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Regenerative Endodontic evaluation by comparing MTA and Biodentin with triple antibiotic paste in immature permanent incisors using CBCT - Case Reports

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Introduction

Objective: This case report clinically and radiographically evaluated the revascularization procedure using Triple Antibiotic Paste followed by Mineral Trioxide Aggregate and Biodentine in permanent incisor teeth with immature apices.

Materials & Methods: Regenerative Endodontic treatment was carried in 8 cases using Triple Antibiotic Paste (TAP) and Mineral Trioxide Aggregate (MTA) and Triple Antibiotic Paste (TAP) and Biodentine for respective cases being evaluated by CBCT.

Results & conclusion: Radiographic images were analyzed to evaluate the root closure at time intervals of 3, 6 and 12 months. The results showed that both MTA and Biodentine were suitable material of choice for revascularization procedure in immature apices of permanent incisor teeth.

Keywords: Biodentine, CBCT, Mineral Trioxide Aggregate (MTA), Revascularization, Triple Antibiotic Paste.

Introduction

Regenerative endodontic procedures can be defined as biologically based procedures designed to predictably replace damaged, diseased, or missing structures, including dentin and root structures as well as cells of the pulp–dentin complex, with live viable tissues, preferably of the same origin, that restore the normal physiologic functions of the pulp–dentin complex.[1]

Revascularization is a new treatment method for immature necrotic permanent teeth. Indeed, it would provide, after treatment, a vital tooth that would be able to complete its root maturation. Up to now, apexification procedures were the choice of treatment for these teeth:

(i) Using calcium dihydroxide to induce the formation of an apical calcified barrier.

(ii) Using mineral trioxide aggregate (MTA) to produce an artificial apical barrier.

Indications for treatment of pulp revascularization are the presence of deep caries or trauma inducing a stop in the development of root canal of an immature tooth. It is important to keep in mind that an endodontic treatment on an immature tooth, often necessary up to now, involves a root canal treatment on an open apex tooth with thin and fragile walls. This will involve the persistence of a weakened tooth with often a reserved long-term prognosis due to the remaining of an intrinsic fragility and to the difficulty to obtain a good sealing of an open apex. Revascularization technique would allow the growth of root and thus avoiding the remaining of thin and fragile walls. It will reduce the risk of root fracture.[2]

Two pulp revascularization techniques are found in the literature: one using calcium dihydroxide and another using a triple antibiotic paste for disinfection of pulp necrosis. Both are two- step procedure. Second step takes place two or three weeks after the first one, only if the tooth is asymptomatic and if there is a visual reducing of the apical lesion. At a subsequent appointment, the paste is removed and bleeding is induced into the canal. The canal is sealed with MTA (Fig 2)/ Biodentine (Fig 3), and after the material has set, a bonded restoration is placed. In pulp revascularization, at three months postoperative, the tooth is normally asymptomatic and about nine months later X-ray radiography shows an increasing thickness of dentinal walls and an apical closure. Root development and apical closure may be visible after six months.[2]

Fig 1: Armamentarium

Fig 2: Mineral Trioxide Aggregate (MTA)

Fig 3: Biodentine (Septodent)

Fig 4: Triple Antibiotic Combination

At present, a recent radiographic technique that is being used is the CBCT, which are the most advanced types of digital radiography. CBCT detects not only the presence of a periapical lesion, but also their relatively true size, extent, nature and location. It is also used for the evaluation of root canal configuration, steps in endodontic treatment and re-treatment, coronal restoration, detection of bone lesions, and experimental endodontology.[3] The aim and objective of this case report (8 cases) was to evaluate and compare clinical and radiographic outcome of revascularization between Mineral Trioxide Aggregate and Biodentine along with Triple Antibiotic Paste in immature permanent incisor teeth over a period of 3,6 and 12 months- An in vivo study.

MTA Case Report

The present study was carried out in the Department of Conservative Dentistry And Endodontics at D.J. college of Dental Sciences And Research, Modinagar (U.P.).

A 15- year- old female patient reported to the department of Conservative Dentistry and Endodontics with pain in relation to maxillary right central and lateral incisor. She had incurred a trauma at the age of 8 years. Palpation and percussion tests were showed positive response. Periodontal pathology was ruled out, as there wasn't any alteration in probing depth and no associated mobility. Pulp vitality tests, including the cold test and an electric pulp testing, elicited a negative response. Radiographic examination revealed wide-open canals with marked periapical radiolucency in relation to both maxillary-left central incisor (Fig 5). Intraoral periapical radiographs revealed immature apices, either blunderbuss canals or wide canals with parallel walls and a slight flaring in the apical end, and in a few cases, moderately developed root but with open apex.

