*Original Article*

# AN EXPERIMENT ON THREE DIFFERENT RESTORATIVE MATERIALS IN THE MANAGEMENT OF CLASS V NON-CARIOUS CERVICAL LESIONS

***Khodeza Akhtar [1], Md. Ali Asgor Moral [2], Abu Rushd Mohammad Mashrur [3], Farhana Hoque Chowdhury [4], Sumaya Siraj [5]***

## ABSTRACT

**Background:** To obtain the best performance in management of non-carious cervical lesion, many restorative materials and technique have tried. The success of the treatment depends on the materials which should be identical to natural tooth structure, adhesive, abrasion resistance, good marginal integrity with excellent surface texture. **Hypothesis:** The clinical application and performance of Giomer is superior to Flowable composite and Resin modified glass ionomer cements (RMGIC) in the management of class V non-carious cervical lesions. **Objectives:** Evaluation of the clinical performance of Giomer, Flowable Composite and Resin Modified Glass Ionomer Cements (RMGIC)in the management of class V non-carious cervical lesions.

**Methods:** An experimental was done among thirty-two healthy adult having at least three non-carious cervical lesions on buccal surface (size 1-2mm) of teeth were selected for the study. The method of sampling was simple random sampling by lottery method. After clinical evaluation, 150 teeth were selected. These 150 samples were divided equally into three groups. Group 1: Giomer, Group 2: Flowable Composite and Group 3: Resin Modified Glass Ionomer Cement. Restoration was assessed by Modified Ryge's Criteria by means of retention, color matching, marginal integrity and surface texture. Patients were recalled after 3, 6, and 12 months for follow up observation. Statistical analysis was performed by one way ANOVA and Tukey's post hoc test, where p value < 0.05 was considered as statistically significant.

**Results:** The result of this study showed that at 12 months follow up, the retention was 48(93.8%), 43(87.5%) and 43(91.5%) for Giomer, Flowable Composite and RMGIC, respectively. There were no statistically significant differences among the retention ability of these materials. Regarding color matching, Giomer and Flowable composite were more color stable than RMGIC ($p< 0.05$) where statistically significant difference were observed. The marginal integrity of Giomer was also significantly better than RMGIC ($p <0.05$). Further more polished enamel surface texture was achieved in 35 (77.8%) Giomer, 32 (76.2%) Flowable composite and 14 (32.6%) RMGIC at 12 months observation ($p<0.05$).

**Conclusion:** It can be concluded that Giomer is more effective than the Flowable composite and RMGIC in respect to surface finish, color stability and marginal integrity.

**JOPSOM 2025; 44(2): 31-39**
**DOI: https://doi.org/10.3329/jopsom.v44i2.89222**

**Key words:** Restorative Materials, Giomer, Flowable composite, Resin Modified Glass Ionomer Cement, Class V Non-Carious Cervical Lesions

---

1. *Khodeza Akhtar, Assistant Professor, Conservative Dentistry and Endodontics, Dental Unit, Chittagong Medical College. Ph-01718004852, E-mail-dr.rikta@yahoo.com*
2. *Md. Ali Asgor Moral, Ex Dean, Dental Faculty, Ex Chairman, Conservative Dentistry and Endodontics, BMU, Dhaka, Ph-01819247363, E-mail-aliasgormoral@gmail.com*
3. *Abu Rushd Mohammad Mashrur, Associate Professor, Conservative Dentistry and Endodontics, Dental Unit, Chittagong Medical College. Ph-01711389465, E-mail-imashrur@hotmail.com*
4. *Farhana Hoque Chowdhury, Associate Professor, Conservative Dentistry and Endodontics, Dental Unit, Chittagong Medical College. Ph-01818398298, E-mail-Fhchy31@gmail.com*
5. *Sumaya Siraj, Lecturer, Dental Jurist, law & ethics, Dental Unit, Chittagong Medical College. Ph-01630574322, E-mail-Sumauasiraj1@gmail.com*

***Correspondence**: Dr. Khodeza Akhtar, Assistant Professor, Conservative Dentistry and Endodontics, Dental Unit, Chittagong Medical College. Ph-01718004852, E-mail-dr.rikta@yahoo.com*

## INTRODUCTION

Class V lesions are those occurring at the cervical aspect of the buccal or lingual surfaces of teeth. A non–carious cervical lesion is defined as the loss of tooth structure at the cemento-enamel junction that is nonrelated to dental caries[1]. The non-carious cervical lesions are further categorized into abrasion, erosion and abfraction[2]. There can be many causes of this condition, including bruxism, clenching, disease, dietary factors, habits and lifestyle, improper tooth brushing, abrasive dentifrices, the craniofacial complex, iatrogenic dentistry, and aging[3]. The decision to treat a cervical lesion should be based on careful consideration of the etiology, the patient's complaints and the extension and depth of the defect. Several preventive and restorative treatment modalities, such as occlusal adjustment, tooth brushing instructions, dietary advice, application of desensitization products and restorative procedures, have been proposed for non-carious cervical lesions[4].

