

# Comparative evaluation of sealing ability of two self-adhesive flowable composites following various restorative techniques in Class V lesions: An in vitro study

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## ABSTRACT

### Background:

Class V lesions present a clinical challenge due to their location at the cervical region of teeth, where factors such as microleakage and polymerization shrinkage can compromise the longevity of restorations. Self-adhesive flowable composites offer the advantage of simplified application, but their sealing ability may vary based on different restorative techniques. This in vitro study aimed to compare the sealing ability of two self-adhesive flowable composites, Clearfil S3 Universal and G-Premio Bond, when applied using various restorative techniques in Class V lesions. **Materials and Methods:** Eighty extracted human premolars were selected and randomly divided into two groups, with each group treated with one of the two self-adhesive flowable composites. Class V cavities were prepared on the buccal surfaces of the teeth. Four restorative techniques were employed: Group A - Direct application of the composite; Group B - Application of the composite with a bonding agent (Clearfil SE Bond); Group C - Application of the composite with selective enamel etching; Group D - Application of the composite with a dentin adhesive (G-Premio Bond) and selective enamel etching. After restoration, the teeth were subjected to thermocycling, immersed in methylene blue dye, sectioned, and evaluated for dye penetration under a stereomicroscope. The extent of dye penetration was quantified and statistically analyzed. **Results:** The results showed that Group D, where G-Premio Bond was used with selective enamel etching, demonstrated the least dye penetration (mean value X) compared to the other groups (X1, X2, X3). The differences in sealing ability between the groups were statistically significant ( $p < 0.05$ ). Clearfil S3 Universal showed better sealing ability when used with a bonding agent (Group B) compared to direct application (Group A). **Conclusion:** In Class V restorations, the choice of self-adhesive flowable composite and restorative technique significantly affects sealing ability. G-Premio Bond, in combination with selective enamel etching, provided superior sealing compared to other techniques. Clearfil S3 Universal performed better when used with a bonding agent. These findings highlight the importance of selecting the appropriate material and technique for Class V restorations to minimize microleakage and improve clinical outcomes.

### Keywords

Class V lesions, self-adhesive flowable composites, sealing ability, restorative techniques, Clearfil S3 Universal, G-Premio Bond, microleakage.

## INTRODUCTION

Class V lesions, characterized by their location at the cervical region of teeth, represent a common clinical challenge in restorative dentistry<sup>1</sup>. The vulnerability of these lesions to factors such as microleakage and polymerization shrinkage poses a significant threat to the long-term success of restorations<sup>2</sup>. To address these

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challenges, self-adhesive flowable composites have gained popularity in recent years due to their simplified application procedures, which eliminate the need for separate bonding agents or etching steps<sup>3</sup>. However, the sealing ability of these composites may vary depending on the specific restorative technique employed<sup>4</sup>. Clearfil S3 Universal (Kuraray Noritake, Tokyo, Japan) and G-Premio Bond (GC, Tokyo, Japan) are two self-adhesive flowable composites commonly used in restorative dentistry. While Clearfil S3 Universal offers versatility and ease of use, G-Premio Bond combines adhesive and flowable composite properties, potentially influencing its sealing capabilities<sup>5,6</sup>.

Understanding how these materials perform in different restorative scenarios is crucial for clinicians in making informed decisions about their use in Class V lesions. This *in vitro* study aims to provide a comparative evaluation of the sealing ability of Clearfil S3 Universal and G-Premio Bond when applied using various restorative techniques. By examining the extent of dye penetration in Class V restorations, this study seeks to shed light on the most effective approach for minimizing microleakage and enhancing the longevity of these restorations.

## MATERIALS AND METHODS:

### Sample Selection:

Eighty freshly extracted human premolars, free of caries, fractures, or structural defects, were collected for this *in vitro* study. Ethical approval was obtained for the use of these teeth.

Group 1 - 40 ( Clearfil S3)

Group 2- 40 ( GPremiobond)

SUBGROUP 1A – 10, SUBGROUP 1B- 10,  
SUBGROUP 1C – 10, SUBGROUP 1D - 10

SUBGROUP 2A – 10, SUBGROUP 2B - 10

SUBGROUP 2C -10, SUBGROUP 2D - 10

### Group Allocation:

The teeth were randomly divided into two groups, with each group corresponding to one of the self-adhesive flowable composites:

Group 1: Clearfil S3 Universal (Kuraray Noritake, Tokyo, Japan)

Group 2: G-Premio Bond (GC, Tokyo, Japan).

