ORIGINAL RESEARCH PAPER
Volume-9 | Issue-5 | May-2020 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

BIODENTINE - A ROOT END FILLING MATERIAL

Dental Science

Dr. Hema. N MDS Pedodontics Senior lecturer, Department of Pedodontics and Preventive Dentistry, k. G. F college of Dental sciences. D. K Plantations, BEMLNagar, K. G. F , Kolar, Karnataka.

Dr O Madhavi* MDS Orthodontics, Associate Professor, Dept Of Dentistry, PES Institute Of Medical Sciences And Research, Kuppam, Chittoor, Andhra Pradesh,*Corresponding Author

Dr Sravanthi Kallepalli MDS Pedodontics, Assistant professor, Dept Of Dentistry, PES Institute Of Medical Sciences And Research, Kuppam, Chittoor, Andhra Pradesh,

Dr. Latha. M MDS Oral Pathology Reader Department of Oral Pathology , K.G.F Dental Sciences D. K Plantations, BEML Nagar, K. G. F. Kolar, karnataka.

Dr B. Haripriya MDS Pedodontics Flat no 306, Rambagh mallaiah towers, Madhavi bloc, Rambagh, Attapur, Hyderabad,

Dr Anjana Yogesh MDS Periodontics Reader, Dept of Periodontics, KGF College of dental sciences, D. K Plantations, BEML Nagar, K. G. F. Kolar, karnataka.

ABSTRACT

AIM: The aim of this study is to evaluate stereomicroscopically the microleakage of root end filling materialsMineral Trioxide Aggregate (MTA) and Biodentine. **METHODOLOGY:** Twenty extracted human premolars were obturated with gutta percha using lateral compaction technique. Following this, teeth were resected apically & standardized root end cavities were prepared. The teeth were then randomly divided into 2 groups of 10 specimens each & were filled with Group – I: MTA, Group – II: Biodentine. They were immersed in 1% methylene blue dye for 72hrs. The teeth were then sectioned longitudinally & examined under stereomicroscope. The depth of dye penetration was measured in millimeters. **Results:** Microleakage was found to be significantly less in Biodentine. **CONCLUSION:** The results suggest that both materials presented microleakage. However , Biodentine showing the least microleakage of all.

KEYWORDS

Microleakage, Root-End Filling, MTA & Biodentine

INTRODUCTION

The aims of periradicular surgery is to remove the causes of disease and to provide a favourable environment for healing of the surgical wound. The placement of a root-end filling is one of the key steps in managing the root end. The ideal root end filling material should not only adhere or bond to tooth tissue and "seal" the root end three dimensionally but also evoke a positive tissue response to promote regeneration of the periodontium.

Since introduction as a root-end filling material in 1993, the use of Mineral Trioxide Aggregate (MTA) has expanded to many applications for root repair and bone healing. Several studies have demonstrated the excellent physicochemical properties of MTA, including the high sealing ability and adaptation to the dentinal walls , high radiopacity and excellent tissue response. However,despite its good properties, MTA, introduced in the market under the commercial name ProRoot MTA (Dentsply/Tulsa Dental, Tulsa, OK, USA), available in two variants as Gray and white MTA, presented some undesirable characteristics such as long setting time, difficult manipulation and insertion.

A newly researched material with largely improved physical properties Biodentine has been introduced which can be used as a root end filling material. Biodentine is a calcium silicate based cement. In addition to the chemical composition based on the Ca3SiO5 and water chemistry which brings the high biocompatibility of already known endodontic repair cements like MTA, it has increased physico-chemical properties like short setting time, high mechanical strength which make it clinically easy to handle and compatible, not only with classical endodontic procedures, but also for restorative clinical cases of dentine replacement.

Increasing the setting time was achieved by a combination of different effects. First, particle size greatly influences the setting time, since the higher the specific surface, the shorter the setting. Also, adding calcium chloride to the liquid component accelerates the system. Finally, the decrease of the liquid content in the system decreases the setting time to harden within 9 to 12 minutes.