Conventional glass ionomers, resin-modified glass ionomers, compomers and several types of resin composites have been used for cervical restorations. Glass ionomers have been used due to their ease of use, adhesion to tooth substance and release of fluoride. The disadvantages of these materials include sensitivity to moisture, low wear resistance and fracture toughness and poor esthetic properties. Recent years, compomers and resin composites have become popular alternatives to conventional glass ionomer cements for the restoration of cervical lesions, based on their satisfactory esthetic properties and high wear resistance[5].

Resin-modified glass ionomer cements (RMGICs) are hybrid restorative materials that combine the properties of conventional glass ionomers and resin composites. They are commonly used in Class V cavities and in the management of rampant caries. RMGICs offer several advantages, including extended working time, controlled setting, good marginal adaptation, and chemical adhesion to enamel and dentin. They also provide fluoride release, improved esthetics, reduced interfacial shrinkage stress, and enhanced mechanical strength.

However, limitations include relatively low wear resistance, reduced fracture toughness, polymerization shrinkage, and potential intrinsic color changes over time. Clinically, the overall success rate of Class V restorations was 72.9% after 2.5–3.5 years of follow-up. RMGIC (Fuji II LC) restorations demonstrated significantly higher success compared to conventional GIC (Fuji IX) ($p = 0.0104$), with better retention ($p = 0.0034$) and color match ($p = 0.0023$)[6].

Flowable composites are low-viscosity restorative materials with particle sizes and distributions comparable to hybrid composites but with reduced filler content. The increased resin matrix lowers viscosity, enhancing handling and adaptability. However, the lower filler loading results in reduced wear resistance in stress-bearing areas, increased polymerization shrinkage, and challenges in achieving a smooth surface finish. These limitations may affect their long-term clinical performance in load-bearing restorations[7].

Recent advancements in restorative dentistry have led to the development of novel materials for managing cervical lesions. Giomers represent one such category, based on pre-reacted glass (PRG) filler technology, in which pre-reacted glass particles are incorporated into a resin matrix. PRG fillers are produced through an acid–base reaction between fluoride-containing glass and polyacrylic acid in the presence of water, forming a wet siliceous hydrogel. This technology is classified into full pre-reacted glass (FPRG) and surface pre-reacted glass (SPRG). In FPRG, the entire glass particle undergoes reaction, whereas in SPRG only the surface reacts, preserving an unreacted glass core. Giomers demonstrate improved handling characteristics, enhanced esthetics, superior shade matching, and excellent polishability, while maintaining fluoride release, anti-plaque properties, and adequate mechanical strength and durability[8].

This study aims to inform the selection of restorative materials for Class V non-carious cervical lesions (NCCLs) and to determine the proportion of dentists who consider lesion etiology prior to treatment, thereby guiding future research. The study hypothesizes that giomer demonstrates superior clinical performance compared to flowable composites and resin-modified glass ionomer cements (RMGICs) in the management of NCCLs. Accordingly, the primary objective of this study is to evaluate and compare the clinical performance of giomer, flowable composite, and RMGIC materials in restoring Class V non-carious cervical lesions under clinical conditions.

## METHODS

A experimental study was conducted in the Department of Conservative Dentistry and Endodontics, Faculty of Dentistry, Bangaladesh Medical University, Dhaka, over a period of 18 months. The study included 150 teeth as the study population. Eligible participants were adults aged 30–50 years presenting with at least three non-carious

https://doi.org/10.3329/jopsom.v44i2. 89222

cervical lesions (1–2 mm) on the buccal surfaces, with intact occlusion, proximal contact, and good oral hygiene. Exclusion criteria comprised immunocompromised status, poor oral hygiene, gingivitis or periodontitis, parafunctional habits (e.g., bruxism), fractured, carious, or discolored teeth, and occlusal disharmony. Participants were selected using simple random sampling through a lottery method.