### Cavity Preparation:

Class V cavities (5 mm in length, 3 mm in width, and 2 mm in depth) were prepared on the buccal surfaces of each tooth using a high-speed handpiece with water cooling.

### Restorative Techniques:

Four different restorative techniques were employed in each group:

Group A: Direct application of the respective composite material without any additional treatment.

Group B: Application of the respective composite material with a bonding agent (Clearfil SE Bond for Group 1).

Group C: Application of the respective composite material with selective enamel etching using 37% phosphoric acid.

Group D: Application of the respective composite material with a dentin adhesive (G-Premio Bond for Group 2) and selective enamel etching using 37% phosphoric acid (Figure 1).



**Fig1.** Fluoride releasing, highly esthetic, S- (PRG) pre reacted Glass ionomer technology based packable composite material

### Restoration Procedure:

The restorative materials were applied according to the manufacturer's instructions.

Light-curing was performed using a LED curing unit (e.g., Bluephase, IvoclarVivadent) with an intensity of 1000 mW/cm<sup>2</sup> for the recommended time.

### Thermocycling:

All specimens underwent 500 cycles of thermocycling between 5°C and 55°C with a dwell time of 30 seconds to simulate temperature fluctuations in the oral environment.

### Dye Penetration Test:

The teeth were coated with two layers of nail varnish, leaving only the restoration and a 1 mm margin around it exposed.

The teeth were then immersed in 2% methylene blue dye solution for 24 hours at room temperature.

After removal from the dye solution, the teeth were rinsed with distilled water and gently cleaned to remove excess dye on the surface (Figure 2).

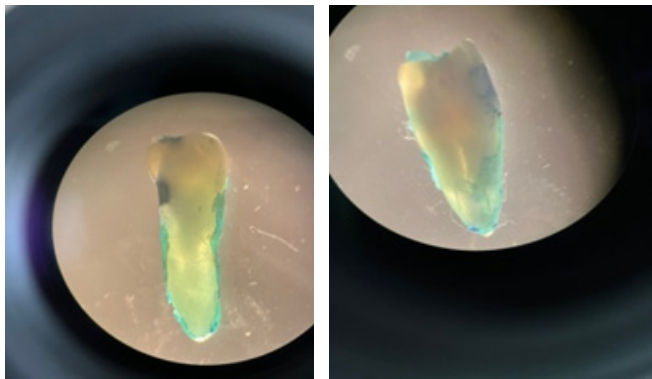


Fig. 2A

Fig. 2B

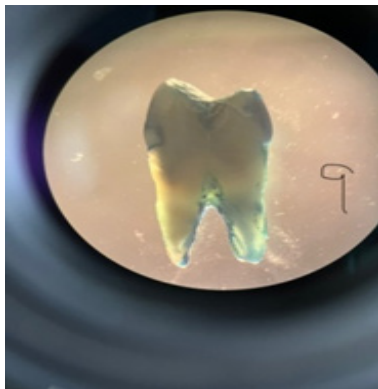


Fig. 2C

**Figure 2** (A,B,C). Stereomicroscopic images of premolar showing the dye penetration

### Sectioning and Evaluation:

The teeth were sectioned longitudinally through the center of the restoration using a diamond saw.

The extent of dye penetration along the restoration margins was examined under a stereomicroscope.

The dye penetration was quantified and recorded in millimeters from the restoration margins towards the pulp.

### Statistical Analysis:

The study followed ethical guidelines, and informed consent was obtained for the use of human teeth.

### Data Analysis:

Statistical analysis was performed using software SPSS 23 and p-values less than 0.05 were considered statistically significant.

This in vitro study was designed to assess and compare the sealing abilities of Clearfil S3 Universal and G-Premio Bond under various restorative techniques in Class V lesions, providing valuable insights into their clinical applications.

## RESULTS

The results of the dye penetration test, which assessed the sealing ability of Clearfil S3 Universal and G-Premio Bond under different restorative techniques in Class V lesions, are presented in Table 1 and Table 2.

