Case report – Regenerative endodontic therapy

*A **13-year-old patient, M.P.**, presented to the clinic for a specialist consultation due to an aesthetic concern — **discoloration of tooth 1.1**, which developed approximately one year following endodontic treatment.*

*The dental history revealed a **traumatic injury** sustained during childhood, occurring during tooth development. This event resulted in **pulp necrosis** and interruption of root formation. The patient had previously undergone endodontic treatment on tooth 1.1.*

Examination of the initial radiograph revealed a radiopaque material within the root canal, extending to the apical third of the tooth. Given the incomplete root formation, the initial assumption was that a regenerative endodontic procedure (revascularization) had been attempted.

Fig. 1 –Initial CBCT

*However, post-treatment discoloration developed and required further management. Upon clinical inspection, **two potential etiologies** were considered: residual pulp tissue left in the coronal chamber during the initial treatment, or discoloration induced by the root filling material (presumed to be MTA).*

Pulpal diagnosis (AAE): Previously treated tooth.
Periapical diagnosis (AAE): Normal periapical tissues.

Diagnostic testing results:

- *Percussion: negative;*
- *Bite test: negative*
- *Palpation: negative;*

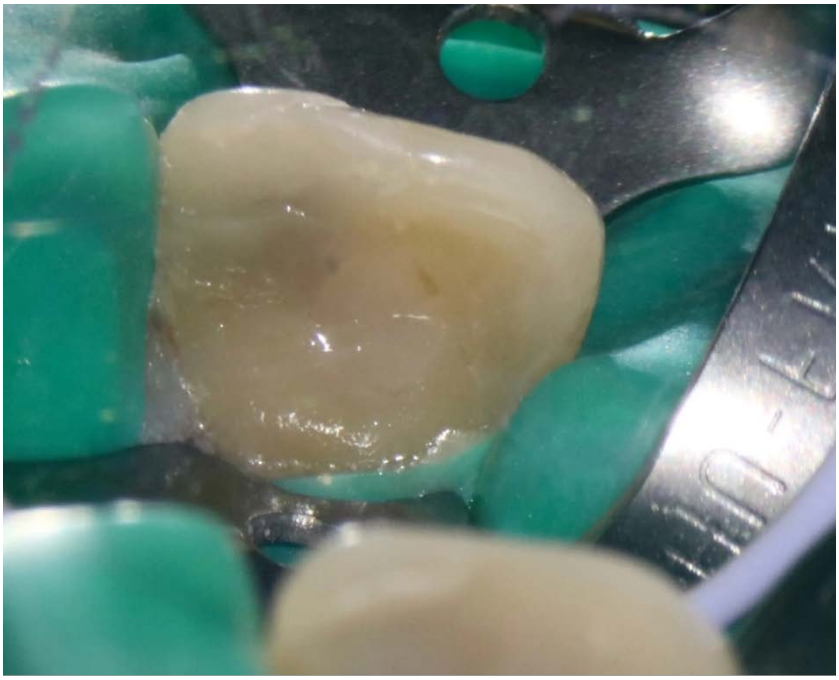


Fig. 2 – Tooth evaluation – the discoloration is observed in the mesial half

An exploratory access preparation was initiated, which revealed the cause of the discoloration — remnant pulp tissue localized within the mesial pulp horn.

Fig. 3 – Removal of the old filling reveals the cause as remnant pulp tissue

To further evaluate the existing endodontic treatment, all coronal restorative material was removed. Upon removal, it was observed that the root canal had been obturated using ***injected gutta-percha****. Since gutta-percha is not the material of choice for immature teeth undergoing regenerative therapy, a decision was made to initiate* ***nonsurgical endodontic retreatment.***

Fig. 4 – After complete removal of the filling, gutta-percha was revealed

Regenerative endodontic therapy is a biologically based procedure designed to manage immature permanent teeth with necrotic pulps and open apices. The primary goal is the ***reestablishment of pulp space vitality through the formation of newly vascularized tissue****, thereby allowing* ***continued root development*** *and* ***apical closure*** *while preserving long-term tooth functionality.*

The procedure involves chemical disinfection of the canal system without mechanical instrumentation, followed by intracanal medication with a triple antibiotic paste or calcium hydroxide to control microbial contamination. Subsequently, controlled bleeding is induced from the periapical tissues to provide a natural blood clot scaffold that promotes the ***migration and differentiation of stem cells*** *from the apical papilla. The canal is then sealed with a bioceramic material and restored coronally with a restoration.*

An optimal outcome of regenerative endodontic therapy is characterized by the absence of clinical symptoms, radiographic evidence of periapical healing, and continued root maturation. This biologically based approach is considered a superior alternative to traditional apexification, as it promotes true tissue regeneration rather than the mere formation of an apical barrier.