**Sample Size:** It was calculated by

$$n = \frac{\left\{\mu\sqrt{\left[\pi_1(1-\pi_1)+\pi_0(1-\pi_0)\right]}+\nu\sqrt{\left[2\bar{\pi}(1-\bar{\pi})\right]}\right\}^2}{(\pi_0-\pi_1)^2}$$ [9]

The sample size was calculated using a standard formula for comparing two proportions. Here, *n* denotes the required sample size per group; *u* represents the standard normal deviate corresponding to the desired power (Zβ = 0.842 for 80% power), and *v* represents the standard normal deviate corresponding to the level of significance (Zα = 1.96 for a 5% significance level). The expected proportions were assumed as $\pi_0 = 0.558$ and $\pi_1 = 0.82$. Based on these assumptions, the calculated sample size was 45.33 per group. This was rounded up to 50 participants per group to ensure adequate precision. Considering the possibility of loss to follow-up, a total sample size of 150 participants (50 in each of the three groups) was finally included in the study, maintaining 80% power at a 5% level of significance.

**Study Materials**

The materials used in this study included:

- Giomer (Beautifil Injectable)
- Flowable composite (Filtek Flow)
- Resin-modified glass ionomer cement (Fuji II LC)
- Adhesive system (BeautiBond)
- Dentin conditioner

**Randomization and Study Procedure**

This study was conducted in the Department of Conservative Dentistry and Endodontics at Bangladesh Sheikh Mujib Medical University (BMU), following approval from the Institutional Ethical Review Committee (Ref: BSMMU/2014/3722).

A total of 150 teeth were selected from 32 subjects who presented with at least three non-carious cervical lesions (NCCLs) on the buccal surfaces. The included lesions had a depth ranging from 1–2 mm and were morphologically classified as either saucer-shaped or V-shaped. The minimum required sample size was calculated to be 45 per group. To compensate for potential loss to follow-up, the sample size was increased to 50 per group, resulting in a total of 150 samples.

**Randomization Technique**

Simple random sampling was employed using the lottery method to assign restorative materials to the selected teeth. Each lesion was randomly allocated to one of the three study groups:

- **Group I:** Giomer
- **Group II:** Flowable composite
- **Group III:** Resin-modified glass ionomer cement (RMGIC)

**Clinical Procedure**

The study protocol consisted of three phases: pre-restorative, restorative, and post-restorative procedures.

*Pre-restorative Phase*

A detailed history was obtained, including dietary habits and oral hygiene practices. A comprehensive clinical examination of the teeth was performed. All participants underwent oral prophylaxis within two weeks prior to the placement of restorations.

*Restorative Phase*

Restorations were placed according to standard clinical protocols using the assigned materials.

*Post-restorative Phase and Follow-up*

Clinical evaluations were conducted at baseline (immediately after finishing and polishing), and at 3, 6, and 12 months post-restoration.

**Outcome Assessment**[10]

All restorations were evaluated using a dental mirror and probe by two independent evaluators who were blinded to the type of restorative material used.

The clinical performance of restorations was assessed using the Modified United States Public Health Service (USPHS) Ryge criteria as described by Barnes et al. (1995). The scoring system was defined as follows:

- **Alpha (A):** Restoration fully intact
- **Bravo (B):** Restoration partially intact
- **Charlie (C):** Restoration completely missing

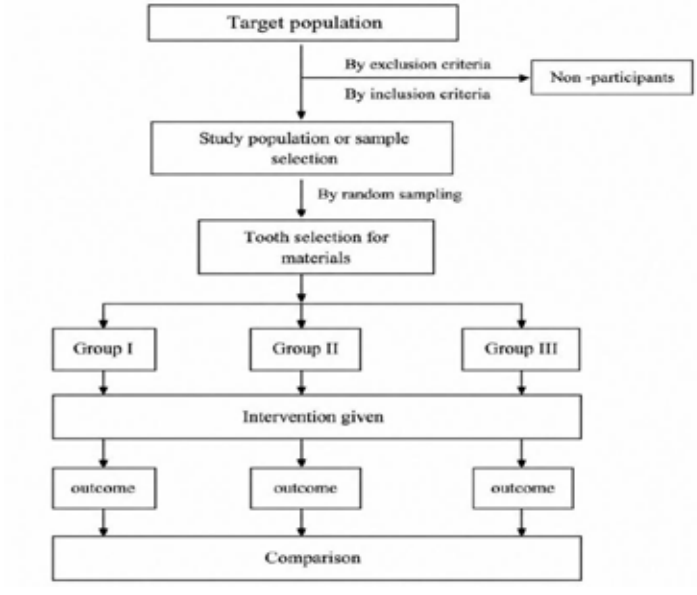
https://doi.org/10.3329/jopsom.v44i2.89222

