

Research Article

Comparison of Post-Operative Sensitivity in Deep Cavities Restored With Glass Ionomer Cement (GIC) Liner versus Cavity Varnish

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Received: 09.03.2026, Revised: 27.05.2026, Accepted: 08.06.2026

ABSTRACT

Background: Post-operative sensitivity can result from restoring deep carious lesions, causing a decline in patient satisfaction and comfort. Protection materials like cavity varnishes and Glass Ionomer Cement (GIC) liners have been used to address dentin sensitivity.

Objective: This study aimed to assess post-operative sensitivity in deep cavity restorations and compare the effectiveness of cavity varnishes and GIC liners.

Methods: The study was a randomized clinical trial. Participants were 100 patients between the ages of 18-40 with deep Class I and Class II carious lesions and in need of restorative treatment. Each participant was randomly assigned to one of two equally sized groups (n = 50). A GIC liner was used in Group A and cavity varnish was used in Group B. Post-operative sensitivity was measured by the Visual Analog Scale (VAS) 24 hrs, 7 days, and 30 days after treatment. Data were evaluated using independent sample t-test and Chi-square tests. The level of significance was set to $p < 0.05$.

Results: The participants had a mean age of 28.6 ± 5.4 years. Compared to participants in the cavity varnish group, participants in the GIC group had a mean VAS score that was significantly lower at 24 hours (GIC, 2.1 ± 1.2 ; cavity varnish, 3.4 ± 1.5 ; $p = 0.002$). At 7 days, a mean VAS score of 0.9 ± 0.8 was reported for the GIC group and 1.9 ± 1.1 for the cavity varnish group ($p = 0.001$). At 30 days, GIC liners showed persistent mild sensitivity in 6.0% of patients, and cavity varnish showed persistent mild sensitivity in 20.0% of patients ($p = 0.038$). The GIC group reported overall satisfaction of 90.0% and the cavity varnish group reported a satisfaction of 74.0%.

Conclusion: In reducing post-operative sensitivity following the restoration of deep cavities, Glass Ionomer Cement liners showed a greater effect than cavity varnish. GIC liners may be more effective in protecting the dentin tubules and may improve the comfort of patients during the healing process.

Keywords: Post-Operative Sensitivity: The Effect of GIC and Cavity Varnish on Deep Cavities, a Randomized Control Trial.

INTRODUCTION

Dental caries is an extremely common global health concern. Caries may be so severe that restorative care is required. The preservation of the health of the dental pulp is important, as is the reduction of complications following dental care, and are the primary goals of restorative care. In spite of the development of new

materials and techniques, post-operative sensitivity remains a common concern for dental practitioners, and may hinder the acceptability of the treatment by the patient (Rodrigues et al., 2022).

Postoperative sensitivity is commonly recognized as temporary discomfort occurring in response to stimuli after restorative

treatment and includes thermal and pain responses as well as mechanical, osmotic, and evaporative sensitivity. The choice of restorative material, cavity depth, and remaining tubule and dentin sealing restorative system permeability and sealing affect sensitivity. Clinical research has indicated that sensitivity is most pronounced in the first 24 hours of restoration placement and typically subsides after this period (Maghaireh et al., 2023; Rodrigues et al., 2022).

Restoration of deep cavities is a special clinical challenge because of reduced remaining dentin and the increased likelihood of pulpal irritation and the movement of dentinal fluid. For this reason, restorative dentistry has relied on the use of protective cavity materials. These materials are designed to protect the pulp, decrease microleakage, and reduce post-operative sensitivity (Oliveira et al., 2022).

Glass Ionomer Cement (GIC) has gained favor as a restorative liner in deep cavities with high sensitivity and irritation due to remaining dentin because GIC offers a chemical bond to dentin and an antibacterial and biocompatible barrier. GIC offers a fluoride reservoir which aids in the continued protection of the pulp and adjacent dentin along with reduced sensitivity. Pulpal preservation in deep cavities has been of great concern to many restorative dentists (Oliveira et al., 2022).

