriate management protocols based on the stage of tooth development.

Stage	Root / Dentin Development	Age (yrs)	Fracture Risk After RCT	Recommended Management
1	¼ root formed; wide open apex; very thin walls; no secondary dentin	6-7	77%	Vital pulp therapy preferred; regenerative endodontics if necrotic
2	½ root formed; primary dentin deposition; thin, fragile walls	7-8	53%	Preserve vitality if possible; regenerative endodontics for necrosis
3	¾ root formed; apex open; walls thickening	8-9	43%	Revascularization or apexification as needed

4	Apical closure begins; thicker dentin; secondary dentin forms	9-10	28%	RCT or VPT depending on pulp status
5	Fully developed root; thick walls; possible sclerotic dentin	10+	2%	Standard RCT; minimal fracture risk

Successful management of immature teeth with open apices, thin dentinal walls, and periapical pathology requires biologically driven therapies that promote true regeneration. Revascularization and regenerative endodontic procedures stimulate the formation of new odontoblast-like cells, vascular tissue, nerves, and mineralized dentin, enabling continued root development, dentinal wall thickening, and apical closure. These benefits are especially important in protruded incisors with malocclusion, where open apices and fragile walls make conventional root canal therapy unreliable due to poor apical sealing and high fracture risk.

In this case, the tooth exhibited slight buccal inclination and sustained trauma during root development stages 2–3, a period marked by thin walls and an open apex. The large periapical lesion and structural fragility warranted a nonsurgical, regenerative approach. Injectable PRF was used to promote osteogenic, odontogenic, and neurovascular regeneration, supporting the formation of bone, dentin, blood vessels, and neural tissue for comprehensive healing.

Case Presentation

Chief complaint

- A 16 year-old female patient came with complaint of fractured maxillary central incisors on right side. The patient reported a history of trauma to the same tooth approximately 8 years ago, resulting from a fall.
- She complained of moderate pain, and teeth were mildly tender to percussion. The teeth had discoloured gradually as observed by the patient.
- Upon clinical examination, Ellis class III fracture was noted and the right central incisor was buccally

placed (Fig. 1&2) along with discolouration, but no mobility was noticed.

- Patient expected pain relief and esthetic correction.

History of present illness

Past medical history – no relevant history

Past dental history- Pt haven't undergone any treatment after fall

Clinical examination-

- Extraoral – No abnormality & no swelling seen
- Intraoral- No soft tissue abnormality seen

No displacement or hard tissue injuries were present.

On palpation, no perforation in buccal and palatal aspect of 11.

Buccally placed central incisor.

No Mobility. No occlusal interference to the traumatised teeth.

Investigations

Radiographs

IOPA & RVG Radiograph-

- Revealed a large periapical radiolucency apical to maxillary right central incisor in mediolateral dimensions.
- The canal appeared quite large compared to the contralateral incisor. However, in RVG dentinal thinning was not prominent, and the apex remained open.
- It also appeared that the adjacent tooth 12 might be involved, so an occlusal radiograph was taken to clarify the doubt.

Occlusal view

- revealed size and extent of the lesion in both anteroposterior and mediolateral dimensions.
- The lesion extends mediolateral from mesial of 21 to distal of 11 showing no involvement of 12 and anteroposteriorly towards the palatal aspect of 11 from buccal cortical plate to palatal cortical plate measuring approximately 13.4 mm x 10.7 mm x 8.4 mm.
- It also showed that apex of 12 was not involved in the radiograph.

OPG revealed no involvement of adjacent or contralateral teeth, no additional lesions, effectively ruling out multiple tooth involvement and providing a clear view without superimposition

CBCT revealed a well-defined periapical radiolucency extending mesiodistally nearly from intermaxillary suture and mesial to tooth 21 to mesial to tooth 13, superoinferior from periradicular region of teeth 11, 12 to nearly 5 mm apical to floor of nasal fossa and buccopalatally from buccal cortical plate to palatal cortical plate measuring approximately 13.4 mm x 10.7 mm x 8.4 mm (superoinferior x mesiodistal x labiopalatal).

