



RESEARCH ARTICLE

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## AN IN-VITRO STUDY TO COMPARE THE MICROLEAKAGE OF THREE HYBRID COMPOSITE RESIN RESTORATIONS

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### ARTICLE INFO

#### Article History:

Received 14<sup>th</sup> September, 2019  
Received in revised form  
17<sup>th</sup> October, 2019  
Accepted 09<sup>th</sup> November, 2019  
Published online 31<sup>st</sup> December, 2019

#### Key Words:

Microleakage, Post-operative sensitivity,  
Marginal leakage, Hybrid composite,  
Class I cavity, Spectroscopy.

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### ABSTRACT

**Background:** In an effort to combine the favorable physical and mechanical properties of conventional composites with the smooth surface typical of the microfilled composites, the hybrid composites were developed. Marginal adaptation of a restoration can be assessed by measuring the amount of microleakage at the interface area, after it has undergone contraction during polymerization. **Objective:** The aim of the present in-vitro study was to compare and evaluate the microleakage in class I cavity restored with hybrid composite. **Method:** Thirty freshly extracted human premolars were used. Standardized Class I cavity was prepared and randomly divided into 3 groups with 10 teeth in each group. The teeth in Group A was restored using Spectrum (Dentsply), Group B-Charisma (Kulzer) and Group C- Hybrid, LOT-FDH07U (Unicorn DenMart) and then subjected to thermocycling; immersion in 1% methylene blue dye for 24 hours; sectioning longitudinally; evaluation of microleakage under a stereomicroscope and scoring on an ordinal scale (0-4). The results were tabulated and subjected to Kruskal- Wallis and Mann- Whitney test for statistical analysis.

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Citation: Dr. Aman Abrol, Dr. Neha Abrol, Dr. Priyadarshini Seal and Dr. Mallika. 2019. "An in-vitro study to compare the microleakage of three hybrid composite resin restorations", *International Journal of Development Research*, 09, (12), 32686-32689.

## INTRODUCTION

Adhesively bonded composites have the advantage of conserving the sound tooth structure while at the same time providing a cosmetically acceptable restoration (Mitra, 2003). Since the very first dental composites were developed, many efforts to improve their clinical performance have been undertaken (Xu, 2006). In an effort to combine the favorable physical and mechanical properties characteristics of conventional composites with the smooth surface typical of the microfill composites, the hybrid composites were developed. The presence of sub-micrometersized micro-filler particles interspersed among the larger particles provide a smooth "patina-like" surface texture in the finished restoration. Composite resins have better mechanical properties, such as compressive strength, than other restorations such as conventional or resin-modified glass ionomers, suggesting a longer clinical life in regions submitted to occlusal loads (Della Bona, 2008).

Marginal integrity is another important property of the tooth-restoration interface. Marginal leakage is clinically undetectable passage of bacteria, fluids, chemical substances between the tooth and the restoration. Marginal leakage is used as a measure by which clinicians and researchers can predict the performance of a restorative material (Alani, 1997). Microleakage can be studied by dye penetration method. Hence this study was conducted to evaluate the best hybrid composite resin material currently used in clinical practice for better clinical results and longevity. The hybrid composites that are compared are Spectrum (Dentsply), Charisma (Kulzer) and Hybrid, LOT-FDH07U (Unicorn DenMart).

**Aim:** To compare the micro-leakage using dye penetration method, of three different hybrid composite resin materials.

**Objectives:** To evaluate the micro-leakage of three hybrid composite resin materials.



Figure 1. Armamentarium

### Armamentarium

1. Air rotor handpiece (NSK)
2. Burs
3. Periodontal probe with gradings
4. Ethchant (Charisma)
5. Bonding agent
  - a. Prime & Bond NT [Dentsply]
  - b. Gluma Self Etch [Kulzer]
  - c. Adper Single Bond 3M ESPE
6. Applicator tip
7. Curing light (Woodpecker)
8. Composite materials
  - a. Charisma [Kulzer]
  - b. Spectrum [Dentsply]
  - c. Hybrid, LOT-FDH07U (Unicorn DenMart).
9. Finishing and polishing kit
10. Nail varnish
11. Methylene blue dye
12. Diamond disk
13. Cold cure resin material
14. Stereomicroscope

**Inclusion Criterion:** 30 freshly extracted intact, non-carious human premolars were included.

**Exclusion Criteria:** Teeth having developmental defects and having visible cracks or fracture were excluded from the study. 30 freshly extracted non-carious human premolars.



