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COMPARATIVE EVALUATION OF DIFFERENT DESENSITIZING AGENTS IN VITAL TOOTH PREPARATION – A CLINICAL STUDY

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ABSTRACT

Background: Dentinal hypersensitivity is a common complication following vital tooth preparation for fixed prosthodontic restorations, leading to postoperative discomfort and reduced patient satisfaction. The application of dentinal desensitizing agents may help to minimize this sensitivity.

Aim: To compare the clinical effectiveness of two dentinal desensitizing agents in reducing postoperative dentinal hypersensitivity following vital tooth preparation.

Materials and Methods: A prospective, randomized in-vivo clinical study was conducted on 30 patients requiring vital tooth preparation for fixed prosthodontic treatment. Participants were randomly allocated into three groups (n=10): Group I (GLUMA), Group II (FGM Desensibilize KF), and Group III (Control group). Dentinal hypersensitivity was assessed using the Visual Analog Scale (VAS) immediately after tooth preparation, at 5 minutes, 1 day, and 7 days following application. Statistical analysis was performed using repeated-measures ANOVA, one-way ANOVA, and Tukey's post-hoc test, with significance set at $p<0.05$.

Results: Both desensitizer groups demonstrated a significant reduction in VAS scores compared with the control group at all follow-up intervals ($p<0.001$). At 7 days, Group I and Group II showed 93.9% and 90.2% reductions in hypersensitivity, respectively, compared with 62.0% in the control group.

Conclusion: The application of dentinal desensitizing agents following vital tooth preparation significantly reduces postoperative hypersensitivity compared with untreated controls. GLUMA demonstrated rapid and sustained reductions in pain scores, with comparable clinical efficacy than FGM Desensibilize KF. These findings highlight the importance of incorporating desensitizers into routine prosthodontic protocols to enhance patient comfort and satisfaction.

KEYWORDS: Dentinal hypersensitivity, Fixed prosthodontic treatment, Postoperative hypersensitivity, Desensitizing agents.

INTRODUCTION

Dentinal hypersensitivity (DH) is a frequently encountered clinical condition characterized by a short, sharp pain arising from exposed dentin in response to thermal, tactile, osmotic, or chemical stimuli, and cannot be explained by any other dental pathology.[1] DH has been reported to significantly affect the oral health-related quality of life and can complicate routine dental procedures.[2] The most accepted mechanism underlying DH is the hydrodynamic theory, which suggests that rapid fluid movement within patient dentinal tubules stimulates pulpal nerve endings, that eliciting pain.[3] This theory provides the rationale for the use of desensitizing agents that aim to occlude dentinal tubules or reduce nerve excitability to mitigate hypersensitivity.[4]

In prosthodontic practice, vital tooth preparation for full-coverage restorations inherently exposes dentin and increases dentin permeability, predisposing prepared teeth to postoperative hypersensitivity.[5] Factors such as heat generation during preparation, dehydration of dentin, and microleakage beneath provisional restorations may further exacerbate pulpal irritation and patient discomfort.[5] Various desensitizing agents have been investigated to control DH, including occluding agents, neural depolarizing agents, bioactive materials,[6] and bonding systems.[7] Recent randomized clinical trials have demonstrated that modern desensitizing strategies, including universal adhesives with bioactive additives, can

significantly reduce hypersensitivity scores in response to multiple stimuli when compared to baseline.[8] Despite these advances, most existing studies focuses on general dentinal hypersensitivity or home use products, with limited focused clinical data on post preparation sensitivity in vital abutment teeth in the context of fixed prosthodontic treatment.[3]
Therefore, there is a clear need for a well designed in-vivo clinical study to evaluate the effectiveness of dentinal desensitizing agents administered after vital tooth preparation for full coverage restorations, with the aim of improving patient comfort, reducing postoperative sensitivity, and guiding evidence based clinical protocols in fixed prosthodontics.

AIM & OBJECTIVE

The study aimed to compare and evaluate different desensitizing agents used during vital tooth preparation in a clinical setting. The objectives of the study are to assess the level of dentinal hypersensitivity following vital tooth preparation using a standardized pain sensitivity assessment scale, to evaluate the effectiveness of dentinal desensitizers in reducing dentinal hypersensitivity after application, to compare dentinal hypersensitivity between the desensitizer group and the control/comparator group, and determine patient comfort levels following vital tooth preparation with and without the application of dentinal desensitizers.

Inclusion Criteria

Patients aged 20-35 years requiring vital tooth preparation for fixed prosthodontic treatment were included in the study. Only individuals with vital, asymptomatic teeth indicated for single crowns or fixed partial dentures, having adequate coronal tooth structure without previous full-coverage restorations, and in good general health were enrolled. Written informed consent was obtained from all participants before inclusion.

