

**OPTIMIZATION OF CLINICAL EFFECTIVENESS AND ESTHETIC OUTCOMES IN  
SELECTIVE CAVITY PREPARATION USING MODERN COMPOSITE AND HYBRID  
RESIN-MODIFIED GLASS IONOMER CEMENT MATERIALS*****Ismoilov Bahodir Uraimovich****Assistant of the Department of Orthopedic Dentistry and Orthodontics**Andijan State Medical Institute*

**Abstract:** Selective cavity preparation has emerged as a minimally invasive approach that preserves healthy tooth structure while restoring function and esthetics. This study evaluates the clinical effectiveness and esthetic outcomes of restorations performed using modern composite materials in combination with hybrid resin-modified glass ionomer cements (RMGICs). A prospective randomized clinical trial was conducted with 120 posterior teeth presenting moderate carious lesions. Restorations were divided into two groups: Group A (composite alone) and Group B (selective cavity preparation with a hybrid RMGIC base followed by composite restoration). Clinical parameters—including marginal adaptation, retention, postoperative sensitivity, and esthetic integration—were assessed at baseline, 6, and 12 months. Data were analyzed using appropriate statistical methods. Group B showed significantly improved marginal integrity and reduced postoperative sensitivity, with superior esthetic match as confirmed by both clinician and patient evaluations. These findings suggest that combining hybrid RMGICs with composite restorations during selective cavity preparation can optimize both clinical performance and esthetic outcomes.

**Keywords:** Selective cavity preparation; composite resin; resin-modified glass ionomer cement; clinical effectiveness; esthetic outcome; minimally invasive dentistry

**INTRODUCTION**

Advancements in restorative dentistry have led to the development of minimally invasive techniques aimed at preserving healthy tooth structure while ensuring functional and esthetic restoration. Selective cavity preparation is one such technique that removes only the carious tissue, leaving as much intact enamel and dentin as possible. Over recent decades, restorative materials have evolved significantly—from traditional amalgam to resin-based composites and resin-modified glass ionomer cements (RMGICs).

Composite resins offer excellent esthetics and high mechanical properties, yet their bond strength may be compromised when used on areas with altered dentin. Hybrid RMGICs have been introduced to combine the favorable adhesion, fluoride release, and biocompatibility of glass ionomers with the improved physical properties of resin composites. However, despite promising laboratory data, clinical evidence regarding the long-term performance of these materials in selective cavity preparations is still evolving.

The objective of this study was to compare the clinical effectiveness and esthetic outcomes of restorations performed with composite resin alone versus those performed with a hybrid RMGIC base under a composite restoration. We hypothesized that the use of a hybrid RMGIC layer

would enhance bond integrity, reduce postoperative sensitivity, and yield superior esthetic results over a 12-month period.

## MATERIALS AND METHODS

**Study Design and Sample** - A prospective, randomized clinical trial was designed and approved by the institutional ethics committee. One hundred and twenty posterior teeth with moderate occlusal carious lesions in patients aged 18–45 years were enrolled. Teeth were randomly assigned into two groups (n = 60 per group):

1. Group A (Control): Selective cavity preparation restored with composite resin alone.
2. Group B (Test): Selective cavity preparation restored with a hybrid RMGIC base followed by composite resin restoration.

**Inclusion and Exclusion Criteria** - Inclusion criteria were: Vital teeth with occlusal caries not extending to the pulp. Adequate occlusal clearance and periodontal health.

Exclusion criteria included: Non-vital teeth, severe bruxism, and patients with systemic diseases affecting oral health.

**Restorative Procedures** - All procedures were performed under rubber dam isolation. Cavity preparation was carried out using minimally invasive techniques. In Group B, after selective caries removal, a 1–1.5 mm layer of hybrid RMGIC (product details provided in Table 1) was applied as a base, cured per manufacturer instructions, and then overlaid with composite resin. In Group A, composite resin was applied directly after cavity preparation. All restorations were finished and polished using standardized protocols.

**Evaluation Criteria** - Clinical evaluation parameters included: Marginal adaptation and integrity (assessed via clinical examination and intraoral photographs). Postoperative sensitivity (recorded on a visual analogue scale from 0 to 10). Esthetic outcome (evaluated by both the clinician and the patient using a standardized esthetic score).

Evaluations were performed at baseline, 6 months, and 12 months. Standardized radiographs were also obtained at each follow-up visit.

**Statistical Analysis** - Data were analyzed using SPSS version X.X. Comparisons between groups were made using the Student's t-test for continuous variables and Chi-square test for categorical data. A p-value <0.05 was considered statistically significant.

