

## Original ARTICLE

### Assessment of sealing ability of two different retrograde filling materials using dye penetration method

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#### ABSTRACT

**Background:** Most of the endodontic failures occur due to the microorganisms which persists after the conventional treatment or due to the entry of the same through coronal leakage. The success of surgical endodontics is again determined by the apical seal which prevents the entry of microorganisms and the tissue fluid in the periapical region in either direction. The main objective of a root-end filling material (REFM) is to provide an apical seal that prevents the movement of bacteria and the diffusion of their products from the root canal system into the periapical tissues. Hence; the present study was undertaken for assessing sealing ability of two different retrograde filling materials using dye penetration method. **Materials and methods:** The present study was conducted in the Department of Conservative Dentistry of the Dental institutions. We selected 60 extracted mandibular premolars. Teeth having any structural anomaly or any carious lesion were excluded from the study. The decoronation of the teeth was done using a diamond disc. Access cavities were prepared and the canal was prepared upto size 25-K file. The root canals were flushed using 1 mL of 5.25% NaOCl solution between each instrument change. They were resected apically at 90° angle to the long axis of the root using diamond disc removing 3 mm of the apex. The 3 mm deep retrograde cavity was prepared using no.2 ultrasonic tip. The cavities were irrigated with saline and dried. The teeth were then randomly grouped into 3 groups of 20 specimens each. **Results:** A total of 60 teeth specimens were included in the study, with 20 specimens in each group. We observed that lowest microleakage was observed in teeth which were restored with Biodentine. Highest microleakage was seen in Group 1 which was control group. The results were statistically significant. **Conclusion:** Within the limitations of the present study, it can be concluded that Biodentine and Giomer, both showed microleakage when used as root end filling materials; however, microleakage was more in Giomer. Thus, Biodentine should be the preferred material for root end fillings.

**Keywords:** Periapical filling, Biodentine, Microleakage

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#### INTRODUCTION

Most of the endodontic failures occur due to the microorganisms which persists after the conventional treatment or due to the entry of the same through coronal leakage.<sup>1</sup> The success of surgical endodontics is again determined by the apical seal which prevents the entry of microorganisms and the tissue fluid in the periapical region in either direction.<sup>2</sup> The main objective of a root-end filling material (REFM) is to provide an apical seal that prevents the movement of bacteria and the diffusion of their products from the root canal

system into the periapical tissues.<sup>3</sup> Different materials have been introduced for this purpose. However, no root-end filling material satisfies ideal requirements, therefore, development of a novel REFM is a constant concern for many researchers.<sup>4,5</sup> The primary aim of obturating a root canal is to achieve a perfect hermetic seal between the pulp space and the periradicular area. When this hermetic seal cannot be obtained through an orthograde filling, a surgical procedure is conducted to place a retrograde root filling to prevent leakage of irritants from the root canal into the periradicular tissues, and vice versa.<sup>6</sup> Hence, the present study was

conducted to assess sealing ability of two different retrograde filling materials using dye penetration method.

**MATERIALS AND METHODS**

The present study was conducted in the Department of Conservative Dentistry of the Dental institutions. The ethical clearance for the study was approved from the ethical committee of the hospital. We selected 60 extracted mandibular premolars. Teeth having any structural anomaly or any carious lesion were excluded from the study. The decoronation of the teeth was done using a diamond disc. Access cavities were prepared and the canal was prepared upto size 25-K file. The root canal shaping was carried out using ProTaper Universal rotary instruments. The root canals were flushed using 1 mL of 5.25% NaOCl solution between each instrument change. Canals were dried with the use of absorbent paper points and obturated with gutta percha using lateral compaction technique with AH plus being the sealer. The samples were then stored in saline for 1 week. They were resected apically at 90° angle to the long axis of the root using diamond disc removing 3 mm of the apex. The 3 mm deep retrograde cavity was prepared using no.2 ultrasonic tip. The cavities were irrigated with saline and dried. The teeth were then randomly grouped into 3 groups of 20 specimens each.