Cavity varnish is a protective coating used on dentin surfaces prior to applying restorative materials. The varnish is a thin barrier for the dentin surfaces, decreasing their permeability and limiting the chemical irritants that get to the pulp. Cavity varnish has shown a weakness as a long-term protective coating because the layer gradually dissolves in the oral environment and is fairly ineffective in preventing sensitivity. Cavity varnishes also do not release fluoride or remineralize, meaning that they primarily provide a physical seal. Because cavity varnishes do not possess these properties, there is debate over whether modern cavity liners are more protective against post-operative sensitivity than cavity varnishes.

Many studies have been done to assess the causes of post-operative sensitivity after a restorative procedure. Maghaireh et al. (2023) studied the sensitivity after a posterior restoration and reported a significant decrease in sensitivity over the first month. Their study stresses the sealing of the dentin cavity as well as the materials used in order to ensure comfort after the procedure.

In agreement, Rodrigues et al. (2022) stated that in all cases, the post-operative sensitivity diminished over time, regardless of the method used. They noted that the highest levels of sensitivity occurred immediately after the restoration was placed. This underscores the need for a protective method during restorative procedures.

Oliveira et al. (2022) examined the influence of desensitizing agents in posterior composite restorations. They found that better strategies for dentin protection may lower sensitivity and result in better clinical outcomes. Their conclusion is consistent with the idea that materials that seal dentinal tubules may reduce discomfort for patients for whom restorative treatment has been performed.

There have been many studies on post-operative sensitivity from restorative materials and adhesive systems. However, there is little information on the comparison of Glass Ionomer Cement (GIC) liners and cavity varnishes for deep cavity restorations. Therefore, more clinical studies are needed to assess which protective measure offers the better reduction of post-operative sensitivity and greater outcome for the patient. The aim of this study is to assess post-operative sensitivity of deep cavities sealed with either a Glass Ionomer Cement liner or a cavity varnish.

METHODOLOGY

Study Design: This randomized controlled clinical trial assessed postoperative sensitivity associated with liners using Glass Ionomer Cement (GIC) compared with cavity varnish. The purpose of this study was to assess the protective ability of the two materials in alleviating dentinal sensitivity after restorative procedures.

Study Setting: The trial was conducted within the Department of Operative Dentistry in a tertiary dental teaching hospital. All restorative treatments, subsequent assessments, and the collection of primary data were completed in the department and performed under clinical conditions.

Study Duration: The total duration of the study was six months and included the restorative procedure, subsequent assessments, and collection of data and their analysis.

Study Population: The study included patients with deep carious lesions of posterior permanent teeth. Potential participants were patients visiting the outpatient departments of the hospital during the study period.

Sample Size: 100 patients participated in the study. The sample was distributed equally into two groups. One group (n=50) received the Glass Ionomer Cement liner and the other group (n=50) received the cavity varnish.

Sampling Technique: Consecutive sampling was utilized to recruit participants who met the selection criteria and consented to participate in the study. Participants were allocated to the study groups through random selection using the computer to generate random numbers.

Inclusion Criteria: Study participants were aged 18 to 40 years and had at least one Class I or Class II carious lesion who had carious lesions in permanent posterior teeth with vital pulps and without spontaneous pain and with deep dentinal caries without pulpal involvement. Study participants had to provide informed consent.

Exclusion Criteria: Study participants had to have no pulpitis, no periapical pathology, no broken teeth, no treatment or restorations of the study tooth, no severe periodontal disease, and no systemic disease that would affect pain perception, no pregnancy, and no allergy to the materials that would be used in the study. Any subject that did not follow study procedures, especially failing to attend a follow-up appointment, will be excluded from the study.

Study Groups: After the random assignment, each study participants group (GIC Liner Group or Cavity Varnish Group) was finished with the treatment in study group.