Clinical protocol: Two-visit treatment sequence

First appointment:

The existing root filling material was removed using ultrasonic U-File tip.

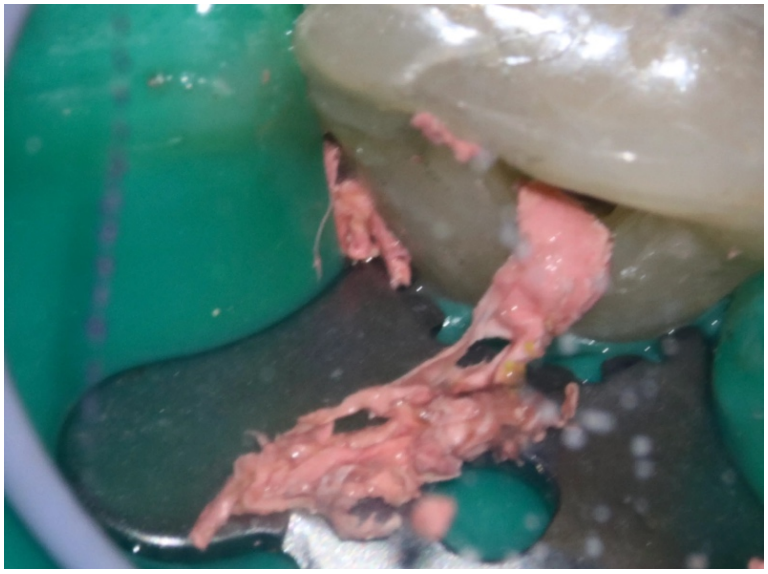


Fig. 5 – The injected gutta-percha is removed with US tips

The irrigation protocol consisted of:

- *1.5% diluted sodium hypochlorite – diluted to minimize cytotoxicity toward stem cells;*
- *17% EDTA – promotes stem cell differentiation and survival;*
- *Distilled water.*

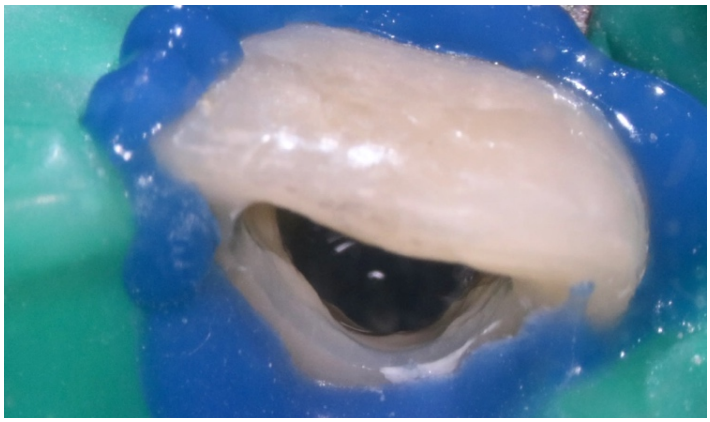


Fig. 6 – Complete removal of gutta-percha

Working length was established, and the canal was dried with paper points. Calcium hydroxide was placed as intracanal medication.