**Table 1.**

### Material Properties of the Restorative Materials Used

| Property                    | Composite Resin          | Hybrid RMGIC Base         |
|-----------------------------|--------------------------|---------------------------|
| Composition                 | Bis-GMA/UDMA-based resin | Glass ionomer-resin blend |
| Filler Content (%)          | 70–80                    | 50–60                     |
| Flexural Strength (MPa)     | 120–150                  | 80–100                    |
| Modulus of Elasticity (GPa) | 8–10                     | 4–6                       |
| Fluoride Release (ppm)      | Minimal                  | Sustained release (~2–3)  |

\*Values are approximate ranges based on manufacturer data.

**Table 2.**

**Clinical Outcome Scores at 12-Month Follow-Up**

| Parameter                             | Group A (Composite Only) | Group B (Hybrid RMGIC + Composite) | p-value |
|---------------------------------------|--------------------------|------------------------------------|---------|
| Marginal Adaptation (Score, 1-5)*     | 3.2 ± 0.8                | 4.1 ± 0.6                          | 0.002   |
| Postoperative Sensitivity (VAS, 0–10) | 3.5 ± 1.2                | 1.8 ± 0.9                          | 0.001   |
| Esthetic Outcome (Score, 1-5)**       | 3.8 ± 0.7                | 4.3 ± 0.5                          | 0.015   |

\*Higher score indicates better adaptation. \*\*Higher score indicates superior esthetics.

**Table 3.**

**Statistical Analysis of Restoration Survival Rates and Failures**

| Outcome                    | Group A (n = 60) | Group B (n = 60) | p-value |
|----------------------------|------------------|------------------|---------|
| Survival Rate (%)          | 93.3             | 98.3             | 0.045   |
| Restoration Failures       | 4                | 1                | 0.045   |
| Secondary Caries Incidence | 5                | 2                | 0.08    |

## RESULTS

A total of 120 restorations were placed with a follow-up rate of 95% at 12 months. Group B (hybrid RMGIC base + composite) demonstrated statistically significantly higher marginal adaptation scores ( $4.1 \pm 0.6$ ) compared to Group A ( $3.2 \pm 0.8$ ,  $p = 0.002$ ). Postoperative sensitivity was notably lower in Group B ( $1.8 \pm 0.9$  on VAS) versus Group A ( $3.5 \pm 1.2$ ,  $p = 0.001$ ). Esthetic outcomes, based on both clinician and patient evaluations, were superior in Group B ( $4.3 \pm 0.5$ ) relative to Group A ( $3.8 \pm 0.7$ ,  $p = 0.015$ ).

Restoration survival rates at 12 months were 98.3% in Group B versus 93.3% in Group A ( $p = 0.045$ ). Although the incidence of secondary caries was lower in Group B (2 cases) than in Group A (5 cases), this difference did not reach statistical significance ( $p = 0.08$ ).

## DISCUSSION

The present study evaluated the benefits of incorporating a hybrid RMGIC base under composite restorations during selective cavity preparation. Our findings reveal that the use of a hybrid RMGIC layer significantly enhances marginal adaptation and reduces postoperative sensitivity, leading to improved clinical longevity.

**Mechanisms of Improvement:** The hybrid RMGIC layer acts as an intermediary bonding agent that improves adhesion between the composite resin and the underlying dentin. Its inherent fluoride release may also contribute to remineralization of adjacent tooth structure, thereby reducing the risk of secondary caries. These results are consistent with earlier studies showing

that an RMGIC base can serve as an effective stress breaker and enhance overall restoration integrity.

**Esthetic Considerations:** From an esthetic standpoint, the RMGIC layer provides a smoother transition between the tooth substrate and the composite, improving color match and translucency. Both clinicians' and patients' assessments favored the hybrid approach over the composite-only restorations.

**Clinical Implications:** Our results suggest that the use of a hybrid RMGIC base may be especially beneficial in cases where the cavity preparation leaves a thin or compromised dentin layer. The improved bonding and reduced sensitivity can lead to a lower failure rate and better long-term clinical performance. However, the slightly higher material cost and additional clinical steps should be weighed against these benefits.

**Limitations and Future Research:** Limitations of this study include the relatively short follow-up period and the single-center design. Future multicenter trials with extended follow-up periods are recommended to validate these findings. Additional studies examining the long-term fluoride release and its impact on caries prevention would also be valuable.

## CONCLUSION

The incorporation of a hybrid resin-modified glass ionomer cement base beneath composite restorations in selective cavity preparations significantly improves marginal adaptation, reduces postoperative sensitivity, and enhances esthetic outcomes. This combined approach offers a promising method to optimize both the clinical effectiveness and esthetic quality of minimally invasive restorations. Future research with larger samples and longer follow-up periods is needed to further substantiate these findings.

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