Figure 2. Samples for the study

- Extracted teeth were scaled to remove debris, calculus, and rinsed with sodium hypochlorite.
- Standardized class 1 preparation (acc. to Sir G.V. Black) was carried out on all teeth with an air-rotor handpiece under air/water spray.
- Standard preparation was carried out according to the following specification.
- Occlusal isthmus-width of 1/3 of distance between cusp tips.
- Depth of the cavity was kept at 2-2.5mm.

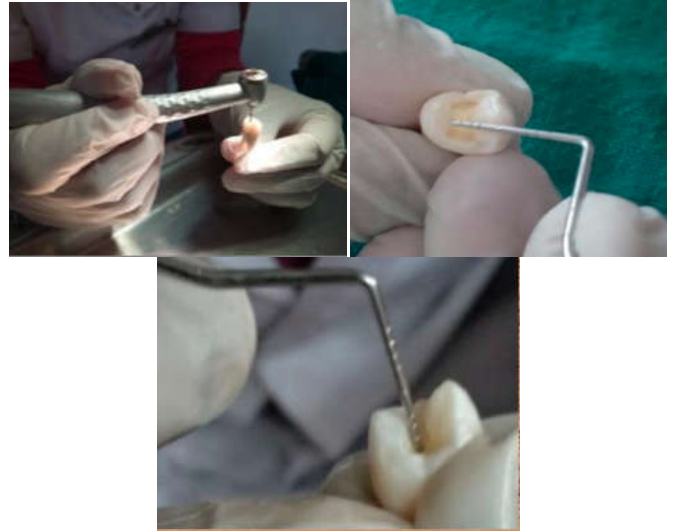


Figure 3. Cavity preparation and standardization

- Teeth were then etched for 20s using 37% phosphoric acid and then rinsed with water for 20s.
- Bonding agent was applied (according to manufacturer's instruction) and cured for 15s.

Teeth were randomly divided into three different groups

- Group A (Spectrum)
- Group B (Charisma)
- Group C (DenMart)



Figure 4. Composites used in study

Horizontal layering technique for composite was followed, with the incremental curing of each layer using the conventional curing light for 40s.

- The final layer was contoured and polished using the composite polishing kit.
- All specimen were stored at room temperature in distilled water for 24h.

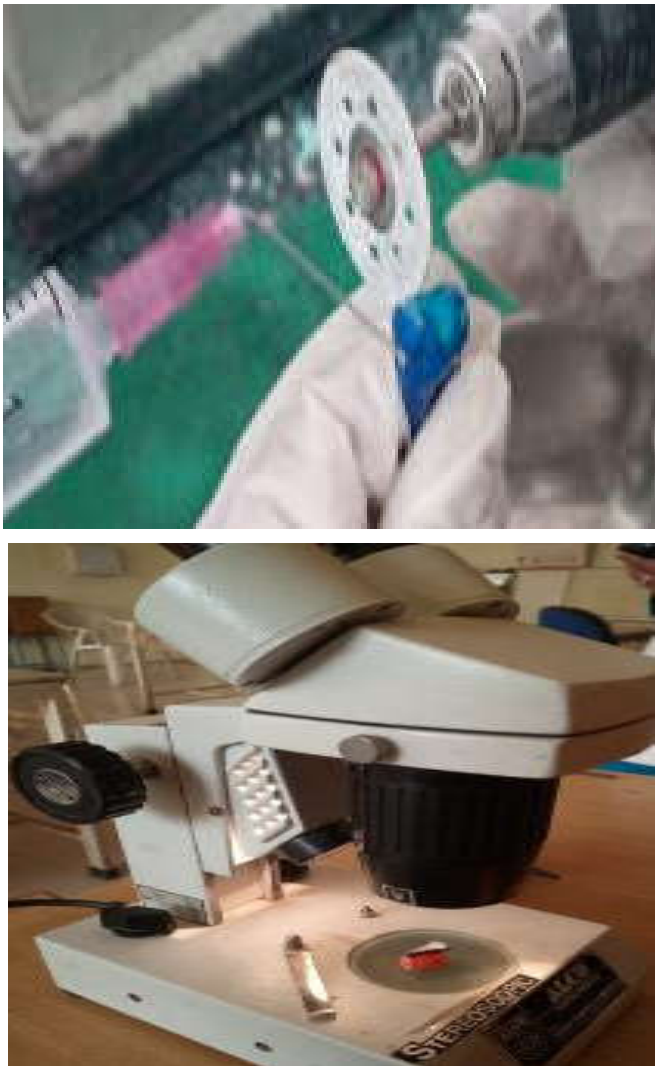


Figure 5. Microleakage method

Teeth were then subjected to thermocycling between 5°C and 55°C for 500 cycles. The dwell time in each bath and the time intervals at room temperature between baths were 20s.

