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Revitalization Of Immature Teeth: A Case Report

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Abstract
Apexification with calcium hydroxide, or MTA, is the standard treatment method for an immature permanent tooth that has experienced pulpal necrosis. However, neither of these methods results in apex maturation and closure, dentinal wall thickening, or lengthening. Through the migration of stem cells into the canal space, regenerative endodontic procedures guarantee the pulpal-dentin complex will regenerate. Additionally, the canal walls will thicken and lengthen, and the apex will mature and close. However, rather than real regeneration, histological evidence of the tissues generated in the pulp canal gap indicates repair. It is anticipated that the existing process will undergo more changes as a result of additional study in this area.
Key Words: *Regenerative; Endodontics; Stem cells*

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I. Introduction

Endodontic treatment of immature permanent teeth has always been difficult. Two methods are frequently employed: apexification, which uses the right ingredients to create a barrier and shut the root's apex, and apexogenesis, which keeps the pulp tissue alive and lets the root grow organically. There are several problems with the apexification strategy. When calcium hydroxide is utilized, extensive instrumentation inside the root canal may damage the canal walls, and repeated intracanal medicine insertion is necessary, increasing the risk of reinfection[1,2]. Innovative materials that can substitute calcium hydroxide, including mineral trioxide aggregate (MTA) or biodentine, are used to replace intracanal medicine. However, none of these materials encourage root completion; instead, they only act as a mechanical barrier to seal the root canal lumen.[3]

Regenerative endodontic treatment (RET) restores the pulp-dentine complex that has been damaged by caries, trauma, or anomalies by applying biological and technical concepts. For young permanent teeth with necrotic pulp and apical periodontitis, it has been proposed as the best therapeutic option. The results ought to resemble those of apexogenesis, a crucial procedure for important pulp treatment.[4]

In the majority of RET, a blood clot inside the root canal system serves as a biological scaffold, resulting in positive outcomes. [5,6] It has also been demonstrated that other physical scaffold types can promote tissue regeneration. The platelets, growth factors, and cytokines found in platelet-rich fibrin (PRF), also known as second-generation platelet concentrates, help tooth repair more effectively over time. The genesis of PRF is entirely autologous. [7,8] This case report describes the use of MTA, and PRF in a regenerative endodontic operation for a maxillary upper incisor with asymptomatic irreversible pulpitis.

II. Case Report

The primary complaint of an 18-year-old male patient who came to the Department of Conservative Dentistry & Endodontics at Jaipur Dental College in Jaipur, Rajasthan, was that his upper front tooth was discolored and damaged for the past two years. The patient reported a history of trauma from a bicycle fall that occurred 2.5 years ago and resulted in a broken tooth. There was no bleeding or loss of consciousness. Additionally, two years after the event, the patient reports using over-the-counter medicines to manage the discomfort. Nearly a year ago, the patient became aware of the discoloration, but they chose not to seek therapy at that time. Ellis Class III fracture i.r.t. 21 was discovered during the clinical examination. The tooth seemed discolored and was not painful to the touch or percussion.

No reaction was obtained from the cold test, indicating that the tooth was not viable. The medical history of the patient did not play a role. On intraoral periapical radiograph i.r.t 21, thin radicular dentin, an open apex, and an unclear peri-apical radiolucency were all seen. As a result of the Ellis class III fracture, pulpal necrosis

was diagnosed. The patient was given an explanation of every therapy option. The patient was also informed of the risks and advantages of the regenerative endodontic therapy, and their agreement was obtained.

To prevent additional root deterioration, the access hole was created and the canal was debrided with minimum filling during the initial session. The working length was established. In order to avoid the irrigating fluid extruding into the periapical region, which might damage the stem cells required for regeneration, extensive saline and 1.5% sodium hypochlorite irrigation was carried out using a side-vented needle that was 1-1.5 mm short of the apex. Paper points were used to dry the canal, and lentulo-spirals were used to apply a triple antibiotic paste (1:1:1) (ciprofloxacin, metronidazole, and minocycline) into the canal. A temporary repair was then made in order to create a suitable coronal seal.