Sensibility test-

Heat test, Cold test and Electric pulp test: – 11- no response, 12- normal response

- All the above tests showed a normal response suggestive of vitality with 12. To avoid incomplete treatment and prevent unnecessary intervention, it was essential to reconfirm that tooth 12 was not involved.
- Although CBCT findings suggested possible involvement of tooth 12, the occlusal radiograph showed no such involvement, and sensibility tests indicated a normal pulpal response. Therefore, endodontic treatment

was initiated only for tooth 11, while tooth 12 was preserved and managed conservatively under close monitoring. Its vitality will continue to be assessed periodically, and if it becomes non-vital in the future, appropriate endodontic treatment will be initiated.

Diagnosis and Treatment Plan-

After correlating the clinical and radiographic findings, and taking into account the patient's young age and regenerative potential, the decision was made to proceed with revascularization using injectable Platelet-Rich Fibrin (i-PRF). Consensus-based Clinical Case Reporting Guidelines (CARE) were used as standard guidance to report the case flow and process of treatment.



Fig.1: Preoperative clinical photograph of non-vital non-vital 11 showing the fracture line and discolouration



Fig.2: Palatal view showing buccal prominence with 11



Fig.3: Cold testing



Fig. 6: OPG

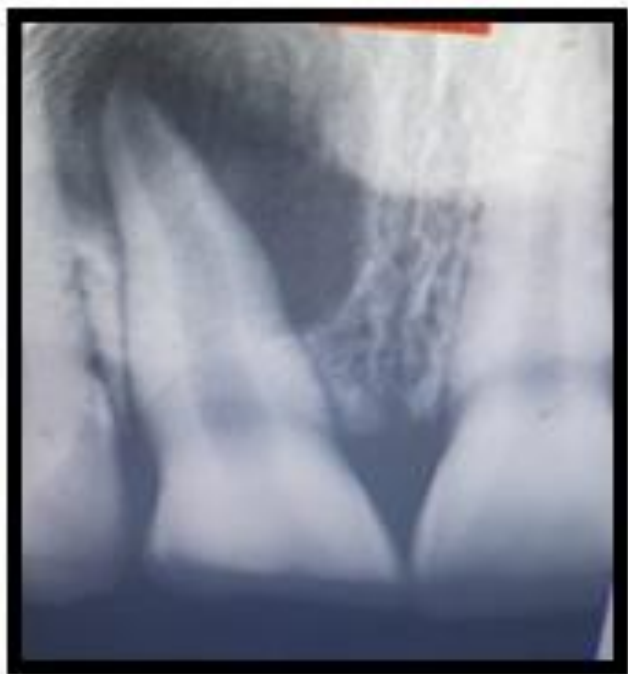


Fig.4: IOPA radiograph

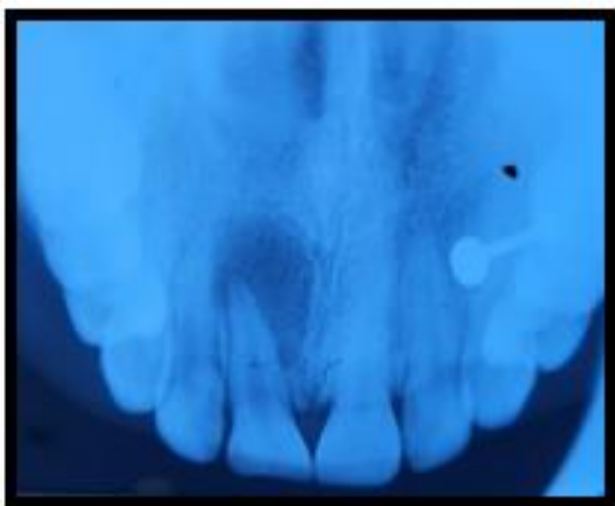
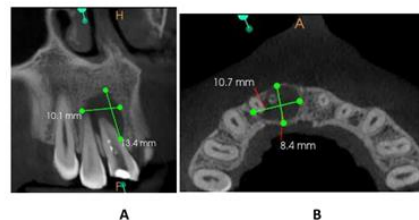
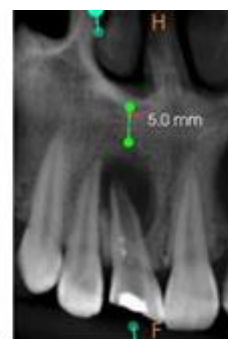