**Table 1: Modified Ryge's criteria for clinical evaluation[10]**

| Modified Ryge's criteria for clinical evaluation Criteria | Test procedure | Rating | Ryge Criteria |
|---|---|---|---|
| Retention | Visual inspection with mirror | Alpha (A)<br>Bravo (B)<br>Charlie (C) | Restoration is fully intact<br>Restoration is partially intact<br>Restoration is completely missing |
| Color Match | Visual inspection with mirror | Alpha (A)<br>Bravo (B)<br>Charlie (C) | Matches the adjacent tooth structure in color, shade and translucency.<br>Light mismatches in color, shade and translucency between the restoration and adjacent teeth.<br>Mismatches in color, shade and translucency is outside the acceptable range of the tooth color and translucency. |
| Marginal integrity | Visual inspection with mirror and explorer | Alpha (A)<br>Bravo (B)<br>Charlie (C) | No visual evidence of a crevice along the margin and explorer does not catch<br>Visual evidence of a crevice along the margin into which the explorer will penetrate.<br>The explorer penetrates crevice detect extended to the dentino-enamel junction |
| Surface Texture | Visual inspection with mirror and explorer | Alpha (A)<br>Bravo (B)<br>Charlie (C) | Similar to polished enamel<br>Gritty or similar to a surface subjects to a white or similar to a composite containing or supramicron-sized particles.<br>Surface pitting is sufficiently coarse to inhibit the continuous movement of an explorer across the surface |

**Statistical analysis:** After completion, the data was presented in the form of tables, figures, and graphs as necessary and statistical analysis of the results was done by using computer based statistical software, SPSS 20.00 version (SPSS Inc. USA). The result was expressed as mean ± SD (standard deviation). One way ANOVA test was done to compare among the groups. Tukey's post hoc test was done for comparison between the groups. 95% confidence level (p value<0.05) was followed for testing level of significance.

**Basic design of the study: (Flow chart)**



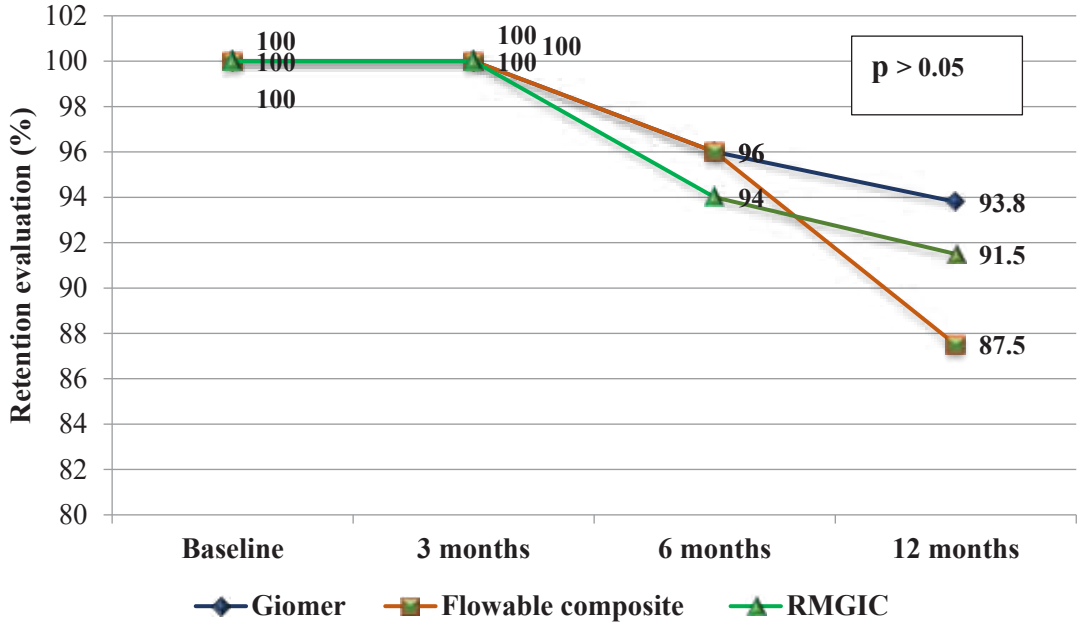

https://doi.org/10.3329/jopsom.v44i2. 89222

## RESULTS

### Retention status:

The retention outcomes are summarized in figure 1. At baseline and the 3-month follow-up, all restorations in the three groups remained intact (100%). Among the materials, giomer demonstrated the highest retention over the observation period. At 12 months, 45 restorations (93.8%) remained intact, while 3 restorations (6.2%) were lost. For the flowable composite group, 42 restorations (87.5%) were intact at 12 months, with 2 restorations (4%) lost at 6 months and 6 restorations (12.5%) lost at 12 months. In the RMGIC group, 43 restorations (91.5%) were intact at 12 months, with 6% lost at 6 months and 4 restorations (8.5%) lost at 12 months. No statistically significant differences in retention were observed among the three groups ($p > 0.05$). The teeth which loss their retention were replaced and discarded from the study.