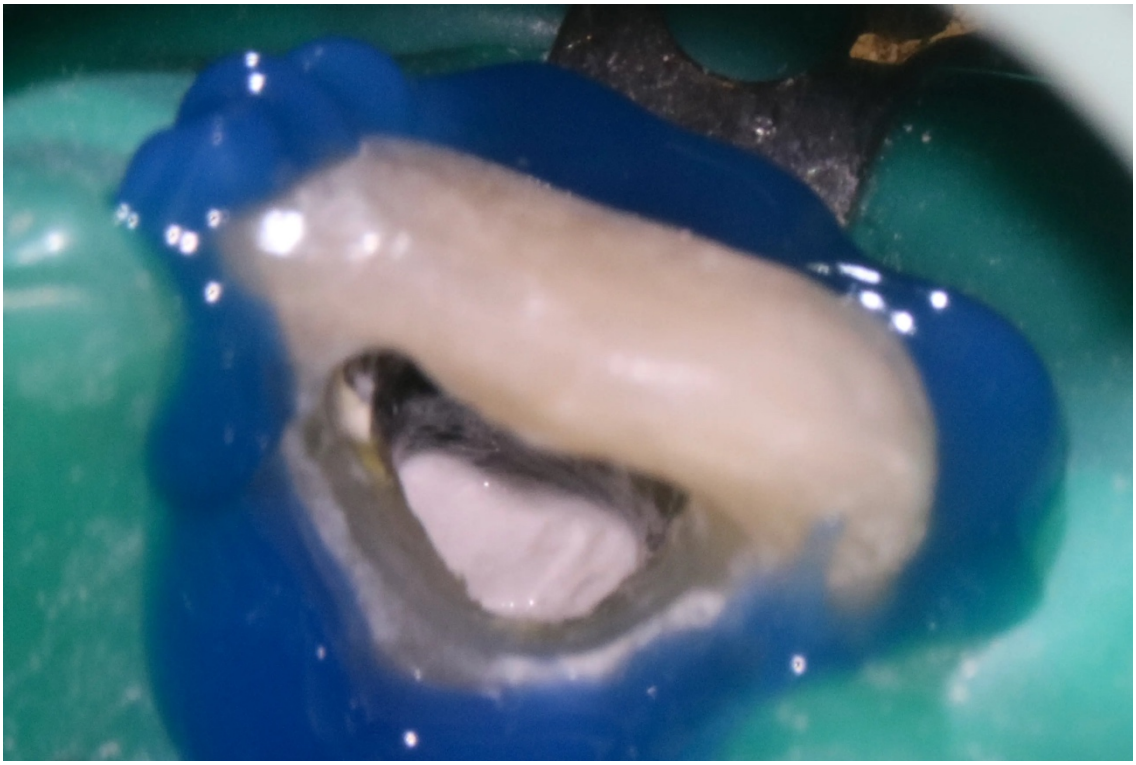


Fig. 7 – Calcium Hydroxide placed in the canal

The access cavity was temporarily sealed with teflon tape and a white flowable composite. The medication remained in situ for three months.

Second appointment:

Local anesthesia was administered using an anesthetic without vasoconstrictor to facilitate bleeding induction. Rubber dam isolation was achieved, and the temporary restoration was removed.

Sodium hypochlorite was excluded from the irrigation protocol due to its cytotoxic potential to stem cells. The canal was irrigated with 17% EDTA to remove calcium hydroxide and then dried with paper points.