Fig. 5: Maxillary Occlusal Radiograph



A: Oblique coronal image B: Axial image at level of apical third of teeth 11 12 region each showing linear measurements of periapical pathology



Oblique coronal image of maxillary anterior region

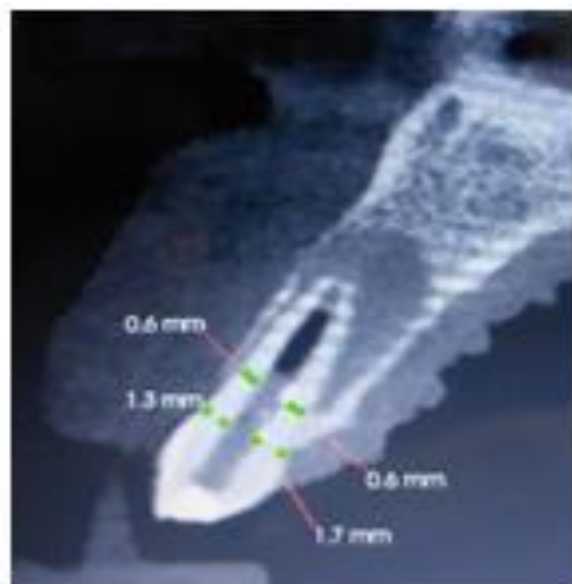


Fig. 7: CBCT showing width of dentinal walls in 11

Ethical clearance and consent

The patient's and parent's informed consent was obtained as it involved drawing the patient's blood. Further, all the details, such as investigations, clinical procedures, complications, and alternative options were explained to the parents, as per the patient information sheet. Ethical approval was obtained from Institutional Review Board in Bhopal, India, without any delay as the procedure did not involve the experimental of any armamentarium and the safety of the technique had been established.

First treatment visit

CBCT report showed involvement of 12, so thermal vitality testing (cold/heat) was performed showing a positive response suggestive of vitality with 12 so to confirm pulpal status, a test cavity was performed on tooth 12, which reaffirmed its vital status. Accordingly, treatment was initiated for tooth 11 only, while tooth 12 was monitored conservatively.

Root canal treatment was performed under complete isolation. The pulp chamber was irrigated with 0.09% normal saline (20 ml) and 10 mL of 5.25% of sodium hypochlorite solution (fig.8). The canals were dried using sterile paper points and triple antibiotic paste was placed (fig. 9). A sterile cotton pellet was placed and sealed temporarily using Cavit and the patient was recalled after two weeks.

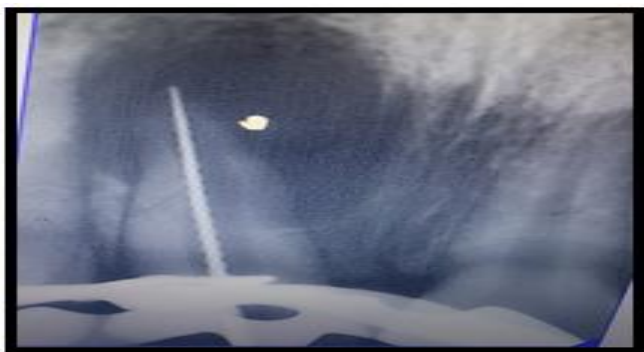


Fig.8: Working length measured



Fig.9: Triple antibiotic paste placed

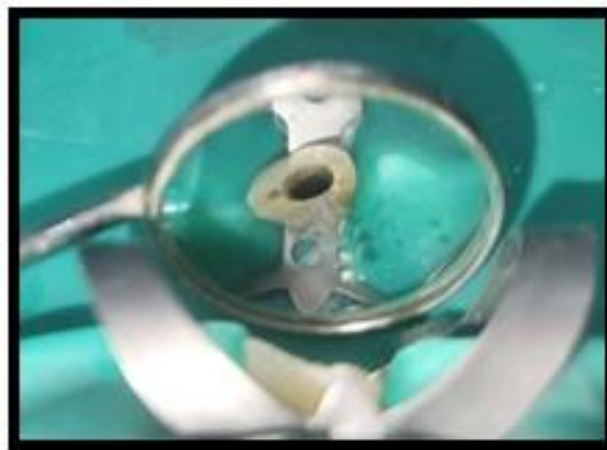


Fig. 10: Intraoral image wrt 11

Second treatment visit

In the second appointment, the canal was copiously irrigated using saline, 1.5% NaOCl and 17% EDTA to remove triple antibiotic paste under complete isolation. Finally, the canal was dried with paper points. blood was drawn before the procedure, and i-PRF was prepared as per standard preparation protocol. For the preparation of i-PRF, 5 ml of venous blood was drawn using a sterile