**Figure 1**: **Retention evaluation of three groups**




The results of color matching are summarized in Table 2. At baseline and 3 months, all restorations exhibited satisfactory color match with adjacent teeth, except for 2 RMGIC restorations (4%) at 3 months, which showed a slight mismatch within the acceptable range. At 6 months, 46 giomer restorations (95.8%) maintained color match, slightly decreasing to 41 (91.1%) at 12 months. For flowable composites, 40 restorations (83.3%) matched at 6 months, declining to 32 (76.2%) at 12 months. RMGIC restorations demonstrated progressive color deterioration; 7 restorations (14.9%) showed slight mismatch at 6 months, while 5 (10.6%) and 8 (18.6%) restorations exhibited unacceptable color mismatch at 6 and 12 months, respectively. At 12 months, the differences in color match among the three materials were statistically significant ($p < 0.05$).

**Table 2**: **Color matching evaluation of three groups**

| Evaluation Period | Score | Groups | | |
|---|---|---|---|---|
| | | I (n=50) | II (n=50) | III (n=50) |
| **Baseline** | Alpha (A) | 50 (100%) | 50 (100%) | 50 (100%) |
| | Bravo (B) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| | Charlie (C) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |

https://doi.org/10.3329/jopsom.v44i2.89222

| | | | | |
|---|---|---|---|---|
| **After 3 months** | Alpha (A) | 50 (100%) | 50 (100%) | 48 (96%) |
| | Bravo (B) | 0 (0.0%) | 0 (0.0%) | 2 (4.0%) |
| | Charlie (C) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| **After 6 months** | Alpha (A) | 46 (95.8%) | 40 (83.3%) | 35 (74.5%) |
| | Bravo (B) | 2 (4.2%) | 8 (16.7%) | 7 (14.9%) |
| | Charlie (C) | 0 (0.0%) | 0 (0.0%) | 5 (10.6%) |
| **After 12 months** | Alpha (A) | 41 (91.1%) | 32 (76.2%) | 20 (46.5%) |
| | Bravo (B) | 4 (8.9%) | 10 (23.8%) | 15 (34.9%) |
| | Charlie (C) | 0 (0.0%) | 0 (0.0%) | 8 (18.6%) |

A = Matches the adjacent tooth in color shade and translucency
B = Light mismatches with adjacent teeth
C = Mismatches in color with adjacent teeth which is not acceptable

Table 3 presents the comparison of color match among the three groups at each observation period. At 6 and 12 months, RMGIC restorations showed a statistically significant difference in color match compared to both giomer and flowable composite restorations ($p < 0.05$).

**Table 3: Statistical analysis of the results shown in table III**

| Groups | | p value | | |
|---|---|---|---|---|
| | At baseline | After 3 months | After 6 months | After 12 months |
| I Vs II Vs III | - | $0.133^{ns}$ | $0.004^{ns}$ | $0.001^{**}$ |
| I Vs II | - | $1.00^{ns}$ | $0.184^{ns}$ | $0.193^{ns}$ |
| I Vs III | - | $0.082^{ns}$ | $0.001^{**}$ | $0.001^{**}$ |
| II Vs III | - | $0.082^{ns}$ | $0.040^{*}$ | $0.001^{**}$ |

ns = not significant; * $p < 0.05$; ** $p < 0.001$

The results of marginal integrity are presented in Table 4. At baseline and 3 months, all restorations showed no visible crevices along the margins, and explorers did not catch, indicating intact marginal adaptation. At 6 months, 46 giomer restorations (95.8%) demonstrated no marginal defects, decreasing slightly to 41 (91.1%) at 12 months. For flowable composites, 41 restorations (85.4%) were intact at 6 months and 35 (83.3%) at 12 months. In the RMGIC group, 32 restorations (74.4%) maintained intact margins at 12 months, while 11 (25%) showed detectable crevices. Statistically, giomer exhibited significantly better marginal integrity than RMGIC at 12 months ($p < 0.05$).