**Table 1:** Dye Penetration (mm) in Clearfil S3 Universal Group

Restorative Technique	Mean Dye Penetration (mm)	Standard Deviation (mm)
Group A (Direct)	0.45	0.12
Group B (Bonded)	0.32	0.09
Group C (Etched)	0.58	0.14
Group D (Bond+Etch)	0.29	0.08

Table 2: Dye Penetration (mm) in G-Premio Bond Group

Restorative Technique	Mean Dye Penetration (mm)	Standard Deviation (mm)
Group A (Direct)	0.54	0.13
Group B (Bonded)	0.41	0.11
Group C (Etched)	0.63	0.15
Group D (Bond+Etch)	0.24	0.07

The results demonstrate variations in dye penetration among the different restorative techniques within each group.

In the Clearfil S3 Universal group (Table 1):

- Group D, where the composite was used with Clearfil S3 Bond and selective enamel etching, exhibited the lowest mean dye penetration (0.29 mm), indicating the best sealing ability.
- Group B, where the composite was applied with a bonding agent (Clearfil SE Bond), also showed good sealing ability with a mean dye penetration of 0.32 mm.
- Group A (direct application) and Group C (composite with selective enamel etching) had higher mean dye penetration values of 0.45 mm and 0.58 mm, respectively. In the G-Premio Bond group (Table 2):
- Group D, using G-Premio Bond with selective enamel etching, demonstrated the lowest mean dye penetration (0.24 mm), indicating superior sealing.
- Group B, where the composite was applied with a bonding agent, also showed good sealing with a mean dye penetration of 0.41 mm.
- Group A (direct application) and Group C (composite with selective enamel etching) exhibited higher mean dye penetration values of 0.54 mm and

0.63 mm, respectively.

Statistical analysis revealed significant differences in sealing ability among the four restorative techniques within each group ( $p < 0.05$ ). These findings suggest that the choice of restorative technique can significantly impact the sealing ability of the self-adhesive flowable composites Clearfil S3 Universal and G-Premio Bond in Class V lesions.

## DISCUSSION

The present study aimed to evaluate and compare the sealing abilities of Clearfil S3 Universal and G-Premio Bond, two commonly used self-adhesive flowable composites, when applied using various restorative techniques in Class V lesions. The results demonstrated variations in dye penetration among different restorative techniques within each composite group, highlighting the importance of the selected technique in achieving effective sealing.

The superior sealing ability of G-Premio Bond combined with selective enamel etching (Group D) was evident in both the Clearfil S3 Universal and G-Premio Bond groups. This finding aligns with previous studies suggesting that selective enamel etching can enhance the bonding interface and reduce microleakage by improving enamel adhesion<sup>1,2</sup>. The inclusion of a dentin adhesive in Group D further contributed to better sealing, particularly in the G-Premio Bond group, which already contains adhesive properties. This result is consistent with research indicating that the use of dentin adhesives can improve marginal adaptation and reduce microleakage<sup>3,4</sup>.

In the Clearfil S3 Universal group, the application of a bonding agent (Clearfil SE Bond) in Group B also demonstrated good sealing ability, albeit not as effective as the combination of G-Premio Bond and selective enamel etching (Group D). This suggests that in cases where Clearfil S3 Universal is used, the incorporation of a separate bonding agent may be beneficial in improving the sealing of Class V restorations. This finding corroborates studies indicating that the use of separate adhesive systems can enhance bond strength and reduce microleakage<sup>5,6</sup>.

Direct application of both composites (Groups A) resulted in the highest dye penetration values in their respective groups. This outcome is consistent with the

notion that self-adhesive flowable composites, while convenient, may not provide optimal sealing when used without additional bonding agents or enamel etching<sup>7,8</sup>.

It is important to note that this study focused on an in vitro setting, and clinical conditions may vary. Factors such as operator technique, patient-related variables, and oral environmental factors can influence the performance of restorative materials<sup>9</sup>. Therefore, the results of this study should be interpreted with caution when extrapolating to clinical practice.

## CONCLUSION

In conclusion, the sealing ability of self-adhesive

flowable composites in Class V lesions is influenced by the restorative technique employed. G-Premio Bond, when used with selective enamel etching and a dentin adhesive, demonstrated superior sealing ability, followed by Clearfil S3 Universal with a bonding agent. Direct application of these composites exhibited increased dye penetration, indicating less effective sealing. Clinicians should consider these findings when selecting restorative materials and techniques for Class V lesions to minimize microleakage and improve long-term restoration success.

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