MATERIALS AND METHODS

STUDY SAMPLES

This was a comparative study involving 20 extracted teeth consisting of two groups, each with 10 samples.

SAMPLE PROCESSING

20 extracted premolars with completely formed apices and straight canals were taken for this study and were divided into 2 groups of 10 for performing the study. (Fig. 1) The teeth were cleaned using ultrasonics. Preoperative radiographs were taken and access cavities were made using endo access bur.(Fig. 2) The pulp tissue was extirpated using barbed broach. K-file was used to confirm the canal patency and the working length (Fig. 3) was determined with help of a radiograph A glide path was prepared till the working length with #25 K-File. Canals were then prepared using the complete sequence of hand files using 3% sodium hypochlorite and 17% EDTA as irrigants .Canals were dried using absorbent paper points and master cone selection was confirmed. Canals were obturated with gutta percha by lateral compaction technique. Radiographs were taken to confirm the quality of obturation (Fig. 4) and the access cavities were sealed with composite resin restorative material after 24 hours. The teeth were then stored in saline for 1 week. They were resected apically at 90° angle axis to the long axis of the root using crosssectional diamond disc removing 3 mm of the apex.(Fig. 5) The 3 mm deep retrograde cavity was prepared using straight fissure diamond bur the cavities were irrigated with saline and dried. The teeth were randomly divided into 2 groups of 10 specimens each:

1. Group I : Mineral Trioxide Aggregate (MTA)
2. Group II : BioDentine


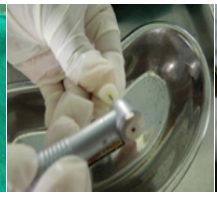


Fig 1 samples **Fig 2 access opening** **Fig 3 working length**

Fig 4 obturation

Fig 5 apical resection

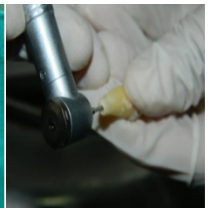

Fig 6 retograde cavity

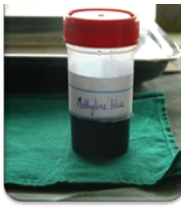

Fig 7methylene blue

Fig 8 varnish coating except

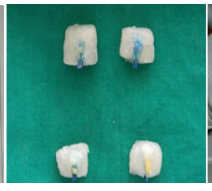

Fig 9 clear acrylic stablie

Fig 10 sectioning

Fig 11 dye in MTA

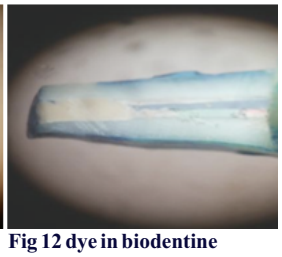

Fig 12 dye in biodentine

These materials were manipulated according to the manufacturer's instructions and the cavities were filled. The specimens were then coated with 3 coats of nail varnish except at the apical 1mm & then were allowed to dry.(Fig. 6) The specimens were then suspended in 1% methylene blue for 72hours.(Fig. 7) Following this the teeth were rinsed for 15minutes under running water. Clear acrylic blocks were made to stabilize them.(Fig. 8) The teeth were then sectioned longitudinally (Fig. 9)and the dye penetration was examined under stereomicroscope & microleakage was evaluated in millimeters.(Fig. 10,11,12,)

RESULTS

Table 1 shows microleakage values for different groups. Comparison of microleakage showed an average leakage value of 0.55 mm with a standard deviation of 0.089 for Biodentine, 0.648mm with a standard deviation for MTA.

