

## ORIGINAL RESEARCH

### Comparison of microleakage property of MTA and GIC as retrograde filling material

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#### ABSTRACT:

**Background:** Root canal therapy is a sequence of treatments involving root canal cleaning, shaping, decontamination and obturation. **Aim of the study:** To compare efficacy of MTA and GIC as retrograde filling material. **Materials and methods:** The present study was conducted in the Department of Endodontics of the Dental institution. For the study, a total of 100 permanent maxillary central incisors without any caries or anatomical malformations were selected. The teeth were cleaned ultrasonically and were stored in normal saline. The teeth were randomly grouped into 2 groups, Group A and B, with 50 teeth in each group. The retrograde cavity of teeth in Group A were filled with MTA and in Group B were filled with GIC. The roots were exposed to an aqueous solution of a fluorescent dye for 24 hours and the dye penetration was studied using a microscope of a longitudinally section of each teeth. **Results:** The material used for retrograde filling in group A was MTA and in group B was GIC. Both the groups had 50 teeth each. We observed that mean dye leakage score was more in Group B as compared to Group A. **Conclusion:** Within the limitations of the present study, it can be concluded that MTA is efficacious in preventing microleakage when used as a retrograde cavity filling material as compared to GIC.

**Keywords:** MTA, GIC, retrograde filling material, microleakage.

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#### Introduction:

Root canal therapy is a sequence of treatments involving root canal cleaning, shaping, decontamination and obturation. It is conventionally performed through a hole drilled into the crown of the affected tooth, namely orthograde root canal therapy. For teeth that cannot be treated with orthograde root canal therapy, or for which it has failed, retrograde root filling, which seals the root canal from the root apex, is a good alternative. <sup>1</sup> Many materials, such as amalgam, zinc oxide eugenol and mineral trioxide aggregate (MTA), are generally used. <sup>2</sup> The materials used for this procedure, ideally, should have the best sealing ability with no microleakage and they should also possess properties like biocompatibility with periradicular tissues, should be

non-resorbable, non-toxic, dimensionally stable, impervious to dissolution or breakdown by the tissue fluids and capable of being adapted as closely as possible to the dentinal walls of the root end preparation exhibiting no/or minimal microleakage so as to prevent penetration of tissue fluids into root canal or leakage of microorganisms and/or their toxins through the apical foramina into the surrounding tissues. In addition, it should be electrochemically active, easy to manipulate and radioopaque. <sup>3</sup> Various materials are flooded in the market that claim their supremacy regarding microleakage, e.g., Direct filling gold, Silver-amalgam, Glass ionomer cement, Light cure glass ionomer cement (LC GIC), Composite, Super-ethoxy benzoic acid Super-ethoxy benzoic acid (EBA), Zinc oxide eugenol, Cavit, Gutta-percha, etc. <sup>4,5,6</sup>

Hence, the present study was conducted to compare efficacy of MTA and GIC as retrograde filling material.

**Materials and methods:**

The present study was conducted in the Department of Endodontics of the Dental institution. The ethical clearance for the study was approved from the ethical committee of the hospital. For the study, a total of 100 permanent maxillary central incisors without any caries or anatomical malformations were selected. The teeth were cleaned ultrasonically and were stored in normal saline. The crowns of all the teeth were removed at the cemento-enamel junction and the working length was standardized to 15 mm. The biomechanical preparation of the root canals was done using K-files and sodium hypochlorite solution was used for irrigation of canals between the canal preparation. The biomechanical preparation was done using step back technique. The root canals were dried using paper points and were obturated with gutta percha points using lateral condensation and root canal sealers. The access cavity was sealed with temporary filling. After obturation, the roots were kept for a week in 100 % humidity. The root resection was done by removing 1 mm of apical root using diamond disc with constant irrigation. The retrograde cavity measuring 3 mm was prepared using no. 8 round bur with contra angle hand piece. The teeth were randomly grouped into 2 groups, Group A and B, with 50 teeth in each group. The retrograde cavity of teeth in Group A were filled with MTA and in Group B

were filled with GIC. The roots were exposed to an aqueous solution of a fluorescent dye for 24 hours and the dye penetration was studied using a microscope of a longitudinally section of each teeth. The dye penetration was graded as follows:

- Grade 0: No dye penetration
- Grade 1: Dye penetration into apical one third of retrograde filling material.
- Grade 2: Dye penetration into apical middle third of retrograde filling material.
- Grade 3: Dye penetration into full length of retrograde filling material.
- Grade 4: Dye penetration beyond retrograde filling material

The statistical analysis of the data was done using SPSS version 11.0 for windows. Chi-square and Student’s t-test were used for checking the significance of the data. A p-value of 0.05 and lesser was defined to be statistically significant.