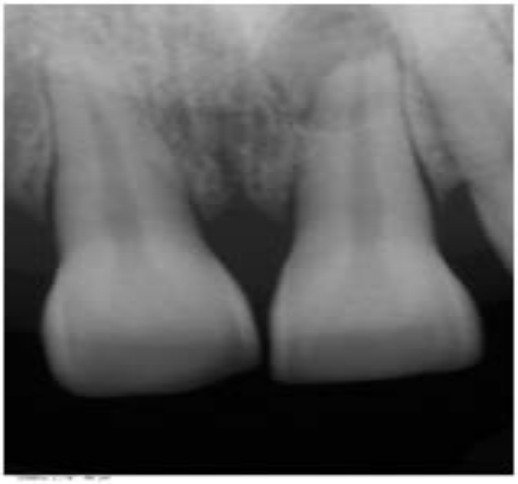


Fig 5: Pre-Op IOPA

Pre-Operative CBCT (Fig 6 & 7) was taken before starting of each case to measure the periapical size of the lesion and tooth length and Post-Operative CBCT was done at 12th months follow-up. Although it might be possible to assess the healing of periapical lesions, it is much more challenging to establish confidently the true extent of the

involution of the lesion by using conventional radiographic techniques. A three-dimensional evaluation of the healing of periapical lesion can be possible with imaging modality like CBCT. Hence, even though a conventional radiograph was showing satisfactory healing, CBCT was advised, as extremely minute bone changes like bone formation are more accurately evaluated by it during follow-up visits than the former.[4]

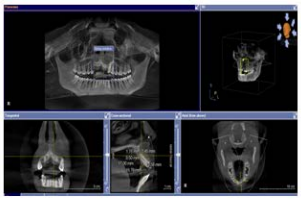


Fig 6: Pre-Op CBCT

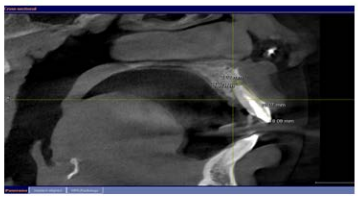


Fig 7: Pre-Op Cross Sectional CBCT

Informed consent was obtained; Local anesthesia was administered using 2% lidocaine with 1:100,000 epinephrine and access cavity was prepared in the permanent incisor. Upon access, hemorrhagic, purulent exudate was found in the teeth. The needle tip was placed 2 mm away from the radiographic root end. Then, the root canal was irrigated with saline and dried with paper points. Bonding agent (3M ESPE) was applied on coronal aspect of the tooth to prevent the discoloration of crown caused due to minocycline. Triple antibiotic paste consisting of equal amounts of metronidazole, ciprofloxacin and minocycline in the ratio of 1:1:1 was mixed with propylene glycol on a glass slab. Using a lentulo spiral, Triple Antibiotic Paste was delivered to the dried root canal and filled at the level of cemento-enamel junction. Then, the access cavity was temporarily sealed with temporary restoration.

After 3 weeks; the patient was recalled for review. The tooth was asymptomatic with lack of clinical signs of pathology in the next visit, the canal was re-entered under anesthesia with 2% lidocaine wand irrigated with Triphala followed by saline and dried. Then bleeding was induced inside the canal by over instrumentation.

After blood clot was formed, a plug of MTA was placed at the level of Cementoenamel junction. It was decided to leave the MTA and continue with barrier placement. A wet cotton pellet was placed against the MTA in tooth.

The access cavity was sealed with bonded restoration after 2 weeks and tooth was reviewed at 3,6 and 12 months. Post-Op CBCT was also taken to measure the root length growth followed by decrease in lesion size and apical diameter size.

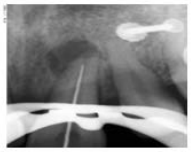


Fig 8: working Length

Fig 9: 3 months follow up

Fig 10: 6 months follow up

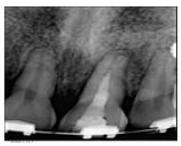


Fig 11: 12 months follow up

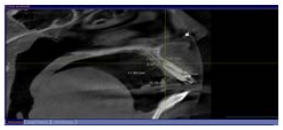


Fig 12: Post-Op Cross Sectional CBCT (12 months)

Biodentine Case Report

A 17- year- old male patient reported to the department of Conservative Dentistry and Endodontics with pain in relation to maxillary right incisor. Pulp vitality tests, including the cold test and an electric pulp testing, elicited a negative response. Radiographic examination revealed wide-open canals with marked periapical radiolucency in relation to both maxillary right central and lateral incisor. The procedure followed was similar to MTA cases.