**Table 4**: **Marginal integrity evaluation of three groups**

| **Evaluation Period** | **Score** | **Groups** | | |
|---|---|---|---|---|
| | | **I (n=50)** | **II (n=50)** | **III (n=50)** |
| **Baseline** | Alpha (A) | 50 (100%) | 50 (100%) | 50 (100%) |
| | Bravo (B) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| | Charlie (C) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| **After 3 months** | Alpha (A) | 50 (100%) | 50 (100%) | 50 (100%) |
| | Bravo (B) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| | Charlie (C) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| **After 6 months** | Alpha (A) | 46 (95.8%) | 41 (85.4%) | 40 (85.1%) |
| | Bravo (B) | 2 (4.2%) | 7 (14.0%) | 7 (14.9%) |
| | Charlie (C) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| **After 12 months** | Alpha (A) | 41 (91.1%) | 35 (83.3%) | 32 (74.4%) |
| | Bravo (B) | 4 (8.9%) | 7 (16.7%) | 11 (25.6%) |
| | Charlie (C) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |

A = No visual evidence of a crevice
B = Visual evidence of a crevice
C = Explorer penetrate up to the dentino-enamel junction

https://doi.org/10.3329/jopsom.v44i2. 89222

Table 5 – shows the compares of marginal integrity among three groups following each observation period. It was found that differences between Giomer and RMGIC only statically significant in the 12 months. (p>0.05)

**Table 5: Statistical analysis of the results shown in table V**

| Groups | | p value | | |
|---|---|---|---|---|
| | At baseline | After 3 months | After 6 months | After 12 months |
| I Vs II Vs III | - | - | 0.169$^{ns}$ | 0.115$^{ns}$ |
| I Vs II | - | - | 0.107$^{ns}$ | 0.333$^{ns}$ |
| I Vs III | - | - | 0.099$^{ns}$ | **0.038**$^{*}$ |
| II Vs III | - | - | 0.962$^{ns}$ | 0.273$^{ns}$ |

ns = not significant; * p < 0.05

The results of surface texture are summarized in Table 6. At baseline, all restorations exhibited surface texture comparable to polished enamel. At 3 months, 3 RMGIC restorations (6.0%) showed minimal surface defects, which were considered clinically acceptable. The differences between RMGIC and both giomer and flowable composite were statistically significant (p < 0.05). At 6 months, 40 giomer restorations (83.3%) maintained enamel-like surface texture, decreasing to 35 (77.8%) at 12 months. For flowable composites, 38 restorations (79.2%) were intact at 6 months, declining to 32 (76.2%) at 12 months. In contrast, 17 RMGIC restorations (36.2%) exhibited altered surface texture at 6 months, increasing to 29 (67.4%) at 12 months. Statistically, RMGIC performed significantly worse than giomer and flowable composite throughout the follow-up period (p < 0.05).

**Table 6**: **Surface texture evaluation of three groups**

| **Evaluation Period** | **Score** | **Groups** | | |
|---|---|---|---|---|
| | | **I (n=50)** | **II (n=50)** | **III (n=50)** |
| **Baseline** | Alpha (A) | 50 (100%) | 50 (100%) | 50 (100%) |
| | Bravo (B) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| | Charlie (C) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| **After 3 months** | Alpha (A) | 50 (100%) | 50 (100%) | 47 (94%) |
| | Bravo (B) | 0 (0.0%) | 0 (0.0%) | 3 (6.0%) |
| | Charlie (C) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| **After 6 months** | Alpha (A) | 40 (83.3%) | 38 (79.2%) | 30 (63.8%) |
| | Bravo (B) | 8 (16.7%) | 10 (20.8%) | 17 (36.2%) |
| | Charlie (C) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| **After 12 months** | Alpha (A) | 35 (77.8%) | 32 (76.2%) | 14 (32.6%) |
| | Bravo (B) | 10 (22.2%) | 10 (23.8%) | 29 (67.4%) |
| | Charlie (C) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |

A = Similar to polished enamel
B = Gritty or white or similar supramicron- sized particales.
C = Surface pitting is sufficiently coarse

Table 7 shows the comparison of surface texture among three groups following each observation period. It was observed that at 3, 6 and 12 months follow up, the results of RMGIC was statistically significant with the Giomer and Flowable composite (p<0.05).