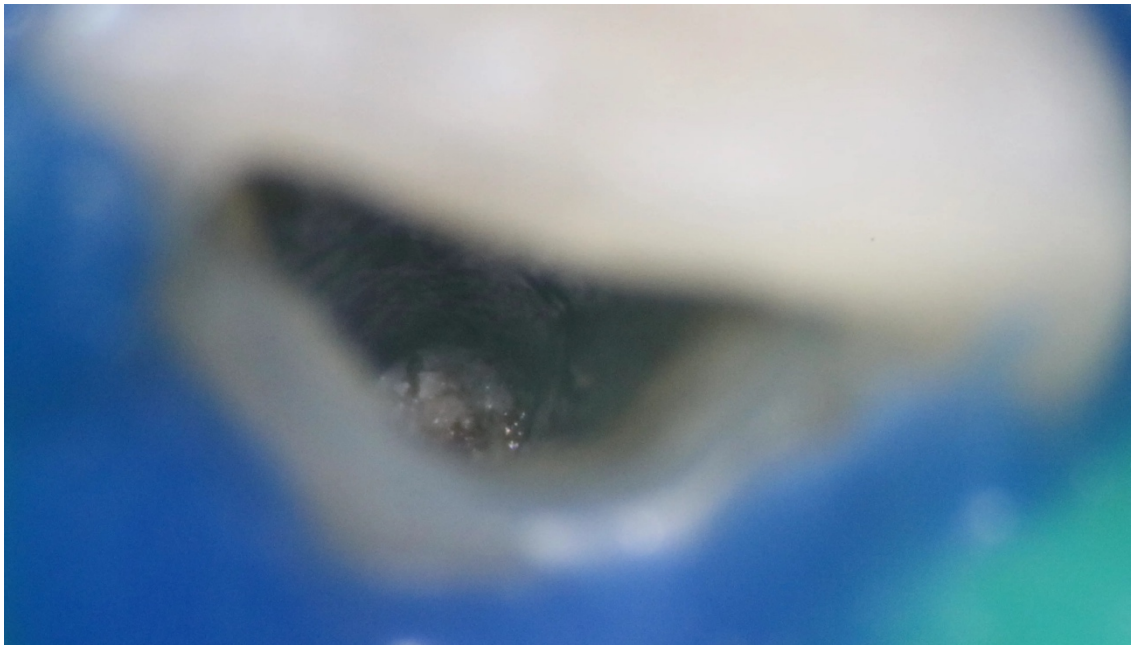


Fig. 8 – Dried root canal

Bleeding was induced by extending a pre-curved K-file slightly beyond the apical foramen with gentle rotational movements

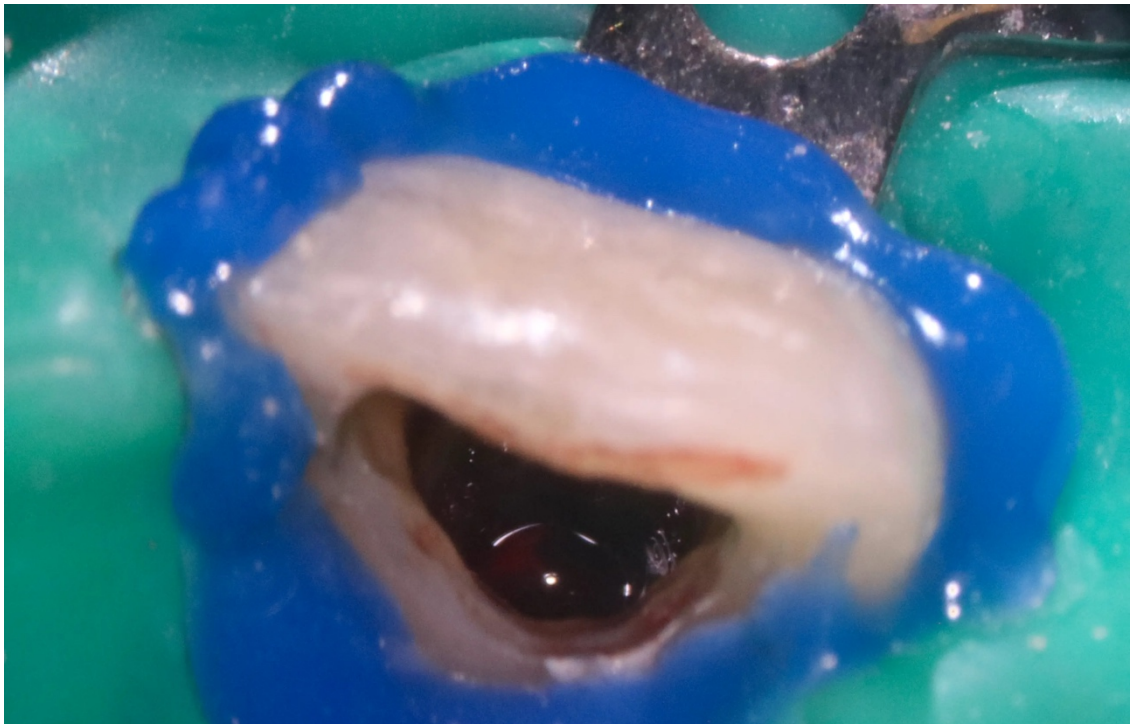


Fig. 9 – Provoking bleeding until the blood enters the canal 3mm under enamel-cement junction

A collagen sponge was inserted at a depth of 3 mm below the CEJ, serving as a resorbable matrix to limit excessive apical placement of the bioceramic material.