Specimens for evaluating microleakage were then sealed with a coating of nail polish, except margins of 1 mm around the restorations and immersed in 2 % methylene blue dye for 24 hr.

The teeth were then washed under running water and dried

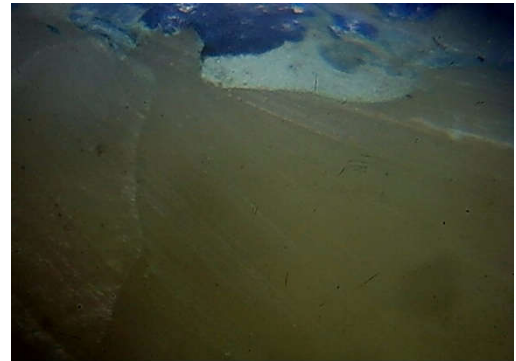
Then teeth were sectioned longitudinally in mesio-distal direction with a slow speed diamond disk under continuous water spray.

The cut surfaces were then examined under a Stereomicroscope for evaluation of marginal leakage.

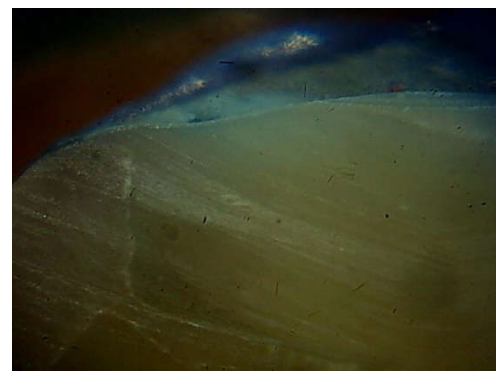
The dye penetration in the specimens was evaluated for both the occlusal and gingival surfaces based on the graded scoring system.

**RESULTS**

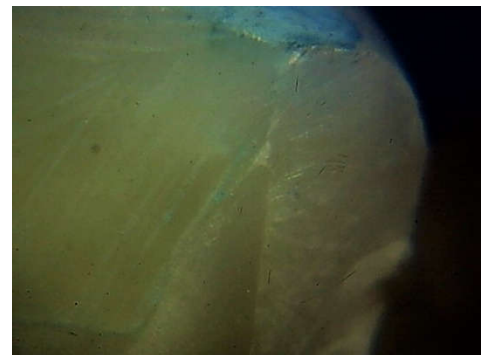
Sample- A



Sample-B

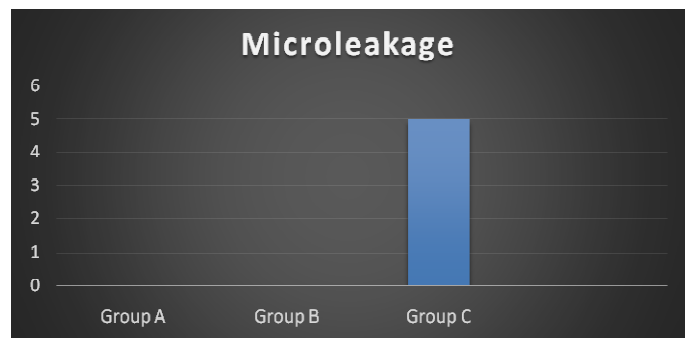


Sample-C



**Microleakage:**

- Sample A:** Score 0
- Sample B:** Score 0
- Sample C:** Score 1



## DISCUSSION

The present in vitro study was done to compare and evaluate the micro leakage of three hybrid composite material. Marginal leakage is used as a measure by which clinicians and researchers can predict the performance of a restorative material. Group A and B showed no micro leakage with zero score, which was statically significant and better than Group C. This can be explained by the fact that both Group A and B has hybrid composites which contain silanes as one of the resin components. These silane molecules react with fillers and the methacrylate group simultaneously during polymerization and act as a re-inforcement. Where as Group C lack such phenomenon. It can be concluded from the present in-vitro study that Spectrum and Charisma will be more suited in the clinical practice to restore a tooth to its strength with low post-operative sensitivity than the other material compared in the study. Further clinical trials are required to support the result of this study.

### Conclusion

Within the limitations of the present in-vitro study, it can be concluded that Hybrid, LOT-FDH07U (Unicorn DenMart) has poor marginal seal among the three composite resins used in the study.

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