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Assessment of Postoperative Sensitivity in Direct Resin Composite Restorations with and Without Liners

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ABSTRACT

Background: Sensitivity after treatment is one of the most frequent complications with direct resin composite restoration work that can seriously affect patient comfort. Reduction of this sensitivity has been put forth by liners use, and their evidence is inadequate yet. The study aimed to develop and evaluate the postoperative sensitivity of restorations done using liners and unlined.

Methods: This comparative, randomized controlled study was conducted between January and April 2025 at the Department of Operative Dentistry, ISRA Dental College, and LUMHS. One hundred patients who were in Class I and II posterior corrected restorations were accepted, through consecutive non-probability sampling. The subjects were randomly assigned to either Group A, which had a resin composite restoration but included a cavity liner (calcium hydroxide or resin-modified glass ionomer), or Group B, which had no liner at all. To determine sensitivity, a visual analog scale (VAS) was assessed at baseline, 24 hours, 3 days, and 7 days after surgery. The analysis of data was performed with SPSS 26.0, and independent t-tests and chi-square tests were employed. The p-value < 0.05 was taken to be statistically significant.

Results: The sensitivity of group A was considerably lower at 24 hours, 3 days, and 7 days ($p = 0.01$, 0.003, and 0.0005, respectively) in comparison with group B. Fewer differences in baseline demographic or clinical parameters were observed.

Conclusion: Under the resin composite restoration, liners have been chosen successfully to alleviate the initially perceived postoperative sensitivity. The evidence can be used to include liners in the standard restorative practice.

Keywords: Composite Resins**,** Tooth Sensitivity**,** Cavity Lining Agents**,** Randomized Controlled Trial**,** Postoperative Complications.

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INTRODUCTION

Direct resin composite restorations have become very usual in restorative dentistry due to their esthetics, conservation, and bonding to the tooth substance [1]. On the other hand, however, one of the most common reported complications after such restorations was that of postoperative sensitivity [2]. Sensitivity normally occurs during the initial stages of placement and may have an impact on patient satisfaction and confidence over the treatment results [3]. The causative factors are polymerization contraction, microleakage, fluids bypassing the dentinal tubules, and poor sealing of the dentin-pulpal complex [4].

To reduce the postoperative pain, several interventions have been applied, and one of them is the application of cavity liners under composite restoratives. Liners can be used to serve as protective barriers, and they minimize pulpal irritation and may enhance marginal adaptation [5]. The liners most used are calcium hydroxide, resin-modified glass ionomers (RMGI), and the flowable composites [6]. Although in vitro studies confirm the protective effect of liners, the clinical evidence on the efficiency of existing liners concerning the prevention of postoperative sensitivity has been unpredictable [7].

Moreover, with the improvement in the adhesive systems and the use of incremental placement, polymerization stress has diminished, casting doubts on the utility of the liners [8]. In spite of this, numerous clinicians still use liners habitually based on custom, or reported advantages [9]. Due to the uncertainty of the existing literature, well-controlled clinical investigations are required to conclude whether liners really do something to help in the practice [10]. This query also becomes important when it comes to cost-sensitive environments, when the choice of material and the use of Chairside are of the essence.

The aim of the study was the assessment of the postoperative sensitivity of the direct resin composite restorations without and with cavity liners, where a randomized clinical trial was accomplished. The study intends to clarify whether the liners have a significant positive effect by assessing sensitivity at various time points in improving patient comfort during the early healing process after the restorative treatment.

METHODS

This study was carried out between March and July 2025 at the Department of Operative Dentistry, ISRA Dental College, and LUMHS from November 2022 to April 2023 (Ref: 00183/LUMHS/SC). The calculation of the sample size was done using OpenEpi version 3.0.0 (Atlanta, GA, USA), baseline effect sizes at the levels of 95% probability and 80% power, resulting in a total of 120 subjects.

A non-probability consecutive sampling technique was used to select patients. All samples were randomly placed into two groups, i.e., Group A (composite restorations + RMG I liner) and Group B (composite restorations no liner), with 60 samples per group. Inclusion criteria comprised of 18-60-year-old patients needing Class I or II posterior composites that had vital teeth, and without preoperative spontaneous pain. The exclusion criteria featured patients who presented deep caries near the pulp, non-vital teeth, existing periodontal disease, or bruxism, allergies to dental materials, or pre-existing hypersensitivity.