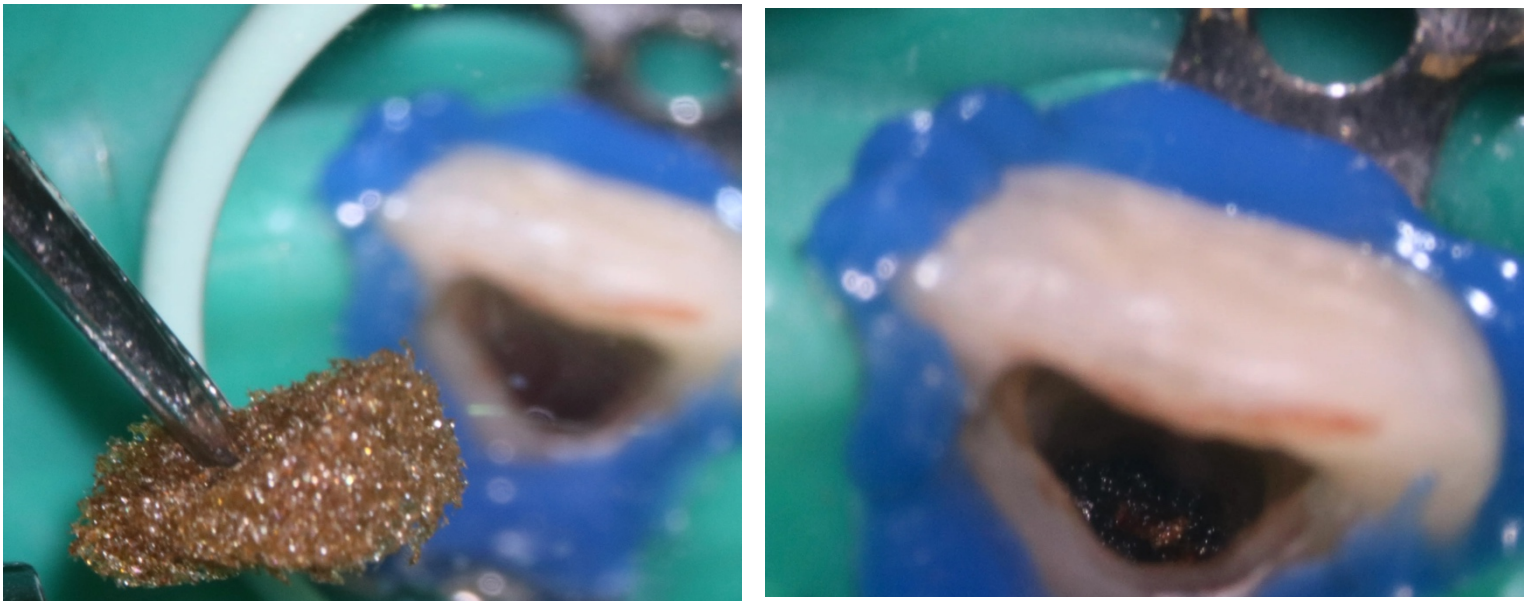


Fig. 10 – Inserting the collagen sponge

A bioceramic plug was placed up to the level of the collagen sponge. Bioceramic material is ideal for endodontic revascularization due to its ***biocompatibility and bioactivity****. It stimulates healing and regeneration of apical tissues, promoting the formation of mineralized and vascularized tissue.*