After two to six weeks, the tooth was examined for any negative symptoms and anesthetized with lidocaine without a vasoconstrictor at the second consultation. The temporary repair was taken out, and the triple antibiotic paste was removed with a lot of saline irrigation because the tooth was discovered to be asymptomatic. To aid in the release of growth factors from the radicular dentin, the canal was then irrigated with 17% EDTA (using a needle that was not quite apical). In order to cause bleeding from the periapical region and transfer the stem cells into the root canal space for regeneration, an endodontic file was then inserted past its working length.

Following blood clotting, PRF—which was made from the patient's blood using Choukroun's Method—was divided into smaller pieces and compressed into the canal, leaving around 3 mm between it and the CEJ. Following PRF installation, MTA was positioned up to CEJ, and Composite Resin was used to create a coronal seal. After two months, the patient was summoned back for a follow-up evaluation, and radiography and clinical evaluation were performed. In addition to the intra-oral periapical radiograph showing the disappearance of periapical radiolucency and ongoing root growth, the tooth was asymptomatic. To assess the procedure's effectiveness, the patient has follow-up appointments set for 3, 6, 12, 24, and 36 months.

FIGURE NO. 1: PREOPERATIVE CLINICAL & RADIOGRAPH PICTURE i.r.t 21

FIGURE NO. 2: ACCESS OPENING DONE i.r.t. 21

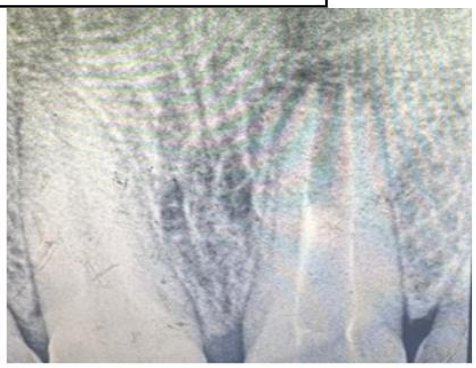


FIGURE NO. 3: BIOMECHANICAL PREPARATION DONE & TRIPLE ANTIBIOTIC DRESSING GIVEN i.r.t. 21

FIGURE NO. 4: INTENTIONAL BLEEDING

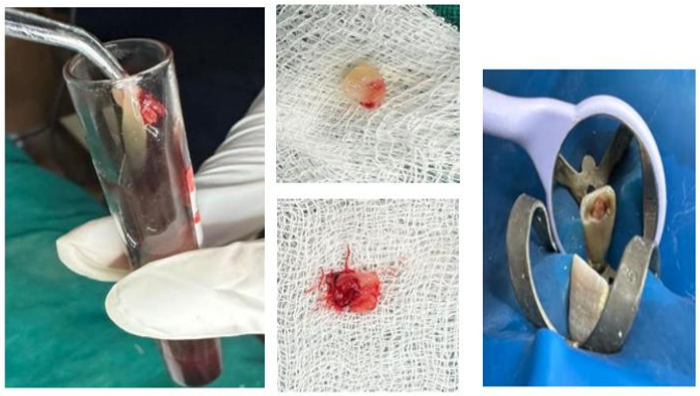


FIGURE NO. 5: PLACEMENT OF PRF DONE i.r.t. 21

FIGURE NO. 6: PLACEMENT OF MTA PLUG i.r.t. 21

FIGURE NO. 7: SEALED WITH COMPOSITE

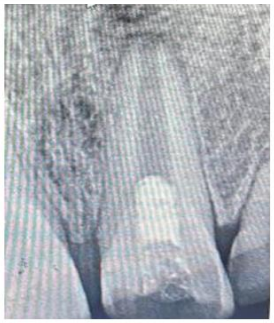
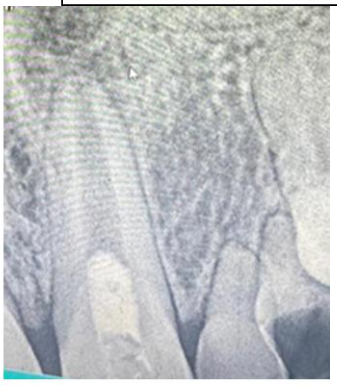


FIGURE NO. 8: 3 MONTHS FOLLOW UP I.R.T. 21

5 MONTHS



7 MONTHS

FIGURE NO. 9: FOLLOW UP i.r.t. 21

III. Discussion

One potential treatment option for nonvital immature permanent teeth is regenerative endodontics, which has begun to gain traction. Apexification with either a one-time MTA apical plug or long-term calcium hydroxide is the alternative therapeutic option. However, the root is still fragile and thin, and it has not fully developed, making it vulnerable to fractures. However, with the aid of stem cells, the regenerative processes enable ongoing root growth and apex maturity. There are three primary components to the regenerative endodontics process: Stem cells, Growth factors and Scaffolds. The main element of regeneration is growth factors and the activation of bleeding. Iwaya et al. were the first to refer to this procedure as revascularization in 2001.