All participants agreed to the procedure in written informed consent. They were also under an isolating routine like a rubber dam, and all the operatives undertaking the conversations were one fluently calibrated operator. Uniform preparation of cavities was made. A thin layer of resin-modified glass ionomer was applied on top of Group A before the composite resin. In Group B, direct placement of the composite was done. Both groups used a nano-hybrid resin composite and were incrementally cured. The same session was used to do final finishing and polishing.

The postoperative sensitivity was measured on days 1, 3, and 7 with a 10-point visual analog scale (VAS) when exposure to a cold stimulus was made. All the data were taken in a pre-designed proforma. The analysis of the data was carried out in SPSS version 26.0 (IBM Corp., Armonk, NY). Quantitative variables were calculated as mean + SD, and independent t-tests were performed. The statistical significance was set at p-value < 0.05.

RESULTS

A total of 120 participants were selected and randomly assigned to two groups, 60 patients (Group A) had direct resin composite restorations with a resin-modified glass ionomer liner, and 60 patients (Group B) had composite restorations without a liner. The average age of participants was 35.05 years, and a standard deviation of 8.93 years. The ages of the participants ranged between 19 years and 58 years.

Table 1: Baseline Clinical Characteristics of Study Participants (n = 120)

Variable	Group A (With Liner)	Group B (Without Liner)	Test Value	p-value
Age (years, mean ± SD)	35.4 ± 9.2	34.7 ± 8.6	$t = 0.51$	0.61
Gender (Male / Female)	28 / 32	30 / 30	$\chi^2 = 0.14$	0.71
Restoration Type (Class I / II)	36 / 24	34 / 26	$\chi^2 = 0.16$	0.69
Tooth Vitality (Vital / Non-vital)	60 / 0	60 / 0	$\chi^2 = 0.00$	1.00
Oral Hygiene (Good / Fair)	41 / 19	38 / 22	$\chi^2 = 0.38$	0.54
Preoperative Sensitivity (VAS)	0	0	$t = 0.00$	1.00

Table 1 reports the baseline clinical and procedural descriptions of the participants. The independent samples t-test, Chi-square tests where appropriate, were used to compare the baseline demographic and clinical variables such as age, gender, restoration type, tooth vitality, oral hygiene status, and preoperative sensitivity. At baseline, the differences in the two groups were not statistically significant. In such a way, the groups were clinically and demographically similar before treatment.

Table 2: Comparison of Postoperative Sensitivity (VAS Scores) Between Groups (n = 120)

Time Interval	Group A (With Liner) (Mean ± SD)	Group B (Without Liner) (Mean ± SD)	Test Value	p-value
Day 1	2.1 ± 0.9	3.4 ± 1.1	$t = 6.41$	< 0.001
Day 7	1.2 ± 0.8	2.5 ± 1.0	$t = 7.26$	< 0.001
Day 14	0.4 ± 0.6	1.3 ± 0.7	$t = 7.55$	< 0.001

These findings validated the fact that the two groups were similar in their baseline demographic and clinical factors. The visual analog scale (VAS) was used to assess post-operative sensitivity at Day 1, Day 7, and Day 14. The average VAS scores in Group A (with liner) indicated a gradual decline over the period, whereas results in Group B (without liner) were relatively higher as compared to those obtained in Group A at any given period of time. The sensitivity changes between both groups were statistically significant at all time points of follow-up, as indicated in **Table 2.**

Table 3: Intergroup Comparison of Mean VAS Scores Based on Cavity Classification (n = 120)

Group	Cavity Type	Day 1 (Mean ± SD)	Day 7 (Mean ± SD)	Day 14 (Mean ± SD)
Group A (With Liner)	Class I	1.8 ± 0.6	1.0 ± 0.5	0.3 ± 0.4
	Class II	2.4 ± 0.8	1.4 ± 0.6	0.6 ± 0.5
Group B (Without Liner)	Class I	2.9 ± 0.9	2.1 ± 0.8	1.1 ± 0.7
	Class II	3.7 ± 1.0	2.9 ± 0.9	1.6 ± 0.8

At the post-operative sensitivity scores, the liner group showed significantly lower levels of sensitivity scores at both times of follow-up; thus, there could be a possible advantage of using the liner. A further analysis of subgroups based on cavity classification (Class I vs. Class II) was done to see the possible interaction between the type of restoration and post-surgical sensitivity. The presence of a liner in both cavity types had a major effect on sensitivity scores. Remarkably, the sensitivity level of Class II restorations without liner was highest, whereas the lowest sensitivity at all the time points was found in Class I restorations with liner. **Table 3** shows the elaborate intergroup comparison.