**Table 7: Statistical analysis of the results shown in table VII**

| Groups | | p value | | |
|---|---|---|---|---|
| | At baseline | After 3 months | After 6 months | After 12 months |
| I Vs II Vs III | - | 0.047$^{*}$ | 0.067$^{ns}$ | 0.001$^{**}$ |
| I Vs II | - | 1.000$^{ns}$ | 0.633$^{ns}$ | 0.867$^{ns}$ |
| I Vs III | - | 0.032$^{*}$ | 0.027$^{*}$ | 0.001$^{**}$ |
| II Vs III | - | 0.032$^{*}$ | 0.082$^{ns}$ | 0.001$^{**}$ |

ns = not significant; * p < 0.05; p<0.001

https://doi.org/10.3329/jopsom.v44i2.89222

## DISCUSSION

The success of cervical restorations is influenced by factors such as retention, color stability, marginal integrity, and surface texture. In the present study, baseline evaluations showed that all restorations were intact, with acceptable color match, proper marginal adaptation, and surface texture comparable to polished enamel.

**Retention:** At 12 months, 45 giomer restorations (93.8%), 42 flowable composite restorations (87.5%), and 37 RMGIC restorations (91.5%) remained retained within the cavity. These findings are consistent with Jyothi et al. (2011), who reported retention rates of 87.5% for giomer and RMGIC after one year, and with Celik et al. (2007), who reported 98% retention for flowable composites. Complete loss of some restorations in the present study may be attributed to differences in isolation techniques; previous studies used rubber dam isolation, whereas cotton rolls were employed in this study. Additional factors, such as improper brushing technique or lack of occlusal adjustment, may have also contributed to restoration failure.

The choice of adhesive system may have influenced retention outcomes. Previous studies used two-step self-etch bonding agents, whereas the present study employed a one-step self-etch adhesive. Clinical evidence suggests that two-step self-etch adhesives generally provide improved retention and bonding durability compared to one-step systems[11]. Additionally, flowable composites contain lower filler content and higher resin proportion, which may increase polymerization shrinkage and reduce bond strength, contributing to lower retention[5]. The lower flexural strength of RMGIC may also partially explain its slightly reduced retention compared to giomer[11].

The presence of sclerotic dentin and hypermineralized surfaces in cervical lesions may further compromise adhesion, as these substrates are resistant to conventional acid etching, limiting hybrid layer formation and reducing restoration longevity[11].

**Color Matching:** At three months, 2 RMGIC restorations (4%) showed slight mismatch, considered clinically acceptable. At six months, 95.8% of giomer, 83.3% of flowable composite, and 74.5% of RMGIC restorations matched adjacent teeth in shade and translucency. By 12 months, only 46.5% of RMGIC restorations perfectly matched adjacent teeth, 34.9% showed slight mismatch (acceptable), and 18.6% were unacceptable. Changes in color of RMGIC over time may result from chemical alterations in the resin matrix, water absorption, and surface characteristics of the set material. These findings are in agreement with earlier studies reporting gradual discoloration of resin-based and resin-modified materials due to their organic content and water sorption properties[12,13]. Flowable composites, with higher organic matrix content, are similarly prone to discoloration over time[12,13].

**Marginal Integrity:** At baseline and three months, all restorations exhibited intact margins, with no detectable crevices. At 12 months, intact margins were observed in 91.1% of giomer, 83.3% of flowable composite, and 74.4% of RMGIC restorations. These results correspond to Jyothi et al. (2011), who reported 87.5% and 77.5% intact margins for giomer and RMGIC, respectively. Slight discrepancies in flowable composite marginal integrity may relate to variations in adhesive systems used [5,14].

**Surface Texture:** Surface texture depends primarily on filler size and composition, influencing polishability. At three months, 3 RMGIC restorations (6%) showed slight roughness. At six months, roughness was observed in 8 giomer (16.7%), 10 flowable composite (20.8%), and 17 RMGIC (36.7%) restorations. By 12 months, 10 giomer (22.2%), 10 flowable composite (23.8%), and 29 RMGIC (67.4%) restorations exhibited slight roughness. Giomer consistently demonstrated superior surface texture compared to RMGIC across all observation periods ($p < 0.001$). These findings are consistent with Jyothi et al. (2011) and Celik et al. (2007), which reported 17% and 34% surface roughness for giomer and RMGIC, respectively. Differences in surface texture may be due to microstructure and mean particle size, with RMGIC, flowable composite, and giomer ranging from 4.5–4.8 µm, 1–2 µm, and 20–40 nm, respectively[12]. Additional factors affecting RMGIC include air entrapment during powder-liquid mixing and weaker filler-matrix coupling, increasing susceptibility to abrasive wear. Giomer surfaces can be polished to high luster, which remains stable over time due to the water-stable PRG fillers[12,16].

All participants adhered strictly to treatment instructions, and confounding variables were controlled during the study, making it unlikely that the results were influenced by external factors.

