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# ORIGINAL RESEARCH

## Comparative evaluation of micro leakage among newer composite materials

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***ABSTRACT:***

**Background:** All composites undergo 0.6-1.4% shrinkage during polymerization depending on the type of composite, the rate of cure and the amount and nature of the filler. This shrinkage can result in a gap formation between the composite material and the tooth structure, particularly if the restoration margin is placed in the dentine or cementum (as is seen in root caries and cervical defects that are prevalent mostly due to aging, gingival recession, and dentin exposure). **Aim of the study:** To compare micro leakage among newer composite materials. **Materials and methods:** The present study was conducted in the Department of Endodontics of the Dental institutions. For the study, we used 40 healthy maxillary premolars extracted for orthodontic reasons which were free from any structural anomalies. The sample teeth of each group were thoroughly dried and restored with the respective restorative materials using Teflon-coated instruments, cured incrementally, polished, and finished as per the manufacturer's instructions. A computer software (Dewinter Biowizard 4.1) was used to assess the depth of dye penetration. **Results:** It was observed that Group A showed higher dye penetration as compared to Group B. The values were found to be statistically significant. **Conclusion**: Within the limitations of the present study, it can be concluded that nanocomposites are better with respect to microleakage as compared to conventional microfilled composites.

**Keywords:** composite, microleakage, dye penetration, restoration.

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### INTRODUCTION:

Over the past 50 years, changes have occurred in the development of restorative materials. Adherence of restorative material to cavity walls is an important criterion for its performance and longevity in the oral cavity. Microleakage is "clinically undetectable passage of bacteria, fluids, molecules, or ions between cavity walls and the restorative material applied to it." [1] All composites undergo 0.6-1.4% shrinkage during polymerization depending on the type of composite, the rate of cure and the amount and nature of the filler.[2,3] This shrinkage can result in a gap formation between the composite material and the tooth structure, particularly if the restoration margin is placed in the dentine or cementum [4] (as is seen in root caries and cervical defects that are prevalent mostly due to aging, gingival recession, and dentin exposure). [5] Bacteria, fluids, molecules, or ions can pass through the gap between the resin composite and the cavity wall, a process called "microleakage." Microleakage is thought to be responsible for hypersensitivity, secondary caries, pulpal pathoses, and failure of restorations. [6] Hence, the present study was conducted to compare micro leakage among newer composite materials.

### MATERIALS AND METHODS:

The present study was conducted in the Department of Endodontics of the Dental institutions. The ethical clearance for the study was approved from the ethical committee of the hospital. For the study, we used 40 healthy maxillary premolars extracted for orthodontic reasons which were free from any structural anomalies.

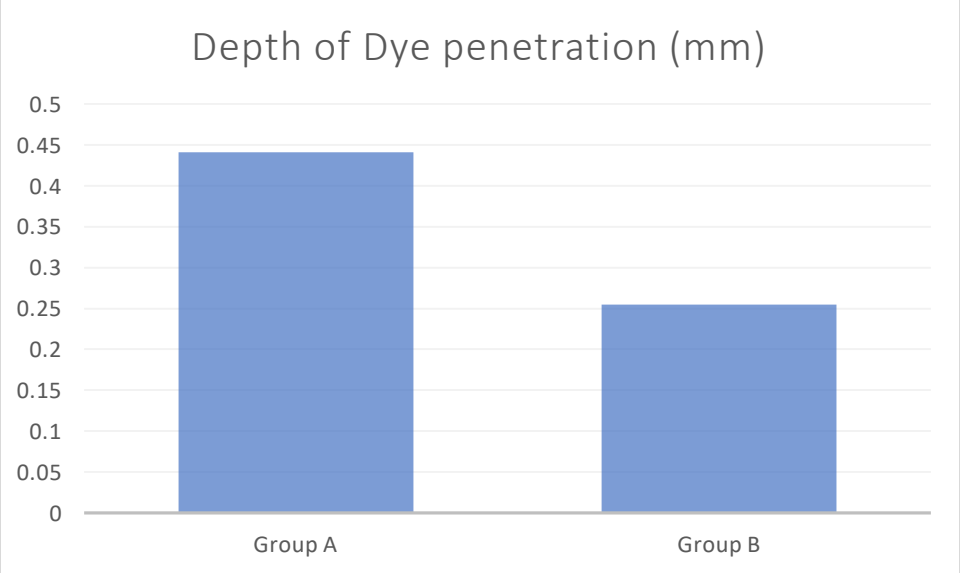
Before the cavity preparation, teeth were stored in normal saline. Standard class II cavities were prepared in the teeth with following dimensions, occlusal depth-1.5 cm, occlusal width-2 mm, width of proximal preparation-3 mm, location of gingival cavosurface-1.5 mm occlusal to cemento-enamel junction, width of gingival floor- 1.5 mm, and depth of axial wall- 3 mm. The teeth with prepared cavities were randomly grouped into 2 groups with 20 teeth in each group: Group A: conventional microfilled composite and Group B- nanocomposite. The sample teeth of each group were thoroughly dried and restored with the respective restorative materials using Teflon-coated instruments, cured incrementally, polished, and finished as per the manufacturer's instructions. The restored teeth were placed in three different Petri dishes group wise and subjected to thermocycling at 5° C, 37° C, and 55° C, 250 cycles. After thermocycling, apices of each tooth were sealed with clear self-cure acrylic resin, and the whole specimen was coated with nail varnish expect for the area of restoration and 2 mm from the periphery of the restoration. This procedure was repeated for all 45 restored teeth, followed by immersion of the sample teeth group wise into freshly prepared 50% silver nitrate solution for 4 h in a dark room. Later, the excess dye was washed off, and samples were again immersed group wise in freshly prepared X-ray developer solution exposed to 200 watts light bulb for 4 h. Later, the teeth were removed from the solution and gently rinsed under running water. The teeth were then sectioned buccolingually and observed under the stereomicroscope (×10 resolution-Trinocular research microscope – Kyowa) to evaluate the depth of dye penetration. A computer software (Dewinter Biowizard 4.1) was used to assess the depth of dye penetration.
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:**
In the present study, we recorded the depth of dye penetration of each slice, and mean value was calculated which was subjected to statistical analysis. Table 1 shows comparison of dye penetration between Group A and B. It was observed that Group A showed higher dye penetration as compared to Group B. The values were found to be statistically significant ($p<0.05$).