Fig 13: Pre-Op Photograph

Fig 14: Pre-Op IOPA

Fig 15: Instrument retrieval

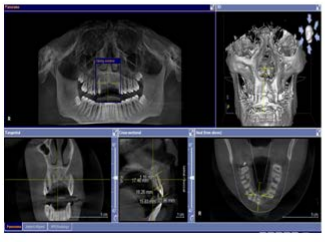


Fig 16: Pre-Op CBCT

Fig 17: Pre-Op Cross Sectional CBCT

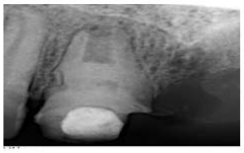
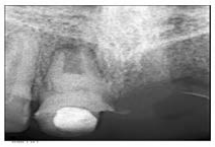




Fig 18: Working length Fig 19: Three months follow up Fig 20: Six months follow up

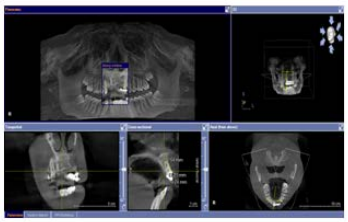



Fig 21: Twelve months follow up Fig 22: Post-Op CBCT


Fig 23: Post-Op Cross Sectional CBCT (12 months) Fig 24: Post-Op Photograph

Result

Table 1: Evaluation and Comparison Showing the Increments of Root Length Increase Pre-Operative and Post-Operative Time Period Between MTA & Biodentine Groups.

	Pre OP (mm)	Post Op (mm)
Case 1 (Biodentine)	**21.96**	**22.4**
Case 2 (MTA)	14.68	18.09
Case 3 (Biodentine)	19.16	20.71
Case 4 (MTA)	19.2	21.9
Case 5 (MTA)	**19.16**	**21.09**
Case 6 (Biodentine))	21.9	22.26
Case 7 (MTA)	19.2	21.9
Case 8 (Biodentine)	19.16	20.71

In Table 1, MTA Case Report showed Pre-Operative Root Length Increase from 19.16mm to 21.09mm, Biodentine Case Report showed Pre-Operative Root Length Increase from 21.96mm to 22.4mm.

Table 2: Evaluation and Comparison Showing the Increments of Apical Diameter Changes Pre-Operative and Post-Operative Time Period Between MTA & Biodentine Groups.

	Pre OP (mm)	Post Op (mm)
Case 1 (Biodentine)	**1.16**	**0.54**
Case 2 (MTA)	0.34	0.31
Case 3 (Biodentine)	0.5	0.36
Case 4 (MTA)	2.62	1.67
Case 5 (MTA)	**0.57**	**0.55**
Case 6 (Biodentine))	2.62	1.67
Case 7 (MTA)	1.87	1.67
Case 8 (Biodentine)	0.34	0.31

In Table 2, MTA Case Report showed Pre-Operative Increments of Apical Diameter Changes Increase from 0.57mm to 0.55mm, Biodentine Case Report showed Pre-Operative Increments of Apical Diameter Changes from 1.16mm to 0.54mm.

Table 3: Evaluation and Comparison Showing the Changes in Size of Lesion Pre-Operative and Post-Operative Time Period Between MTA & Biodentine Groups.

	Pre OP (mm)	Post Op (mm)
Case 1 (Biodentine)	**3**	**1.02**
Case 2 (MTA)	2.84	0.84
Case 3 (Biodentine)	1.75	1.33
Case 4 (MTA)	5.76	1.96
Case 5 (MTA)	**3.01**	**2.02**
Case 6 (Biodentine))	5.76	1.96
Case 7 (MTA)	3.22	1.96
Case 8 (Biodentine)	2.84	0.84

In Table 3, MTA Case Report showed Pre-Operative Changes in Size of Lesion from 3.01mm to 2.02mm, Biodentine Case Report showed Pre-Operative Changes in Size of Lesion from 3mm to 1.02mm.

Sampling method: Random sampling method was used for the study.