syringe and was transferred into noncoated, anticoagulant-free blood collection tube to allow natural fibrin polymerization. The blood is then centrifuged at a low speed of 700 rpm (60 g) for 3 min using a centrifuge, as lower centrifugal forces help preserve the platelet count, leukocytes, and growth factors. The extracted i-PRF was collected, bleeding was induced and then injected inside the canals with syringe placed 1 mm short of the working length.

Placing injectable platelet-rich fibrin (i-PRF) in the root canal is a relatively recent regenerative technique, particularly useful in revitalization, revascularization, and regenerative endodontics—especially in immature teeth with necrotic pulps and open apices, or to promote periapical healing.

For the precise delivery of injectable Platelet-Rich Fibrin (i-PRF) into the root canal, a 30G or 27G needle is typically used due to its fine diameter, which minimizes tissue trauma and allows controlled delivery. A 1 mL insulin compatible syringe with leur lock system is used (e.g., U-100 DispoVan or BD Ultra-Fine 30G). To enhance flow direction and prevent apical binding, the needle is gently bent 2–3 mm from the hub at an angle of 10°–20°, using a needle bender, or gauze with finger pressure. This bend helps direct i-PRF laterally, reducing the risk of perforation and promoting even distribution. Length control is crucial; the needle must be inserted 1–2 mm short of the apex, confirmed with an apex locator or radiograph, and a stopper should be used to maintain accurate depth. Delivery should be slow and steady, relying on capillary action and gentle plunger pressure, avoiding any forceful injection to prevent backflow or material extrusion.

A collagen membrane matrix was then placed 1 mm below the level of the canal orifice and then, mineral trioxide aggregate (MTA) was placed over the membrane

at the level of the canal orifice. The cavity was then be double-sealed with a glass ionomer cement base and a resin composite restoration. The patient was recalled in the sixth, ninth, and twelfth months and was evaluated clinically and radiographically.



Fig. 11: Insertion of i-prf inside canal in 11



Fig. 12: Insertion of Collacote sponge



Fig. 13: MTA placed followed by GIC

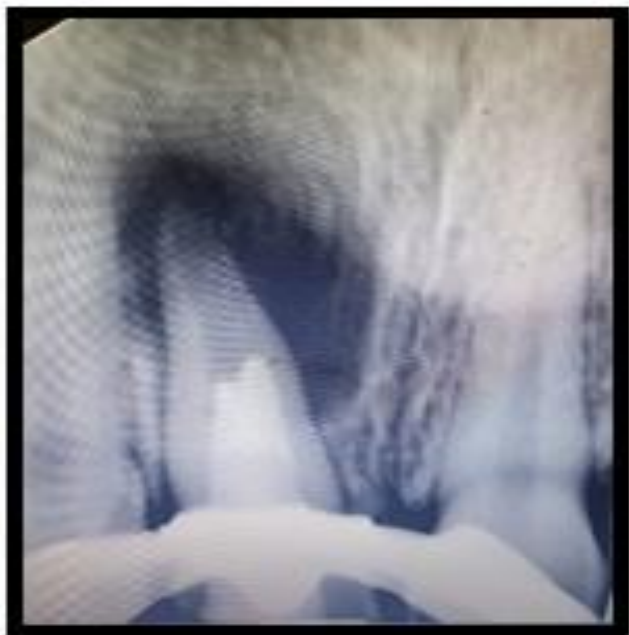


Fig. 14: Postoperative after placement of MTA and GIC



Fig. 15: Post operative photograph with composite restoration with 11

Follow-up examination

A periapical radiograph was taken in the follow-up. Root length formation, increase in dentin thickness, and root end closure was assessed in the radiographs at 06, 09 and 12 months.

