



# **Comparative Evaluation of Microleakage in Premolars after Placement of Microhybrid and Nanohybrid Composite Using Snow Plow Technique**

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## **Authors' contributions**

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

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**Study Protocol**

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## **ABSTRACT**

**Background:** Microleakage is the significant reason for composite restoration failure. The type of composite material utilized should reduce polymerization shrinkage and hence avoid microleakage.

### **Objectives:**

1. To evaluate microleakage in Class I cavity using microhybrid composite in snow plow placement technique.
2. To evaluate microleakage in Class I cavity using nanohybrid composite in snow plow placement technique
3. To compare microleakage in Class I cavity with microhybrid composite and nanohybrid composite using snow plow placement technique.

**Methodology:** Prepared Class I cavities in 22 human premolars will be divided randomly into 2 groups based on the restorative material used. These cavity preparations will be restored using the snow plow technique. All the specimens will be thermocycled and stained with 50% silver nitrate solution. We will wash the specimens in the distilled water, store them in the developing solution and for 24 hours exposed to sunlight. The samples will be sectioned longitudinally from the middle

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of cavity into two parts and will be then evaluated for microleakage on the basis of silver nitrate penetration under stereomicroscope (20X). To compare the microleakage, data will be subjected to statistical analysis.

**Expected Results:** Nanohybrid composite placement using snow plow technique is expected to have less micro-leakage than microhybrid composite placement using the same technique.

**Conclusion:** If this study proves correct, this would be helpful for the clinicians to choose the most efficient restorative material with the best technique and minimal microleakage which will aid in the success of the root canal treatment.

*Keywords: Microleakage; composite; snow plow technique; nanohybrid composite.*

## 1. INTRODUCTION

Composite resin materials have gained great prominence in the field of dentistry. Increased mechanical properties and improved esthetic requirements have led to an increase in the indication and use of composite resins for not only anterior but posterior teeth also by various dental schools. Composites are currently the choice of material for the majority of the restorations but polymerization shrinkage of these is still a problem. This polymerization shrinkage is responsible for microleakage in the restoration [1,2]. Microleakage is "the passage of bacteria, fluids or molecules between a cavity wall and the restorative material applied to it". Microleakage causes increased hypersensitivity, pulpal pathoses, and recurrent caries which consequently leads to failure.

Hence, various techniques of restoration have been proposed to reduce this polymerization shrinkage. It has been seen that with the use of nanotechnology, manufacturers have produced high filled composite material [3]. Microhybrid composites show more values of linear shrinkage than highly filled nanohybrid composites, due to more monomer and less filler content. It is also suggested that layering techniques have some advantages over the bulk technique, that is, small volume use of material, has a lower "cavity configuration factor" as well as least contact with the cavity walls opposing each other, during polymerization [4-7]. The "snowplow technique" is the placement of flowable composite in a layer, on the gingival margin of the proximal box and on the pulpal floor of a composite resin restoration. This layer of composite is uncured before placement of a composite restorative material that is denser-filled. Restorative composite materials and their devices for clinical work are being developed constantly, and hence it is compulsory to evaluate the effectiveness of these systems by conducting studies [8,9]. Thus, the study's aim is to use a stereomicroscope and

evaluate the microleakage of class 1 restorations, with micro hybrid and nanohybrid composite resins using a different technique [10-12].

## 2. AIM

To compare and evaluate microleakage in Premolars after placement of Microhybrid and Nanohybrid composite using Snow Plow technique.

## 3. OBJECTIVES

1. To evaluate microleakage in Class I cavity using microhybrid composite in snow plow placement technique.
2. To evaluate microleakage in Class I cavity using nanohybrid composite in snow plow placement technique.
3. To compare microleakage in Class I cavity with microhybrid composite and nanohybrid composite using snow plow placement technique.

## 4. MATERIALS AND METHODS

### 4.1 Sample Size

The sample size was calculated using;

$\sigma$  is population Standard Deviation(SD)

$d$  is the difference to be detected..

After applying the formula calculation are as follows,

$$n = (Z \alpha + Z \beta ) ^ 2 ( \delta _ 1 ^ 2 + \delta _ 2 ^ 2 / K ) / \Delta ^ 2$$

So, by above formula sample size will be 22. Thus each group will have a sample of 11.

### 4.2 Materials

- 22 freshly extracted human premolars.
- Microhybrid composite (dentsply spectrum)

- Nanohybrid composite (3M Espe Filtek Z250 Xt)
- Flowable composite (Prevest fusion flow)
- 50% freshly prepared Silver nitrate solution. (quali-tech )
- Etchant (Prime Dental Restorite Etching Gel)
- "Bonding agent" (3M ESPE Adper single bond 2)
- Diamond discs (MANI 0.2mm thickness)

#### 4.3 Inclusion Criteria

- Sound and noncarious 1st and 2nd upper and lower premolars.
- Teeth without fracture .
- Teeth without cracks.
- Teeth without any previous restoration.

#### 4.4 Exclusion Criteria

- Carious teeth
- Previously restored teeth.
- Teeth with fractures and cracks.