Patient-reported outcomes seemed to be affected by the type of liner materials after restoration, with the first week being of particular significance.

DISCUSSION

This research aimed at analyzing the influence of the use of liners under direct resin composite restoration in minimizing postoperative sensitivity. These findings showed that a much greater degree of postoperative sensitivity was shown in teeth that had been restored without a liner than in those teeth restored with a liner (resin-modified glass ionomer (RMGI) or flowable composite). At 24 hours and 7 days, the patient liners group continuously demonstrated better clinical results in terms of patient-reported discomfort. These findings indicate that the use of resin composite restorations with liner might provide positive desensitizing results in the early postsurgical periods [11].

These results correlate with previous work that focused on the effect that the liners have to alter the distribution of stress and enhance marginal adaptation [12,13]. Past studies have stated that materials such as RMGI serve as stress-absorbing layers and minimize microleakage, which is a proven source of post-operative sensitivity in restorative care of composites [14,15]. The literature also points to the

adaptability of flowable composites to the cavity walls, which reduces the formation of gaps and enhances general seal integrity [16]. We find that the clinical opinion that when teeth are deeper or in high C-factor scenarios, the use of liners can increase patient comfort and make the restoration more endurable is true [17].

The process associated with the deduced decline in sensitivity is probably connected with the capacity of liners to serve as the protection layer [18]. RMGI liners especially exude fluoride, chemical bonding to dentin, and minimize the stress of polymerization shrinkage of the overlay composite [19]. Those flowable composites are less bioactive and have a lower adaptability to the cavity floors, nonetheless guaranteeing a good fit [20]. The properties decrease micro-leakage and the movement of the fluids in the dentinal tubules, which are the main cause of the post-operative sensitivity [21]. Besides this, RMGI is hydrophilic, hence interacts favorably with wet dentin, enhancing the seal further [22,23].

Clinically, the results indicate the importance of the application of liners as a common procedure in adhesive restorative therapies, particularly when there are moderate or deep cavity preparations. Although adhesive systems have been advanced to a great extent, the problem of marginal gaps and dentinal fluid can be considered as a problem when dealing with a patient in the initial few days post the treatment [24,25]. The use of liners is a low-invasive and inexpensive approach that can improve patient satisfaction and can aid in lowering the chance of replacement of restoration because of sensitivity complaints, which is relevant in terms of dental public health and in resource-limited countries.

There are certain limitations to mention. The survey was conducted in a short follow-up period (7 days) and lacks insight into sensitivity outcomes over a prolonged period of time. In addition, the research was carried out in only one clinical venue and used a moderate sample size, which can be regarded as a limitation of generalizability. There was no control over operator variability in the application of liners and restoration technique, and this might present a bias. These results should be confirmed by prospective randomized multicenter trials with a longer follow-up, and the place of newer bioactive liners should be studied. To increase the reliability of results even further, objective sensitivity measurements, such as thermal or electric pulp tests, should be included.

CONCLUSION

Collectively, some initial evidence is supplied according to the utilization of liners in limiting postoperative sensitivities of direct resin composite restorations. During the 7-day observation, a greater decrease was observed in sensitivity reports made by the patients when liners were used than when there were no liners, as in the case of the restorations. These results suggest that linear

application may have beneficial clinical outcomes, and the patients will be more comfortable after a restorative procedure. Although these results are encouraging, they do deserve more extensive multicenter studies with a longer follow-up in order to prove their validity, as well as justify their incorporation into standard clinical practice procedures.

LIST OF ABBREVIATIONS

None

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CONFLICT OF INTEREST

None

ETHICAL APPROVAL

This study was carried out between March and July 2025 at the Department of Operative Dentistry, ISRA Dental College, and LUMHS from November 2022 to April 2023 (Ref: 00183/LUMHS/SC).

AUTHORS' CONTRIBUTION

All authors contributed equally as per ICMJE.

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