	MTA	BIODENTINE
1	0.886552	0.082464
2	0.804527	0.206161
3	0.659735	0.077482
4	0.711255	0.092915
5	0.633945	0.07234
6	0.769056	0.123804
7	0.783411	0.097926
8	0.805084	0.11899
9	0.59534	0.134005
10	0.582524	0.083464
AVERAGE	0.6486	0.0891

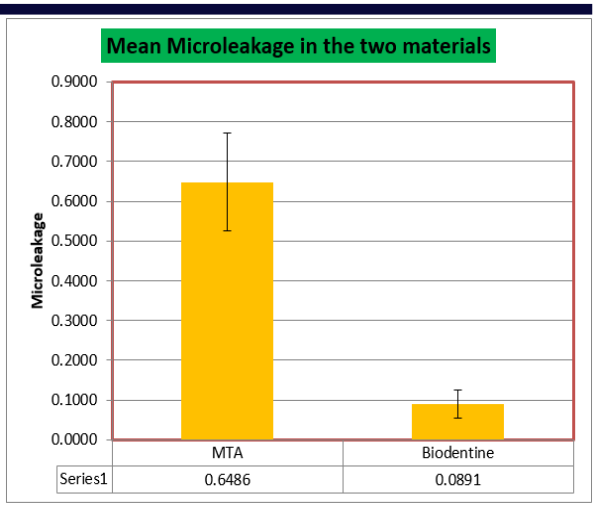

Table 1 and graph

Graph 1 shows a mean wise graphic representation of the average microleakage of MTA and Biodentine in which Biodentine shows the least microleakage.

DISCUSSION

The goal of a periradicular surgery is to gain access to the affected area, evaluate the root circumference and root canal anatomy and place a biocompatible seal in the form of root end filling that stimulates the regeneration of periodontium. Numerous substances have been used as root end filling materials. The choice of a root-end filling material could be governed by handling properties, biocompatibility, apical seal and long term clinical success. Most *in vitro* studies evaluate leakage of the apical seals, but the correlation between dye leakage around root-end filling materials and their clinical performance is uncertain. The clinical significance of microleakage in apical surgery has not been elucidated. However it seems logical that the lesser leakage would prevent migration of bacteria and toxins into the periradicular tissue.

MTA has been investigated as a potential alternative restorative material to the presently used materials in endodontics. Several *in vitro* and *in vivo* studies have shown that MTA prevents microleakage. Its adaptation and properties are not affected by moisture as seen in various studies where it has been proved that there was no significant difference in its retention when a dry or wet cotton pellet was used during its packing into the cavity. These properties of MTA make it a suitable root end filling material. When non-adhesive materials are used for apical sealing, a microscopic space always exists between the restoration and the tooth which leads to microleakage.

Despite its good physical, biological properties and it being hydrophilic in nature, MTA has some disadvantages such as long setting time and high cost.

Biodentine turns out to be one of the most biocompatible of all the biomaterials in dentistry as demonstrated according to all the ISO standard tests, as well as in the different preclinical and clinical research collaborations. Moreover, reactionary dentine formation was demonstrated in rats, exhibiting high quality and quantity of protective dentine stimulation in indirect pulp capping. In the case of direct pulp capping and pulpotomy in pigs, the compatibility with the pulp enables a direct contact with fibroblasts, with limited inflammatory response compared to controls. Formation of a regular and dense dentine bridge is histologically demonstrated within one month. Besides the usual endodontic indications of this class of calcium-silicate cements (repair of perforations or resorptions, apexification, root-end filling), Biodentine has been evaluated for its restorative properties, as a permanent dentine substitute and temporary enamel substitute. Restoration of deep or large crown carious lesions provides a very tight seal, without post-operative sensitivity and insures the longevity of restorations in vital teeth. Biodentine has also achieved 100% success in direct pulp capping in adults presenting healthy pulp. Biodentine has some features which are superior to MTA.

Biodentine consistency is better suited to the clinical use than MTA and presentation ensures a better handling and safety than MTA.

Biodentine does not require a two step obturation as in the case of MTA.

The results of this study showed that all materials exhibited microleakage but there was significantly less leakage in Biodentine (0.089 mm) when compared to MTA (0.648 mm) These microleakage values obtained were similar with previously done studies.

CONCLUSION

Comparative evaluation of results of this in vitro study, showed that MTA & Biodentine exhibited microleakage with Biodentine showing the least microleakage of all. This study is an effort to evaluate the sealing ability of the newly introduced material Biodentine. However it is still open for further research not only for the sealing ability but also the related physical properties as well as critical manipulative steps.

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