Huang and Lin then used the term revitalization in 2008 to refer to the same procedure because it was reported that soft and hard tissues, not just blood vessels, were growing and regenerating. In contrast, Murray et al. coined the phrase "regenerative endodontics" in 2007, and the American Dental Association adopted it.[9] Nygaard-Ostby and Hjortdal conducted the first experimental studies in this area in 1961 and 1971, respectively.[9]

"Biologically based procedures designed to replace damaged tooth structures, including dentine and root structures, as well as cells of the pulp–dentine complex" is the definition of regenerative endodontics.[10] Apical papilla stem cells rise by 35% as a result of dentin conditioning with 17% EDTA. On the other hand, the vitality of the stem cells and the sodium hypochlorite concentration are inversely correlated. The quantity of apical papilla stem cells is reduced by 37% at concentrations of 0.5%, 1.5%, and 3% sodium hypochlorite, and the survival of apical papilla stem cells is significantly decreased at 6% concentration.[11]

Debriding the broad canal with thin and weak walls, which restricts the amount of mechanical debridement achievable, is the primary obstacle in regenerative endodontic operations. As a result, chemical methods are mostly used for disinfection. The detrimental effects of decreased sodium hypochlorite concentrations can be entirely reversed with 17% EDTA.[11] Pre-treating dentine with EDTA as the last irrigation step improves the effectiveness of regeneration operations because dentine conditioned with EDTA causes stem cells to migrate, adhere, and differentiate onto the dentin.[12]

In order to overcome these drawbacks, some changes can be made to our regenerative endodontic procedure. These include the use of an alternative antibiotic, lidocaine without epinephrine, and collagen matrix above the blood clot for stability. Complications of the revascularization procedure in immature teeth include discoloration of the coronal structure, failure to induce bleeding, and collapse of MTA into the canal space.

For the regenerative endodontic operation to be successful, age and the root's apical diameter are also crucial considerations. Although the younger age groups are more successful, it may be performed on teeth with apical diameters as little as 0.5mm. Teeth with apical diameters more than or equal to 1mm exhibit superior increases in root length, thickness, and apex narrowing.[13]

The following results can be used to determine if a regenerative endodontic procedure was successful: Eliminating clinical indications and symptoms and demonstrating bone healing are the main objectives.

The ongoing development of the root's length and thickness is the secondary objective. The restoration of neurogenesis and a favourable vitality test result are the tertiary goals.

Chen et al. have identified five categories of radiography results. The first is the ongoing root growth and thickening of the canal wall. Type two has a blunt but closed root apex; there isn't any noticeable root growth. Type three refers to a root that continues to develop while maintaining an open apex. Type four is when the canal space is completely occluded by significant calcifications. The fifth kind involves the development of a hard tissue barrier between the root's apex and the coronally positioned MTA.

Regenerative endodontic procedures have various drawbacks, including the need for more than one session and a longer treatment period, as well as the possibility of coronal coloring from minocycline and grey MTA. Instead of actual regeneration, histological evidence shows repair, and in certain instances, root fracture. PDL, cementum, and bone development that causes ankylosis, increases the risk of intra-canal calcifications, and only increases the success rate in younger age groups.[12]

IV. Conclusion

Since the apex is open and there is no chance of manually debriding the thin canal walls, managing an immature non-vital tooth is never easy for the clinician. Apexification has its own limits because it simply aims to construct an apical barrier rather than re-establish a pulpal-dentin complex. Regenerative endodontic procedures, on the other hand, create fresh opportunities for angiogenesis and neurogenesis, which aid in the thickening, lengthening, and apical closure of canals. Regenerative endodontics is a constantly developing discipline, and further studies in this area will inevitably be conducted to alter the treatment procedures for permanent teeth that are immature and have an open apex.

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