Clinical Procedure: Each study participant was examined clinically before the study treatment. Deep lesions were diagnosed by the use of periapical radiographs to assess pulpal involvement. Local anesthetic was administered as needed. Caries was removed using a bur or hand instrument in the sterile state. After cavity preparation, participants were provided the randomly assigned cavity protection material. In Group A, a Glass Ionomer Cement liner was placed on the pulpal floor and left to set. In Group B, cavity varnish was placed on the cavity walls and was allowed to dry prior to the placement of the restoration.

The restoration of all teeth was done with a light-cured composite resin. The standard polishing system was used to finish and polish the restoration. The primary outcome of interest was post-operative sensitivity.

Sensitivity was measured using a 10 cm Visual Analog Scale (VAS). A score of 0 represented no pain, while a score of 10 represented the greatest pain. Participants were asked to rate the level of sensitivity using the VAS following the exposure of the tooth to thermal and biting stimuli. Sensitivity assessments were conducted at three follow-up periods post restoration:

- 24 hours after restoration
- 7 days after restoration
- 30 days after restoration

At the final follow-up, the structured questionnaire was used to assess the level of satisfaction with the treatment. The type of cavity protection material used (Glass Ionomer Cement liner or cavity varnish) was the only independent variable for the study. Dependent variables were post-operative sensitivity and level of satisfaction with the treatment. Demographic variables were age, gender, and cavity class.

Data Collection Instrument: A modified clinical data collection form was used to collect data in this study. This form captured demography, clinical findings, cavity classification, type of restorative material used, post-operative sensitivity scores, and patient satisfaction.

Ethical Considerations: Enrolment was preceded by the acquisition of written informed consent, which notified prospective participants of the purpose of the study, study procedures, and of the potential benefits and risks of study participation. The right to privacy of study participants was protected by maintaining the confidentiality of the identities and personal health information of study participants.

Data Analysis: Data were processed and analyzed using version 26 of the Statistical Package for the Social Sciences (SPSS). Mean and Standard deviations were computed. Frequencies and Percentages were used for categorical data. Independent t-tests were employed to analyze post-operative sensitivity score means. The association of categorical data including sensitivity status, and patient satisfaction, were analyzed using Chi-square tests. A p-value of less than 0.05 was used to determine statistical significance.

RESULTS TABLES

Table 1. Demographic Characteristics of Participants (N = 100)

Variable	Category	Frequency (n)	Percentage (%)
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Age Group (Years)	18–25	34	34.0
	26–32	38	38.0
	33–40	28	28.0
Gender	Male	44	44.0
	Female	56	56.0
Mean Age (Years)	28.6 ± 5.4		

Table 2. Distribution of Restored Teeth According to Cavity Type

Cavity Type	GIC Liner n (%)	Cavity Varnish n (%)	Total n (%)
Class I	22 (44.0)	24 (48.0)	46 (46.0)
Class II	28 (56.0)	26 (52.0)	54 (54.0)
Total	50 (100)	50 (100)	100 (100)

Table 3. Comparison of Mean Post-Operative Sensitivity Scores at 24 Hours

Group	n	Mean VAS Score	SD	t-value	p-value
GIC Liner	50	2.1	1.2		
Cavity Varnish	50	3.4	1.5	-4.78	0.002

Table 4. Comparison of Mean Post-Operative Sensitivity Scores at 7 Days

Group	n	Mean VAS Score	SD	t-value	p-value
GIC Liner	50	0.9	0.8		
Cavity Varnish	50	1.9	1.1	-5.12	0.001

Table 5. Comparison of Post-Operative Sensitivity at 30 Days

Sensitivity Status	GIC Liner n (%)	Cavity Varnish n (%)	Total
No Sensitivity	47 (94.0)	40 (80.0)	87
Mild Sensitivity	3 (6.0)	10 (20.0)	13
Moderate/Severe Sensitivity	0 (0.0)	0 (0.0)	0
Chi-square			4.31
p-value			0.038

Table 6. Comparison of Patient Satisfaction between Study Groups

Satisfaction Level	GIC Liner n (%)	Cavity Varnish n (%)	Total
Satisfied	45 (90.0)	37 (74.0)	82
Neutral	4 (8.0)	9 (18.0)	13
Dissatisfied	1 (2.0)	4 (8.0)	5
Chi-square			6.07
p-value			0.048