**Results:**

Table 1 shows demographic details of groups A and B. The material used for retrograde filling in group A was MTA and in group B was GIC. Both the groups had 50 teeth each. Table 2 shows mean microleakage score with retrograde filling of Group A and B. We observed that mean dye leakage score was more in Group B as compared to Group A. The results were compared and were found to be statistically significant. (Fig 1)

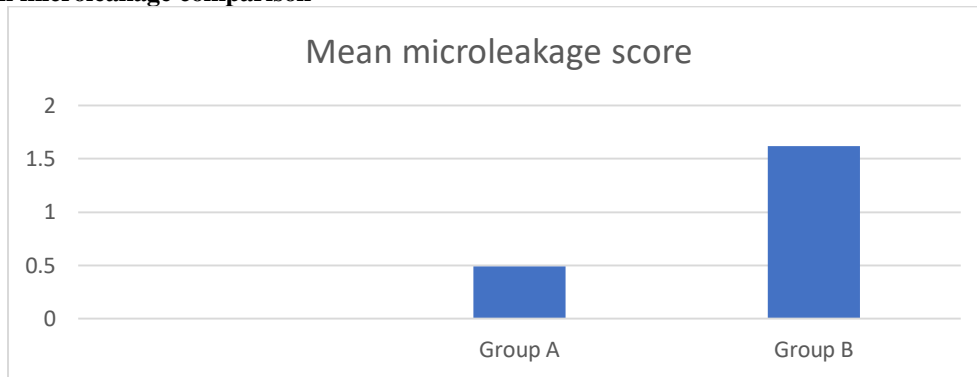
**Table 1: demographic details of groups A and B**

Groups	Material used for retrograde filling	No. of teeth
Group A	MTA	50
Group B	GIC	50

**Table 2: Mean microleakage score**

Groups	Mean microleakage score	p-value
Group A	0.49	0.02
Group B	1.62	

**Fig 1: Mean microleakage comparison**



**Discussion:**

In the present study, 100 maxillary incisors were used. The teeth were randomly grouped into two groups for retrograde filling with different materials used in each group. On comparison of microleakage, we observed that mean score of microleakage for MTA was comparatively lower as compared to GIC. On comparison the results were found to be statistically significant. The results were compared with previous studies and found to be consistent. Galhotra V et al compared the microleakage of mineral trioxide aggregate (MTA) with commonly used retrograde filling materials, like light-cured composite with dentin-bonding agents, light-cured glass ionomer cement (LC GIC) and resin-modified zinc oxide eugenol. Ninety freshly extracted non-carious single-rooted human anterior teeth were used in the study. They were randomly divided into four experimental groups and two control groups of 15 each. All the four materials used in the study showed some microleakage throughout the experimental period. The sealing ability in terms of microleakage can be summarized as: MTA > Composite resin with dentin bonding agent > LC GIC > Resin modified zinc oxide eugenol.<sup>7</sup> Shahriari S et al compared the apical sealing ability of three common root end filling materials namely mineral trioxide aggregate (MTA), intermediate restorative material (IRM) and calcium-enriched mixture (CEM) cement using a bacterial leakage model. They conducted study on 83 single-rooted human teeth. The samples were divided into three groups (n=25) according to the root-end filling material including MTA, IRM and CEM cement. This procedure was continued for 70 days. No significant difference was found in bacterial microleakage among three groups; MTA showed slightly (but not significantly) less microleakage than IRM and CEM. However, the difference in the mean time of microleakage was significant among the groups and in MTA samples leakage occurred in a longer time than CEM. They concluded that the three tested root end filling materials had equal sealing efficacy for preventing bacterial leakage.<sup>8</sup>

P V R et al evaluated the marginal adaptation of three root-end filling materials Glass ionomer cement, Mineral trioxide aggregate and Biodentine™. Thirty human single-rooted teeth were resected 3 mm from the apex. Root-end cavities were then prepared using an ultrasonic tip and filled with one of the following materials Glass ionomer cement (GIC), Mineral trioxide aggregate (MTA) and a bioactive cement Biodentine™. The apical portions of the roots were then sectioned to obtain three 1 mm thick transversal sections. Confocal laser scanning microscopy (CLSM) was used to determine area of gaps and adaptation of the root-end filling materials with the dentin. Statistical analysis showed lowest marginal gaps and good

marginal adaptation with Biodentine™ followed by MTA and highest marginal gaps with GIC which were statistically significant. They concluded that Biodentine™ showed better marginal adaptation than commonly used root end filling materials.<sup>9</sup> Solanki NP et al compared the biocompatibility and sealing ability of mineral trioxide aggregate (MTA) and biodentine as root-end filling material. They concluded that good sealing ability of biodentine along with its favorable biological properties show that materials can be used competently in clinical practice as a retrograde filling material. However, long-term assessment in clinical situations is necessary for further inferences.<sup>10</sup>

Bhavana V et al evaluated the antibacterial and antifungal properties of calcium-based cement, Biodentine, compared to commercial glass ionomer cements (GICs) and mineral trioxide aggregate (MTA). Test indicates that the antimicrobial activity of Biodentine, on all the microorganisms tested, was very strong, showing a mean inhibition zone of 3.2 mm, which extends over time towards all the strains. For Biodentine, GIC, and MTA, the diameters of the inhibition zones for *S. mutans* were significantly larger than for *E. faecalis*, *Candida*, and *E. coli*. They concluded that all materials showed antimicrobial activity against the tested strains except for GIC on *Candida*.<sup>11</sup>

**Conclusion:**

Within the limitations of the present study, it can be concluded that MTA is efficacious in preventing microleakage when used as a retrograde cavity filling material as compared to GIC.

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