**Table 1: Comparison of Dye penetration between Group A and B**

| Material | Depth of Dye penetration (mm) | p-value |
|---|---|---|
| **Group A** | 0.4412±0.12 | 0.002 |
| **Group B** | 0.2549±0.06 | |

**Fig 1: Comparison of Dye penetration between Group A and B**



**DISCUSSION:**

In the present study, we observed that dye penetration was more significant in conventional microfilled composite material as compared to nanocomposite. The results were statistically significant. This indicates that nanocomposites are better with respect to microleakage as compared to conventional microfilled composites. The results were compared to other studies from literature and were found to be consistent. Sudhapalli SK et al compared the microleakage among newer composite materials. Forty-five extracted healthy premolars were collected; standard Class II cavities were prepared. They were randomly divided into three groups of 15 teeth each. The groups were made based on the different composite restorative materials used for restoration. Group A consisted of conventional microfilled composite resin restorations, and Group B was posterior nanocomposite resin. Group C was restored using ORMOCER – Admira. After completion of restorations, all teeth were subjected to thermocycling at 5° C, 37° C, and 55° C for 250 cycles. Later, all samples were immersed into 50% silver nitrate dye group wise for for 4 hours (h), and teeth were sectioned buccolingually. Sectioned teeth were observed under a stereomicroscope for the evaluation of microleakage. The results of this study showed that Group C (ORMOCER – Admira) presented with the least microleakage followed by Group B (Tetric N-Ceram) followed by Group A (Tetric Ceram). They concluded that overall ORMOCER – Admira performed better than the other two composite materials with the least microleakage. Somani R et al determined the microleakage of the 6 th , 7 th , and 8 th generation dentin bonding agents. Forty-five extracted human premolars were taken for the study. Standardized Class V cavities were prepared on all the teeth. The samples were divided into three groups according to the generation of bonding agent used. Group I was bonded with the 6 th generation, Group II with the 7 th generation, and Group III with the 8 th generation dentin bonding agent. All the Class V preparations were restored with a nano-ceramic composite restorative (Ceram X). The samples were then thermocycled between 5 and 55 ± 2°C for 100 cycles and immersed in 2% methylene blue for 48 h for evaluation of microleakage under a stereomicroscope. The microleakage value was the highest in Group II (7 th generation bonding agent) followed by Group I (6 th generation bonding agent) and least in Group III (8 th generation bonding agent). They concluded that the 8th generation dentin bonding showed statistically significant results in terms of lesser microleakage as compared to the 6 th and 7 th generation dentin bonding agents. [7, 8]

Patel MC et al compared marginal sealing of three different bulk-fill composite restorations of Class II cavities under in vitro conditions. Thirty human extracted pre-molars were divided into three groups of 10 each. Class II cavities were prepared and restored using Filtek Bulk Fill (Group I), Tetric N-Ceram Bulk Fill (Group II) and X-tra Fil Bulk Fill (Group III) composite materials. Depth of dye penetration along the lateral walls of each specimen was evaluated under stereomicroscope, and marginal gap was evaluated under scanning electron microscope. Stereomicroscopy showed no dye penetration in 90%, 70% and 30% of restorations in Groups I, II and III, respectively. The mean width of marginal gap (μm) was 1.691, 3.076 and 4.546 in Groups I, II and III, respectively. They concluded that Filtek Bulk Fill composite material showed least microleakage and better marginal adaptation. Hegde MN et al compared the microleakage in three different newer direct composite resins using a self-etch adhesive bonding system in class V cavities by fluorescent dye penetration technique. Class V cavities were prepared on 45 human maxillary premolar teeth. On all specimens, one coat of G-Bond (GC Japan) applied and light cured. Teeth are then equally divided into 3 groups of 15 samples each. Filtek Z350 (3M ESPE), Ceram X duo (Dentsply Asia) and Synergy D6 (Coltene/Whaledent) resin composites were placed on samples of Groups I, II and III, respectively, in increments and light cured. After polishing the restorations, the specimens were suspended in Rhodamine 6G fluorescent dye for 48 h. The teeth were then sectioned longitudinally and observed for the extent of microleakage under the florescent microscope. Results showed no statistically significant difference among three groups tested. [9,10]

**CONCLUSION:**

Microleakage is one of the factors which affects the performance of the material in the oral cavity. Within the limitations of the present study, it can be concluded that nanocomposites are better with respect to microleakage as compared to conventional microfilled composites.

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