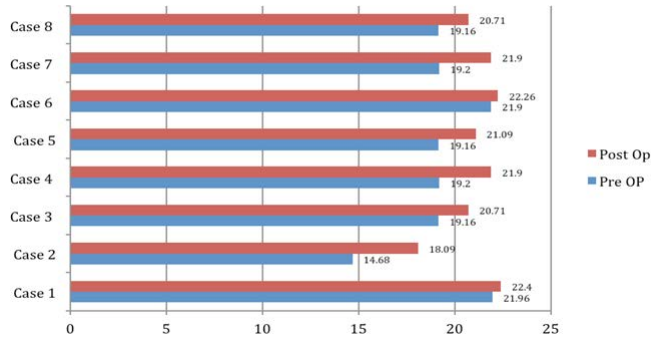
Analysis of the Data

Radiographic IOPA images are to be obtained and analysis needed to be done to evaluate the root closure at time intervals of 3rd, 6th and 12th months. The results obtained were subjected to statistical analysis.

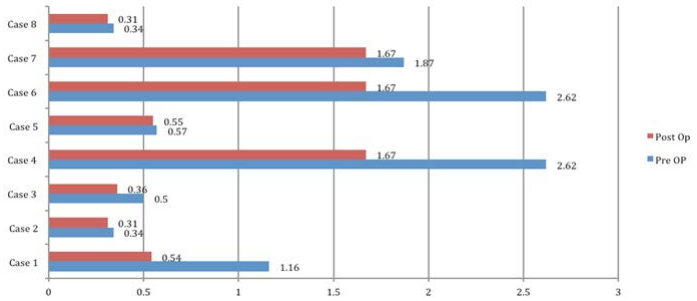
*** Statistical method used:** ANOVA test - All the data obtained were tabulated and subjected to statistical analysis

Graphical Representations

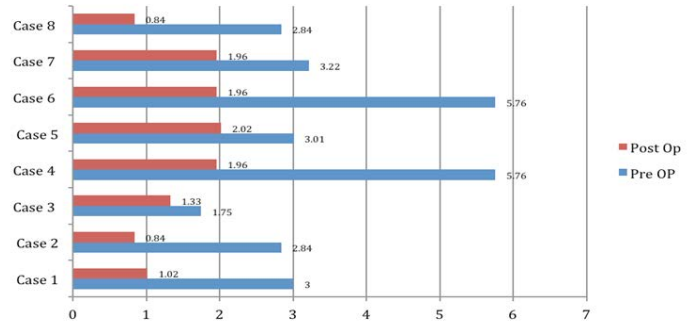
Graph 1: Evaluation and Comparison Showing the Increments of Root Length Increase Pre-Operative and Post-Operative Time Period in MTA and Biodentine Cases.



Graph 2: Evaluation and Comparison Showing the Increments of Apical Diameter Changes Pre-Operative and Post-Operative Time Period in MTA and Biodentine Cases.



Graph 3: Evaluation and Comparison Showing the Changes in Size of Lesion Pre-Operative and Post-Operative Time Period in MTA and Biodentine Cases.



Discussion

Pulp revascularization was considered to be the treatment of choice in order to save the teeth and promote root development. The primary goal of regenerative endodontic procedures is healing of apical periodontitis as stated in the revised AAE guidelines (July 2013). According to the guidelines, the secondary goal is to increase root wall thickness and/or root length. The tertiary goal is to regain a positive response to pulp testing. Both the secondary and tertiary goals are desirable but possibly not essential to determine the clinical success.[4]

This case report describes 8 cases that underwent the revascularization protocol as described by "**Banchs and Trope"**. The decision to use revascularization instead of apexification was made primarily because of the potential for increased root length and thickness of root walls. Because this protocol is very technically demanding, elements of the technique evolved from case to case. Changes may occur with this technique as more research

is completed.

Recent studies have shown that irrigation with CHX may be detrimental to stem cells and may require a modification of our irrigation method with this technique. If infection persists in the root canal, not only regeneration but also repair will not occur in the pulp-periapical tissue complex. Triphala has a potent antibacterial activity against enteric pathogens and has shown significant inhibitory activity against 2-week biofilm. Triphala may also have an added advantage of being an antioxidant and anti-inflammatory agent over traditional root canal irrigants, thereby proving to be an excellent herbal alternative without undesirable side effects of NaOCl.[3]

Because of the complexity of the root canal infection, it is unlikely that any single antibiotic could result in effective sterilization of the canal. A combination would be needed to address the diverse flora encountered. The most commonly used medicament is a combination of three antibiotics, referred to as a triple antibiotic paste (TAP). Hoshino et al. recommended a ratio of 1:1:1 of metronidazole (500 mg), minocycline (100 mg) and ciprofloxacin (200 mg) for the 3Mix formulation. Comparing TAP, calcium hydroxide and formocresol as intra-canal medicaments in non-vital young permanent tooth, the triple antibiotic group showed the highest percentage increase in the dentin wall thickness compared with the other two groups. It was also reported that TAP could help promote functional development of the pulp–dentin complex. TAP contains both bactericidal (metronidazole, ciprofloxacin) and bacteriostatic (minocycline) agents and hence may be considered the material of choice to allow for successful revascularization.[4]