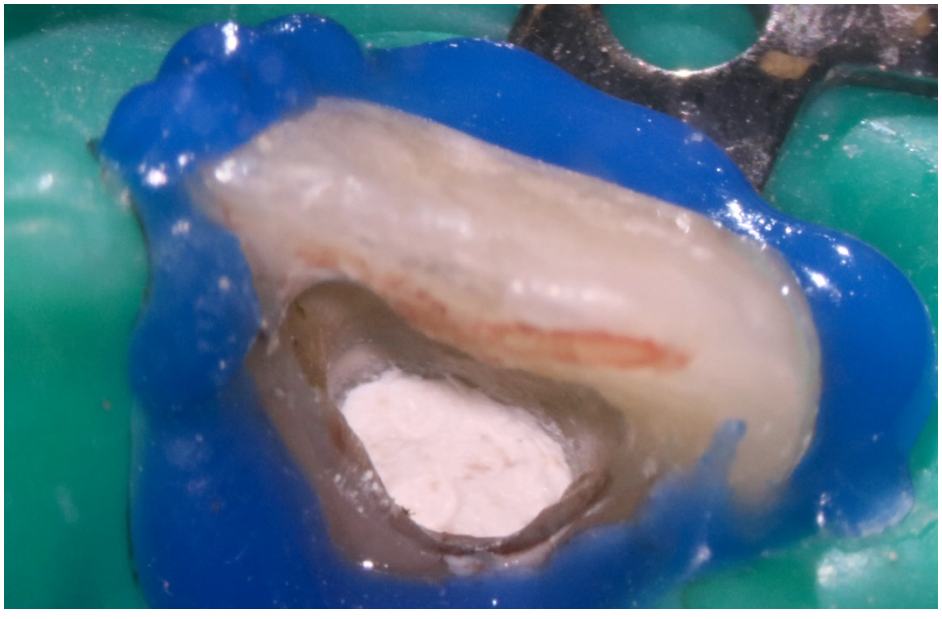
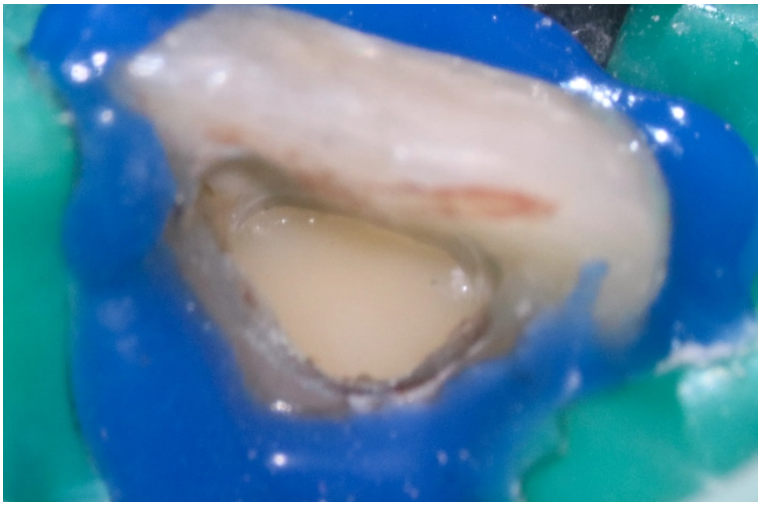


Fig. 11 – Application of a 3 mm layer of bioceramic below the enamel-cement junction



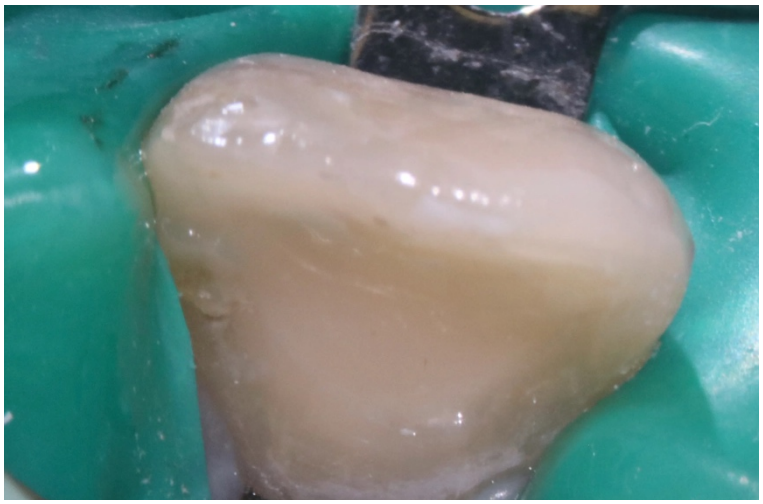


Fig. 12 – Placement of ionosite and the final restoration

The ideal result of endodontic revascularization is the ***absence of clinical symptoms*** *and* ***continued root development****, radiologically evidenced by root elongation, thickening of dentinal walls, and natural closure of the apex. In some cases, a positive response to vitality tests can also be observed, a sign of real reinnervation and revascularization of the canal. A favorable long-term outcome implies* ***clinical stability, tissue healing, and maintenance of the structural integrity of the tooth****.*

CBCT post treatment ***1 year recall***

CBCT post treatment

1 year recall

Video – Post treatment

Video – 1 year recall