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Original Research

Assessment of microleakage in composite inlays by using different luting cements at different levels

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***ABSTRACT*:**
Background: Fixed prosthodontics is a commonly used dental treatment that restores and preserves oral tissues. Marginal gaps at the tooth-restoration interface are an inevitable component of any fixed restoration and need to be sealed effectively. Luting cements are used to seal gaps and preserve the tooth from microbial invasion. 1 Failure of cements to seal gaps may result in an inflammatory response in the pulp and subsequent pulpal necrosis, which compromises the longevity of restorations. **Aim of the study:** To assess composite inlays by using different luting cements at different levels. **Materials and methods:** The present study was conducted in the Department of Conservative Dentistry and Endodontics of the Dental institutions. For the study, we selected 40 extracted premolar teeth free from any caries or structural anomaly. The teeth were randomly grouped into 2 groups with 20 teeth in each group. Standardized class II inlay box cavities were prepared on each tooth using high speed hand piece along with air and water spray. GROUP I –Multilink N as a luting agent and GROUP II- Multilink speed as a luting agent. The luting cements were mixed and applied as per the manufacturer's instructions. The inlay was seated into the cavity and excess material was removed with scalers. The margins were light cured for 20 seconds as per the manufacturer's instructions. **Results:** There were 20 teeth in each group I and II. The mean rank of microleakage for Group I teeth was 9.23 and for Group II teeth was 8.21. On comparing the results, it was found that results are statistically non-significant. **Conclusion**: Within the limitations of the present study, it can be concluded that the microleakage of composite inlay with luting cements Multilink N and Multilink speed are very minimal but there is not much difference between both the cements as per microleakage.
Keywords: Composite, Microleakage, Endodontic, Luting cement

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INTRODUCTION

Fixed prosthodontics is a commonly used dental treatment that restores and preserves oral tissues. Marginal gaps at the tooth-restoration interface are an inevitable component of any fixed restoration and need to be sealed effectively. Luting cements are used to seal gaps and preserve the tooth from microbial invasion. [1] Failure of cements to seal gaps may result in an inflammatory response in the pulp and subsequent pulpal necrosis, which compromises the longevity of restorations. [1, 2] Microleakage is indicated by

post-treatment hypersensitivity, chronic tooth hypersensitivity, and marginal discoloration around the restoration. [3] The most important cause of microleakage in indirect composite resin restorations is polymerization shrinkage and subsequent mechanical and thermal tensions. Several studies have mentioned the benefits of dentin adhesive systems in obtaining a strong and durable adhesion between the composite resin and tooth structure. [4] Prevention of microleakage greatly depends on establishing and maintaining a good seal at the interface of restorative material and tooth structure. In the new generation of dentin bonding agents, the bond strength and marginal integrity have significantly improved. [5, 6] Hence, the present study was conducted to assess microleakage in composite inlays by using different luting cements at different levels.

MATERIALS AND METHODS

The present study was conducted in the Department of Conservative Dentistry and Endodontics of the Dental institutions. The ethical clearance for the study was approved from the ethical committee of the hospital. For the study, we selected 40 extracted premolar teeth free from any caries or structural anomaly. The teeth were debrided first with ultrasonic scaler and then by dipping in sodium hypochlorite. The teeth were randomly grouped into 2 groups with 20 teeth in each group. Standardized class II inlay box cavities were prepared on each tooth using high speed hand piece along with air and water spray. The dimensions of each cavity was 2mm mesiodistally and 4mm buccolingually. Following that, separating medium was applied, composite was placed incrementally and cured initially (40 sec) using halogen light curing unit. Then, the composite inlays were removed from the teeth and post cured in polymat light curing unit. Bonding surface of the inlays were sandblasted using intra oral microetcher device. Sandblasted surfaces were irrigated with water and air dried. Teeth were grouped into two groups randomly with 20 teeth in each group. GROUP I –Multilink N as a luting agent and GROUP II- Multilink speed as a luting agent. The luting cements were mixed and applied as per the manufacturers instructions. The inlay was seated into the cavity and excess material was removed with scalers. The margins were light cured for 20 seconds as per the manufacturer's instructions. Restorations were finished and polished using composite finishing discs. The teeth apices were sealed with flowable composite resin. Two layers of nail varnish was applied to all the tooth surfaces except for about 1mm around the restoration margin. All the samples were then placed in 0.5% basic fuchsin for 24 hours. After dye penetration and irrigation of the teeth, samples were sectioned mesio-distally in vertical plan using a diamond disc in slow speed with water spray. The sections were mounted on slides and the degree of dye penetration was recorded under stereomicroscope with X20 magnification. Leakage was evaluated according to scores mentioned below for the degree of dye penetration.

A: Occlusal margin

1 - No microleakage

2 - Microleakage not reaching the DEJ

3 -Microleakage penetration over the DEJ

4 -Microleakage into the dentinal tubule towards the pulp

B: Cervical margin

1 - No microleakage

2 - Microleakage less than half the cervical wall of the cavity

3 - Microleakage penetration through all the cervical wall of the cavity

4 -Microleakage along the cervical or axial wall, into the dentinal tubules

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.