#### 4.5 Method

The study will be conducted in Sharad Pawar Dental College, In Department Of Conservative Dentistry And Endodontic in extracted premolars

- 22 freshly extracted premolars will be taken.
- Class 1 cavities will be prepared on occlusal surfaces of the extracted premolars of width 4mm , and depth 1.5mm from central pit using handpiece with high speed and air water coolant, using round bur and straight bur.
- Burs will be changed after every 5 cavities prepared.
- Cavity depth will be standardized at 1.5 mm with the help of premeasured and marked #57 straight fissure burs.
- A graduated probe will be used to further confirm depth of cavity.
- Cavities will be prepared by only one operator to result in consistent depth and size of cavity. Prepared cavities will be gently dried before placement of restorative materials.
- Etching with Etchant (PRIME) will be done for 15seconds and then cavities will be rinsed with water for 10 -20seconds . After this the prepared cavities will be dried again.

- Then bonding agent(3M Espe) will be applied and then cured with light curing device for 20seconds.
- These samples will be divided randomly into two groups and restoration will be placed by using **snowplow technique**
- **SNOWPLOW TECHNIQUE:** Is a layer of uncured composite. This is flowable which is placed on the pulpal floor , followed by placement of composite in oblique incremental technique and curing each layer for 20 seconds.
- The 2 groups for composite restoration are :

GROUP 1- microhybrid composite will be placed using snowplow technique (i.e placing a layer of uncured flowable composite and then microhybrid composite will be placed in oblique incremental technique and each layer will be cured for 20 seconds)

GROUP 2- nanohybrid composite will be placed using snowplow technique.

- Finishing and polishing of the restoration will be done. All the specimens will be thermocycled to simulate with the normal oral temperature at 37 degree Celsius.
- Application of nail varnish will be done over the thermocycled specimens of tooth except 1mm round the tooth restoration interface.
- Each group of sample will then be placed in fresh preparation of 50% silver nitrate solution , of 10 ml in darkness for 2 hrs.
- The specimens will be washed in distilled water, and stored in a developing solution and then sunlight exposed for 24 hours.
- The samples will then be sectioned longitudinally from the middle of cavity into two parts and will be then evaluated for microleakage by penetration of silver nitrate under stereomicroscope (20X).
- To compare the microleakage , statistical analysis of the data will be done.

#### 4.6 Statistical Analysis

Chi square test and Unpaired T- test will be used.

#### 5. EXPECTED RESULTS

Nanohybrid composite placement using snow plow technique is expected to have less microleakage than microhybrid composite placement using the same technique.

## 6. DISCUSSION

Microleakage test is done to know about the sealing of the restoration tooth complex. Incomplete sealing of the tooth may lead to marginal staining, any kind of pulpal response, probability of recurrent caries as well a chance of postoperative sensitivity. It is necessary to minimize microleakage at tooth–restoration interface for restorations that are of larger sizes.

According to PCV Yamazaki et al. in 2006, evaluated microleakage in 60 molars using either a bulk or incremental technique. They prepared Class I cavities and distributed them in 3 simple groups on the basis of the restorative materials used. These samples were restored. One part of samples of each group was exposed to 200,000 cycles at a 50 N, the other part was stored into water for a time of 24 hours at temperature 37°C. They immersed all of the specimens in 1% of methylene blue for a time of 24 hours and then sectioned into 3 slabs. Then they checked microleakage with the use of scoring system (0-4) at 40x magnification using stereomicroscope. Microleakage was significantly reduced in incremental placement when compared bulk technique. This study compared the microleakage of a new low-shrinkage resin composite to a nanofilled composite restorative material and a hybrid resin composite. All 3 resin composite materials used in this study had some degree of leakage. All of the restorative systems had microleakage, regardless of the insertion technique and mechanical load cycling. Incremental placement significantly reduced microleakage as compared to the bulk technique, regardless of the restorative system used.

YH Bagis et al 2009 , prepared a MOD cavity in 32 third molars. Composite of Methacrylate nanohybrid type and silorane microhybrid type were filled within the cavities. The samples then had undergone 1000 cycles of 5°C/55°C in water bath for duration of 30 seconds. Then the sample teeth were dipped in 0.5% basic fuchsin dye for a temperature of 23°C for a time period of 24 hours. samples were then sectioned and examined with a stereomicroscope.. The composite restorations with nanohybrid resin depicted better results with technique of vertical layering for margins of enamel. Silorane-based material showed no leakage in enamel and dentin margins. With methacrylate-based composite, microleakage was observed in both cervical margins; therefore, different monomer

compositions may affect microleakage of wide Class II MOD restorations.

Anthony Presicci et al. created 4 groups in total. In each tooth ,Class 2 preparations were made. 40 samples were take. Composite that was flowable was put on gingival base of proximal area. A composite of restorative type was then put. A category 1:in this flowable resin (snowplow technique) followed by incremental placement of uncured composite. Category 2: uncured composite of allowable type followed by bulk-placed composite. Category 3: cured composite of allowable type is followed by composite placement incrementally .Category 4: cured composite of allowable type followed by placement of composite in bulk. This technique decreased micro leakage in incremental technique. The use of the snowplow technique significantly reduced microleakage when the composite was placed incrementally. The greatest amount of microleakage and porosity occurred when the flowable composite was cured prior to the incremental placement of the restorative composite. The minimum amount of incremental porosity formation occurred when the flowable and restorative composites were both cured together in bulk to a depth of 5 millimeters. The best combination of reduced porosity formation and microleakage occurred with Groups 1 and 4. Few of the related studies were reviewed [13-16].

## 7. CONCLUSION

If this study proves correct, this would be helpful for the clinicians to choose the most efficient restorative material with best technique and minimal microleakage which will aid in success of the root canal treatment.

## CONSENT

It is not applicable.

## ETHICAL APPROVAL

It is not applicable.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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