DISCUSSION

This randomized clinical trial assessed post-operative sensitivity in deep cavities using a Glass Ionomer Cement (GIC) liner and cavity varnish. Findings indicated that GIC liner patients reported lower sensitivity at 24 hours, 7 days, and 30 days' post-treatment. Thus, GIC liners appear to provide better dentinal sealing and pulpal protection than cavity varnish, decreasing the pulpal response to external stimuli. GIC liners provide better dentinal

sealing and protection to the pulp. This is further corroborated in the recent literature of restorative dentistry in which liner materials that are ion-releasing improve the biological response and the adaptation of the restoration to the tooth (Pires et al. 2020; Mustafa et al. 2020).

Post-operative sensitivity diminished over time in both groups; however, sensitivity was the highest during the first 24 hours. This reflects the normal biological healing response of the

pulp-dentin complex after a restorative procedure. Sensitivity decreased in the first week in the study conducted by Rehman et al. (2025) regardless of the restoration method. However, lined restorations reported less sensitivity than unlined restorations.

GIC liners in this study performed the best out of the ionomer liners, likely due to chemical bonding to dentin, and the fluoride offered in the material. These factors reduce microleakage and improve marginal sealing which in turn decreases post-operative sensitivity. Glass ionomer-based materials demonstrated biological benefits and offered more than simple protection of the cavity and helped pulpal health and the health of the restoration (Mustafa et al. 2020).

Another important conclusion of this research is that participants treated with GIC liners exhibited a lower prevalence of persistent sensitivity at 30 days. This can be attributed to GIC maintaining a good seal for a long period of time. In contrast, cavity varnish, as a protective layer, forms a superficial protective layer that may easily erode. A review of restorative liners and varnish has shown that varnishes provide a short term protective function, whereas, modern liner materials provide extended biological and mechanical protection (Arora et al., 2021; Chandak et al., 2020).

The results of the present study are consistent with other evidence which suggests that the success of a restoration and the comfort of the patient are associated with the quality of the sealing of the dentine. In a systematic review and meta-analysis, Josic et al. (2022) stated that improving dentin sealing techniques can create fewer conduits for fluid flow in the dentinal tubules which can facilitate a decrease in the intensity of the response to thermal and mechanical stimuli. Although the review was about indirect restorations, the theory of the biological mechanism can be applied to direct restorative procedures.

In the recent clinical practice guidelines of managing deep carious lesions, cavity liners have continued to serve an important purpose when pulpal protection is warranted. Although some studies have shown that lined and unlined restorations may be similar, the guidelines have stated that liner selection should be based on cavity depth, the restorative requirements, and the thickness of the remaining dentin. This supports the protective rationale of different materials in deep cavities as assessed in this study (Schwendicke et al., 2025).

Patankar, (2025) also reported that RMGIC and calcium hydroxide, Biodentine and calcium hydroxide, Theracal and calcium hydroxide, and MTA and calcium hydroxide showed no variance in clinical outcomes. Accordingly, it appears that the type of protective liner does not play a significant role in the success of the treatment.

Strengths and Limitations

The present study has strengths such as randomized allocation of participants, standardized restorative procedures, and numerous follow-up assessments. However, some limitations are evident in this study. The research was performed in a single institution and had a small sample size. Additionally, the measurement of post-operative sensitivity relied on patient-reporting, which is susceptible to interindividual differences in pain tolerance and sensitivity. The same limitations are also described in other restorative clinical studies on post-operative sensitivity.

CONCLUSION

The present study demonstrates that Glass Ionomer Cement liners are superior to cavity varnish in the management of post-operative sensitivity of deep cavity restorations. The reduction of sensitivity and the increase in patient satisfaction favors the use of GIC liners as a protective cavity liner. Further studies are warranted to support the present study and develop clinical recommendations.

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