In Mineral trioxide aggregate (MTA) case reports, MTA developed at Loma Linda University in the 1990s as a root-end filling material was used. This study demonstrated that the application of MTA immediately after root canal preparation favored the establishment of a normal periodontal ligament and formation of new bone and cementum. The MTA, even in the presence of exudate and contamination observed at the time of preparation, promoted the disinfection of the canal and stimulated the formation of an apical barrier of hard tissue.

In Biodentine case reports, Biodentine was used as the coronal barrier instead of MTA. Biodentine is bioactive tooth-colored calcium silicate-based cement. A previous study showed the bioactivity of Biodentine as it increased pulp cell proliferation and biomineralization. Therefore, Biodentine, as a suitable material, has been suggested for the purpose of dentin-pulp complex regeneration in the clinical setting.

In all the cases, several challenges in the management were overcome and applied to the next case. First, it took several attempts to induce bleeding into the canal space. We found that inducing bleeding was easier when an anesthetic solution did not contain a vasoconstrictor. Research has shown that the ‘‘inclusion of a blood clot in the canal space tended to improve the revascularization outcome’’, and the induction of bleeding into the canal may provide stem cells, which can induce dentin formation. Others show regeneration with or without formation of a blood clot, suggesting that additional research is needed in this area. Second, the placement of MTA over a blood clot was technically difficult, and condensation resulted in apical displacement of the material, which looked as though an apical barrier had been placed.

The follow-up times for the cases ranged from 3, 6 and 12 months. Because revascularization cases require stringent follow-up, non-compliance of the patient/guardian may be a contraindication for these procedures. Healing of the periapical lesion was observed at the 4-months follow- up. After 7 months, continued root growth was noted in both the cases. Apical closure was observed at the 12-months

follow-up in both MTA and Biodentine cases. A CBCT was done at pre-op and post op follow up which revealed a decrease in the size of the periapical radiolucency, showed continued root growth was noted, and increased radiodensity around filling over this period and demonstrated a narrowed canal lumen in both MTA and Biodentine cases. In both the patients included here, resolution of the apical radiolucency was seen. The patient when observed clinically after 1 year was asymptomatic and had no complaint of discomfort.

Conclusion

There is considerable debate on the ideal outcome of regenerative endodontic treatment. With respect to the nature of regeneration, it seems that there is a gap between the expected histological outcomes and what actually happens in the root canal system, at least in many instances.

MTA and Biodentine both biocompatible materials with various exciting applications in dentistry. MTA and Biodentine both induced the hard tissue formation. Hence MTA and Biodentine can be of a great choice in various treatment aspect of dentistry. CBCT was found to be useful for the diagnosis, management and post-operative evaluation of a case involving a permanent anterior tooth with open apex and periapical lesion.

Since many of these teeth achieve acceptable clinical outcomes i.e. being infection-free, asymptomatic and clinically functional, it seems logical to reframe our perspectives in this field and expand the scope of definition of success in endodontic regenerative treatment, and consider the fore mentioned clinical outcomes as success.

References

1. Franklin Garcia-Godoy, Peter E. Murray. Recommendations for using regenerative endodontic procedures in permanent immature traumatized teeth. Dental Traumatology 2011:1-9.

2. **Mélanie Namour and Stephanie Theys.** Pulp Revascularization of Immature Permanent Teeth: A Review of the Literature and a Proposal of a New Clinical Protocol. Scientific World Journal Volume 2014.1-9
3. **Vijay Shekhar, Ruchi Arora, Mukesh Roy.** Role of Cone Beam Computed Tomography and White Mineral Trioxide Aggregate in the Successful Management of a Permanent Anterior Tooth with Open Apex. Journal of International Oral Health 2014; 6(4): 68-72.
4. **Joseph A. Petrino, DDS,* Kendra K. Boda et al.** Challenges in Regenerative Endodontics: A Case Series. Journal of Endodontic (JOE), 2009; 1-6.
5. **Mehrfam Khoshkhounejad, Noushin Shokouhinejad, Salma Pirmoazen.** Regenerative Endodontic Treatment: Report of Two Cases with Different Clinical Management and Outcomes. Journal of Dentistry, Tehran University of Medical Sciences, Tehran, 2015; 12(6):460-468.