**Limitations:** This study was small, with a limited sample size and short follow-up period, which may restrict the generalizability of the findings.

https://doi.org/10.3329/jopsom.v44i2. 89222

## CONCLUSION

This study demonstrates that giomer exhibits superior clinical performance compared to flowable composite and resin-modified glass ionomer cement (RMGIC) in the management of non-carious cervical lesions. Giomer showed excellent retention, stable color, intact marginal integrity, and smooth surface texture over the observation period. Its performance can be attributed to the pre-reacted glass (PRG) filler technology, optimal particle size, and a stable resin matrix, which collectively provide predictable aesthetics and durable clinical outcomes. Flowable composites performed adequately but were slightly inferior in terms of retention and surface smoothness, likely due to higher resin content and lower filler loading. RMGIC showed more noticeable changes in color, marginal adaptation, and surface texture, possibly related to its lower flexural strength, powder-liquid mixing technique, and weaker filler-matrix coupling.

## RECOMMENDATION

Giomer may be considered a preferred restorative material for non-carious cervical lesions, providing superior aesthetics and clinical durability. Further long-term studies with larger sample sizes are recommended to validate these findings and to explore the influence of different adhesive protocols, occlusal adjustments, and patient-specific factors on restoration success.

## REFERENCES

1. Keramen E, Yazici AR, Ozgunaltay G, Dayangac B. Clinical evaluation of a nanohybrid and a flowable resin composite in non-carious cervical lesions: 24-month results. J Adhes Dent. 2012;14:485–92.
2. Ballal S, Seshadri S, Nandini S, Kandaswamy D. Management of class V lesions based on the etiology. J Conserv Dent. 2007;10(4):141–7.
3. Singh ML, Kugel G, Papas A, Magnuson B. Non-carious lesions due to tooth surface loss: to restore or not to restore? Inside Dent. 2004;17(1):27–32.
4. Perez CR, Gonzalez MR, Prado NAS, Miranda MSF, Macêdo MA, Fernandes BMP. Restoration of noncarious cervical lesions: when, why, and how. Int J Dent. 2012;2012:PMC3246729.
5. Çelik Ç, Özgünaltay G, Attar N. Clinical evaluation of flowable resins in non-carious cervical lesions: two-year results. Oper Dent. 2007;32(4):313–21.
6. Santos MJMC, Leon L, Siddique I, Butler S. Retrospective clinical evaluation of RMGIC/GIC Class V restorations. Dent J (Basel). 2023;11(9):225. doi:10.3390/dj11090225.
7. Soley Arslan, Demirbuga S, Üstün Y, Sahin AN, Canakci BC, Zorba YO. The effect of a new-generation flowable composite resin on microleakage in Class V composite restorations as an intermediate layer. J Conserv Dent. 2013;16(3):189–93. doi:10.4103/0972-0707.111311.
8. Jyothi KN, Annapurna S, Kumar AS, Venugopal P, Jayashankara CM. Clinical evaluation of giomer- and resin-modified glass ionomer cement in class V noncarious cervical lesions: an in vivo study. J Conserv Dent. 2011;14(4):409–13.
9. Kirkwood BR, Sterne JAC. Essential Medical Statistics. 2nd ed. Oxford: Blackwell Publishing; 2005.
10. Schirrmeister JF, Huber K, Hellwig E, Hahn P. Four-year evaluation of a resin composite including nanofillers in posterior cavities. J Adhes Dent. 2009;11(5):399–404.
11. Pecie R, Krejci I, Garcia-Godoy F, Bortolotto T. Noncarious cervical lesions (NCCL) – a clinical concept based on the literature review. Part 2: Restoration. Am J Dent. 2011;24:183–92.
12. Yap AU, Mok BY. Surface finish of a new hybrid aesthetic restorative materials. Oper Dent. 2002;27:161–6.
13. Mohamed Tahir MA, Yap AU. Effect of pH on the surface texture of glass ionomer-based/containing restorative materials. Oper Dent. 2004;29:586–91.
14. Browning WD, Dennison JB. A survey of failure modes in composite resin restorations. Oper Dent. 1996;21(4):294–306.
15. Flowaczy M, Loher C, Mehl A, Kunzelmann KH, Hinkel R. Tooth-colored filling materials for the restoration of cervical lesions: 24-month follow-up study. Oper Dent. 2000;25:251–8.
16. Tay FR, Pashley ER, Huang A, Hashimoto M, Sano H, Smales RJ, Pashley DH. The glass ionomer phase in resin-based restorative materials. J Dent Res. 2001;80:1801–12.

https://doi.org/10.3329/jopsom.v44i2.89222