Group 1 (n=20): Control Group

Group 2 (n=20): Biodentine

Group 3 (n=20): Giomer

These materials were manipulated as per the manufacturer’s instructions and the cavities were filled. The specimens were then coated with 2 coats of nail varnish except at the apical 1mm & then were allowed to dry. The specimens were then placed in India Ink for 72 hours. After this the teeth were rinsed under running water for 15 minutes. The teeth were then sectioned longitudinally using diamond disc, and the dye penetration was examined under stereomicroscope & microleakage was evaluated in millimetres. The specimens were scored for linear measurement of dye penetration along cavity walls using the scores given below

- 0 = No dye penetration
- 1 = Dye penetration into apical one third of retrograde filling material
- 2 = Dye penetration into apical middle third of retrograde filling material.
- 3 = Dye penetration into full length of retrograde filling material.
- 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 statistical significant.

**RESULTS**

Table 1 shows the comparison of microleakage in different groups. A total of 60 teeth specimens were included in the study, with 20 specimens in each group. We observed that lowest microleakage was observed in teeth which were restored with Biodentine. Highest microleakage was seen in Group 1 which was control group. The results were statistically significant. (p<0.05)

**DISCUSSION**

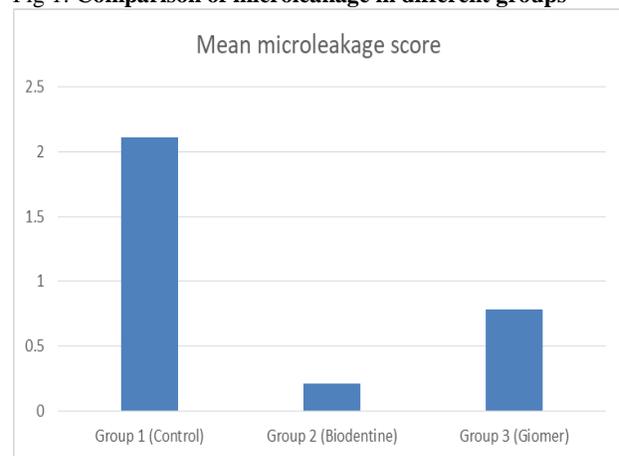
In the present study, we observed that Biodentine was most efficacious as retrograde filling as there was minimal microleakage observed in teeth restored with Biodentine. Giomer was also fairly efficacious but the microleakage was more evident as compared to Biodentine. The results were found to be

statistically significant. The findings were compared to studies in previous literature and were found to be consistent. Gerdolle DA et al evaluated the microleakage of indirect resin composite inlays cemented with 4 luting agents.

**Table 1: Comparison of microleakage in different groups**

Groups	Number of teeth	Mean microleakage score	p-value
Group (Control)	1 20	2.11	0.012
Group (Biodentine)	2 20	0.21	
Group (Giomer)	3 20	0.78	

**Fig 1: Comparison of microleakage in different groups**



Standardized Class V inlay preparations overlapping the cemento-enamel junction were prepared on the buccal and lingual surfaces of 40 extracted human mandibular third molars. Eighty postpolymerized, heat-treated resin composite inlays (Targis, 72 specimens, 8 controls) were processed in stone replicas and cemented into the preparations using 4 luting agents (n = 18 + 2 controls for each cement group): a resin composite used with a bonding agent (Variolink II/Excite), a resin composite used with a self-etching primer, but without bonding agent (Panavia F/ED Primer), a modified resin composite used with a bonding agent (Resinomer/One Step), and a resin-modified glass-ionomer cement (Fuji Plus). Thirty-six inlays (n = 9 + 1 control) were subjected to thermal cycling (2000 cycles, 5 degrees C/55 degrees C), whereas the other 36 were not. All the teeth were then immersed in 1% methylene blue dye solution for 48 hours. Microleakage score, margin location (enamel/cementum), thermal cycling history, and preparation location (buccal/lingual) were analyzed using a multivariate model (alpha = .05). Multivariate analysis was performed using a polychotomous logistic regression. The preparation location had no significant effect on dye penetration. The margin location (enamel or cementum) and the thermal cycling had a significant effect on microleakage. In comparing the 3 resin-based luting agents to Fuji Plus, Panavia F exhibited the lowest significant overall microleakage, followed by Variolink II, whereas Resinomer demonstrated the greatest significant overall microleakage. Within the experimental conditions of this in vitro study, thermal cycling significantly