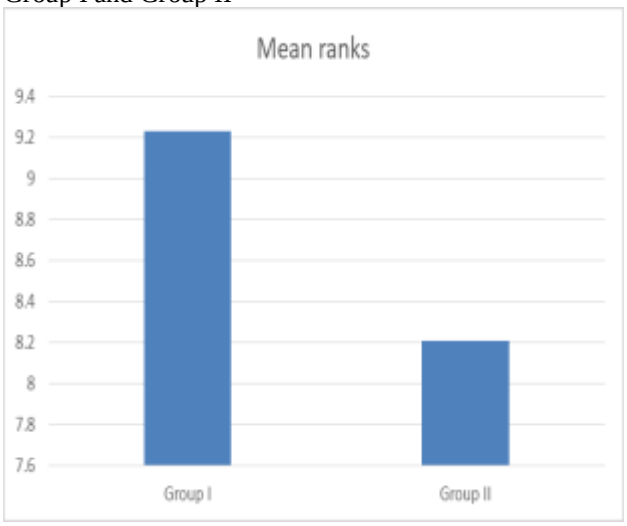
RESULTS

Table 1 shows comparison of microleakage with luting cements used in Group I and Group II. There were 20 teeth in each group I and II. The mean rank of microleakage for Group I teeth was 9.23 and for Group II teeth was 8.21. On comparing the results, it was found that results are statistically non-significant ($p<0.05$). [Fig 1]

Table 1: Comparison of microleakage:

Groups	Number of teeth	Mean ranks	p-value
Group I	20	9.23	0.32
Group II	20	8.21	0.11

Fig 1: Comparison of microleakage with luting cements in Group I and Group II



DISCUSSION

In the present study, we observed that microleakage with both the luting cements was present, however was very minimal. . The mean rank of microleakage for Group I teeth was 9.23 and for Group II teeth was 8.21. On comparing, the results were found to be statistically non-significant. On comparing the results with previous studies, it was found to be consistent. Medeiros PL et al evaluated the sealing ability of three root-end filling materials (white MTA, CPM, and MBPc) using an Enterococcus faecalis leakage model. Seventy single-root extracted human teeth were instrumented and root-ends were resected to prepare 3 mm depth cavities. Root-end preparations were filled with white MTA, CPM, and MBPc cements. Enterococcus faecalis was coronally introduced and the apical portion was immersed in BHI culture medium with phenol red indicator. The bacterial leakage was monitored every 24 h for 4 weeks. The statistical analysis was performed using the Wilcoxon-Gehan test. All cements showed bacterial leakage after 24 hours, except for the negative control group. The MBPc showed significantly less bacterial leakage compared with the MTA group. No significant differences were found between the CPM and the other groups. They concluded that the epoxy resin-based cement MBPc had lower bacterial leakage compared with the calcium silicate-based cements MTA and CPM. Rahimi S et al evaluated the dye penetration in different thicknesses of calcium enriched mixture (CEM) cement as root-end filling material. Following root canal filling in 70 extracted human single-rooted premolar teeth, the apical 3 mm of their root-ends was resected; the root-end cavities with depths of 1, 2 and 3 mm were prepared by ultrasonic retrotips and filled with CEM cement. After setting of cement, the roots were immersed in 2% Rhodamine B and the dye leakage was measured under stereomicroscope (×16) using Image J software. The data were analyzed by one-way ANOVA and Bonferroni post hoc tests at 5% significance level. The means and standard deviations of dye penetration in the 1, 2, and 3 mm groups were 3395.5±1893.4, 3410.4±1440.5, and 2581.6±1852.9 μm, respectively. The one-way ANOVA analysis indicated significant differences; however, the Bonferroni post hoc test revealed that only the positive control group differed significantly from the experimental groups. They concluded that the findings demonstrated CEM cement to have an adequate root-end , sealing ability in 3-mm thickness. [7, 8]

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. The study was conducted on 83 single-rooted human teeth. Tooth crowns were cut and root canals were prepared using the step-back technique. Apical 3 mm of the roots were cut and a three-mm-deep cavity was prepared using an ultrasonic instrument. The samples were divided into three groups (n=25) according to the root-end filling material including MTA, IRM and CEM cement. The roots were inserted into cut-end microtubes. After sterilization with ethylene oxide, microtubes were placed in sterile vials containing 10 mL of Brain Heart Infusion (BHI) broth and incubated at 37°C and 0.1 mL of Enterococcus faecalis suspension compatible with 0.5 McFarland standard (1.5×108 cell/ ml), which was refreshed daily. This procedure was continued for 70 days. The data were analyzed using the chi-square, Kruskal-Wallis and log rank tests. The level of significance was set at 0.05. 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. It was concluded that the three tested root end filling materials had equal sealing efficacy for preventing bacterial leakage. Jain A et al compared the sealing ability of four root-end filling materials MTA, Portland cement, IRM, RMGIC in teeth with root apices resected at 0 and 45 angle using dye penetration method under fluorescent microscope. Hundred extracted human maxillary anterior teeth were sectioned horizontally at the cement-enamel junction. After cleaning, shaping and obturation with gutta-percha and AH Plus sealer, the tooth samples were randomly divided in two groups (the root apices resected at 0° and 45° to the long axis of the root). The root resections were carried out by removing 2 mm and 1 mm in both the groups. Following which 3 mm deep root-end cavities were prepared at the apices and the root were coated with nail varnish except the tip. The teeth in both the group were randomly divided into four subgroups each (Pro root MTA, Portland cement, IRM and Light cure nano GIC Ketac N-100). All the retrofilled samples were stored in acrydine orange for 24 hours after which they were cleaned and vertically sectioned buccolingually. The sectioned root samples were observed under fluorescent microscope. The root apex sealing ability of Mineral Trioxide Aggregate (MTA) was superior to Portland cement, Intermediate Restorative Material (IRM) and LC GIC. IRM demonstrated the maximum apical leakage value among all the materials. Portland cement and LC GIC showed comparable sealing ability. They concluded that the angulation whether 0° or 45° angle did not affect the sealing ability of all the four materials used, MTA proved to be one of the superior materials for root-end filling. [9,10]

CONCLUSION

Within the limitations of the present study, it can be concluded that the microleakage of composite inlay with luting cements Multilink N and Multilink speed are very minimal but there is not much difference between both the cements as per microleakage.

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