At the 6-month follow-up, the soft and hard tissues were within normal limits. There was no swelling or sinus tract. The large cyst like osteolytic lesion had partially filled with trabecular bone formation, and the density of the lesion increased.

At the 12-month follow-up, the hard and soft tissues were within normal limits. The large cyst like osteolytic lesion

had filled considerably with trabecular bone formation, indicating incomplete healing (Fig.18). Pulp canal obliteration was pointed out at the cervical third of the root canal at the end of the 12-month follow-up period and didn't respond to pulp tests. Further, the clinical and radiographic appearance correlated with the desired treatment protocol.



Fig. 16: 3 month follow-up



Fig. 17: 6 month followup



Fig. 18: 12 month followup

Discussion

Inflammatory periradicular lesions from endodontic infections typically measure 5–8 mm, with lesions larger than 10 mm often representing periapical cysts. The present case involved a large cyst-like lesion. Treatment options for such lesions range from nonsurgical root canal therapy with intracanal medicaments to various surgical procedures. However, conventional endodontics is limited in teeth with open apices due to poor drainage, inadequate apical sealing, and high fracture risk, while surgery carries risks of delayed healing, scarring, and esthetic compromise—especially when the buccal plate is deficient.

Regenerative endodontics provides a minimally invasive alternative by preserving tooth structure and enhancing biological healing. In this case, a regenerative approach was chosen to avoid surgery. Trauma occurred at Stage 3 root development, with three-fourths of the root formed and an open apex. CBCT showed dentinal walls >1.5

mm, adequate for structural stability and permitting direct regenerative therapy.

At the first visit, thorough debridement was followed by triple antibiotic paste (TAP) placement to eliminate residual bacteria and support a favorable environment for healing. TAP was confined below the CEJ and the chamber sealed with a dent in bonding agent to prevent discoloration. At the second visit, TAP was removed under magnification, and apical bleeding was induced to create some natural scaffold rich in stem cells, particularly SCAP.

Injectable PRF (i-PRF) was then introduced to enhance regeneration. Its liquid form allows easy placement and rapid release of growth factors, while traditional PRF offers sustained release for up to 10 days. After inducing bleeding and placing i-PRF, a collagen membrane was positioned to contain the scaffold, followed by an MTA barrier to create a sterile, stable coronal seal. The tooth was restored with GIC and composite.

In younger patients, ongoing skeletal growth and gingival maturation can affect long-term anterior crown success. As the gingival margin and alveolar bone continue to migrate and the maxilla and mandible develop, early placement of permanent crowns may cause esthetic issues such as margin exposure, color mismatch, midline shifts, or spacing changes. To avoid repeated replacements, composite restorations are used as interim solutions, with permanent crowns ideally placed after 18–21 years, once growth and gingival zeniths have stabilized.

The patient was monitored at 6, 9, and 12 months, with CBCT at one year. Most healing occurs within 7–12 months, but long-term follow-up of up to 7 years is recommended for large lesions. At one year, trabecular bone formation indicated progressive but incomplete

healing—expected in a large through-and-through lesion, which may require extended time or heal with scar tissue. This case demonstrates that regenerative endodontic therapy using TAP and i-PRF can effectively manage large cyst-like lesions in immature teeth. Strict asepsis, careful case selection, and minimally invasive principles are essential for successful outcomes. RET reflects a shift in endodontics toward biologically based tissue regeneration, with growing evidence supporting its ability to promote vascularization, cellular proliferation, and functional pulp–dentin healing. Emerging research suggests its potential applications even in mature teeth, marking a significant evolution in contemporary endodontic practice.

Conclusion

This case demonstrates that RET using TAP + i-PRF is an effective, conservative approach for managing large cyst-like periapical lesions in immature teeth. By promoting true biological regeneration and preserving dentinal structure, RET offers predictable outcomes while avoiding the drawbacks of surgical intervention.

Initial healing was evident by trabecular bone formation at the one-year follow-up. However, due to the lesion's size and complexity, long-term follow-up extending beyond 5 to 7 years is essential, as late failures have been reported in the literature. Thus, despite promising early outcomes, regenerative therapy outcomes should be interpreted cautiously, and ongoing monitoring is necessary to ensure complete healing and functional success.

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