increased microleakage. The overall microleakage at the enamel margins was significantly lower than the overall microleakage at the cementum margins for the 4 luting agents tested. Haralur SB et al assessed the effect of various dentin bonding techniques on the microleakage after accelerated ageing in porcelain laminate veneers. Forty intact, premolar teeth were prepared to receive the PLV. The lithium disilicate PLV were fabricated from IPS e.max System. The intaglio surfaces were prepared with hydrofluoric acid and silane. Teeth samples were randomly divided among four groups of ten each according to the tooth surface preconditioning; it included etch-wash light cure, etch-wash dual cure, self-etch and self-adhesive techniques. The Teeth samples were subjected to the accelerated ageing with thermocycling and exposure to xenon light. The microleakage was accessed with die penetration test using 0.5% basic fuchsin. The data was statistically analysed by Kruskal–Wallis and Mann–Whitney U tests. The etch-wash dual cure resin cements recorded the lowest interfacial microleakage score of 0.90 and 0.60 at cervical tooth-composite resin and incisal enamel-composite regions respectively. The highest corresponding values of 3.00 and 1.60 was recorded with self-Adhesive resin luting cements. The microleakage at cervical tooth- composite interface was significantly higher in comparison to incisal enamel-composite interface across all the tested groups. The microleakage values at porcelain-composite interface was considerably less to the tooth- composite interface. They concluded that Etch-wash composite resin luting cements for PLV provided the best bonding interface, with the least interfacial microleakage.<sup>7,8</sup>

Eftekhar Ashtiani R et al assessed the marginal microleakage of four cements in metal ceramic restorations with adapted and open margins. Sixty sound human premolars were selected for this experimental study performed in Tehran, Iran and prepared for full-crown restorations. Wax patterns were formed leaving a 300 µm gap on one of the proximal margins. The crowns were cast and the samples were randomly divided into four groups based on the cement used. Copings were cemented using zinc phosphate cement (Fleck), Fuji Plus resin-modified glass ionomer, Panavia F2.0 resin cement, or G-Cem resin cement, according to the manufacturers' instructions. Samples were immersed in 2% methylene blue solution. After 24 hours, dye penetration was assessed under a stereomicroscope and analyzed using the respective software. Data were analyzed using ANOVA, paired t-tests, and Kruskal-Wallis, Wilcoxon, and Mann-Whitney tests. The least microleakage occurred in the Panavia F2.0 group and the maximum was observed in the Fleck group. The Fleck group displayed significantly more microleakage compared to the Fuji Plus and Panavia F2.0 groups in both closed and open margins. In open margins, differences in microleakage between the Fuji Plus and G-Cem as well as between the G-Cem and Panavia F2.0 groups were significant. In closed margins, only the G-Cem group displayed significantly more microleakage as compared to the Panavia F2.0 group. Paired t-test results showed significantly more microleakage in open margins compared to closed margins, except in the Fuji Plus group. They concluded that Fuji Plus cement exhibited better sealing ability in closed and open margins compared to G-Cem and Fleck cements. When using G-Cem and Fleck cements for full metal ceramic restorations, clinicians should try to minimize marginal gaps in order to reduce restoration failure. In situations where there are doubts about perfect marginal adaptation, the use of Fuji Plus cement may be helpful. Karaağacloğlu L compared the marginal seal of Class II

cavities restored with indirect inlays constructed on glass ionomer cement linings having different curing properties. Also the effect of acid-etching of these liners on microleakage was investigated. Mesio-occlusal and disto-occlusal cavities in 80 extracted human molars having the cervical floor below the cemento-enamel junction were prepared (n:160). Half of the preparations were restored with Ceramco II porcelain and the rest with SR-Isosit resin inlay material. Liners as light curing Ionoseal light+chemically curing LCL 8 and Ziommer and chemically curing Ketac-Bond glass ionomer cements (GICs) were used. On mesial preparations GICs were acid-etched but were not on distal preparations. All inlays were cemented with Ultrabond composite material. After thermocycling the teeth were placed in a basic fuchsin dye solution for 24 h, then each tooth was sectioned. By using a stereomicroscope the extent of marginal leakage was scored and statistically evaluated. Microleakage was observed beneath all GIC linings and was more extensive between light curing GIC/dentine interface. By acid-etching of GICs the microleakage between GIC/dentine interface was increased significantly. Whether acid-etching was applied or not a significantly increased microleakage was recorded between chemically curing GIC/composite interfaces. Although the marginal microleakage was witnessed in both inlays, it appeared that porcelain inlays provided a better marginal seal, in comparison to SR-Isosit inlays.<sup>9,10</sup>

#### CONCLUSION:

Within the limitations of the present study, it can be concluded that Biodentine and Giomer, both showed microleakage when used as root end filling materials, however, microleakage was more in Giomer. Thus, Biodentine should be the preferred material for root end fillings.

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