Exclusion Criteria

Patients with non-vital or endodontically treated teeth, caries, dentin-involving restorations, structural defects, pre-existing dentinal hypersensitivity, periodontal disease, severe tooth wear, systemic conditions affecting pain perception, pregnancy or lactation, or recent analgesic use (within 24 hours) were excluded.

METHODOLOGY

Sources of Data: The data for the present study were obtained from patients reporting to the department who require vital tooth preparation for fixed prosthodontic treatment and fulfill the inclusion criteria of the study.
Study Design: The present study was designed as a prospective, randomized, in-vivo clinical study conducted over a period of 6 months. Participants were selected using a simple random sampling method.
Sample size estimation was performed using GPower software (version 3.0). Based on a one-way ANOVA with an effect size of 0.50, an α error probability of 0.05, a statistical power of 80%, divided into three study groups i.e Group I (GLUMA), Group II (FGM Desensibilize KF), and Group III (Control) and the required sample size was calculated to be 30 participants (10 participants per group).
Procedure: Dentinal hypersensitivity was assessed immediately after tooth preparation and prior to the application of the desensitizing agent using a standardized cold test (Endo-Frost). The patient's pain response was evaluated using the Visual Analog Scale (VAS), which served as the baseline assessment. Subsequent evaluations of dentinal hypersensitivity were performed using the same standardized Endo-Frost cold test, and pain intensity was recorded using the VAS at predetermined time intervals of 5 minutes after desensitizer application, 1 day, and 7 days following the procedure.
Data Analysis Plan
The collected data were entered into Microsoft Excel and subsequently analyzed using IBM Statistical Package for Social Sciences (SPSS) version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were computed for all study variables. Continuous variables, including age and Visual Analog Scale (VAS) scores, were expressed as mean ± standard deviation (SD), while categorical variables such as gender, tooth type, and jaw distribution were presented as frequencies and percentages.
The normality of continuous data was assessed using the Shapiro–Wilk test. Baseline demographic and clinical characteristics among the three study groups were compared using one-way Analysis of Variance (ANOVA) for continuous variables and Chi-square test for categorical variables.
Intragroup changes in VAS scores over different follow-up intervals (immediate post-preparation, 5 minutes post-application, 1day post-application, and 7 days post-application) were evaluated using repeated-measures Analysis of Variance (RM-ANOVA). Pairwise comparisons between time points were performed using Bonferroni-adjusted post-hoc tests to control for multiple comparisons.
Intergroup comparisons of mean VAS scores at each follow-up interval were carried out using one-way ANOVA. When significant differences were observed, Tukey's Honestly Significant Difference (HSD) post-hoc test was employed to identify specific group differences.
The percentage reduction in VAS scores from baseline was calculated for each follow-up interval to assess the magnitude of reduction in dentinal hypersensitivity. Statistical significance was set at $p < 0.05$ for all analyses, and all tests were two-tailed.

Informed Consent – Written informed consent was obtained from the patients before commencing the procedure and entire procedure was discussed in detail.

RESULTS

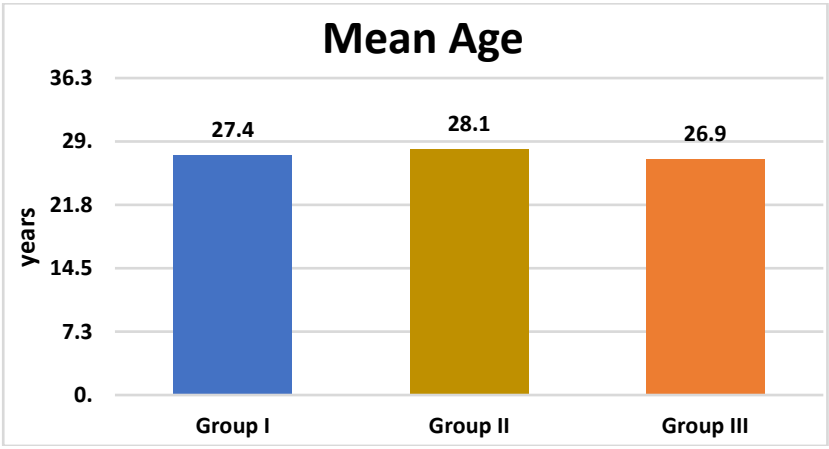
The results of the foregoing study were presented in the form of tables i.e. table 1 to table 3 and also plotted in graphs i,e. graph 1 to graph 3 to facilitate interpretation and comparison between the study groups.

Table 1 and Graph 1 (a and b) showed that the three study groups were comparable at baseline. There were no statistically significant differences in age (p = 0.742), and gender distribution (p = 0.632). Baseline VAS scores were identical (0.0) in all groups. These findings indicated that the groups were well matched before the intervention.

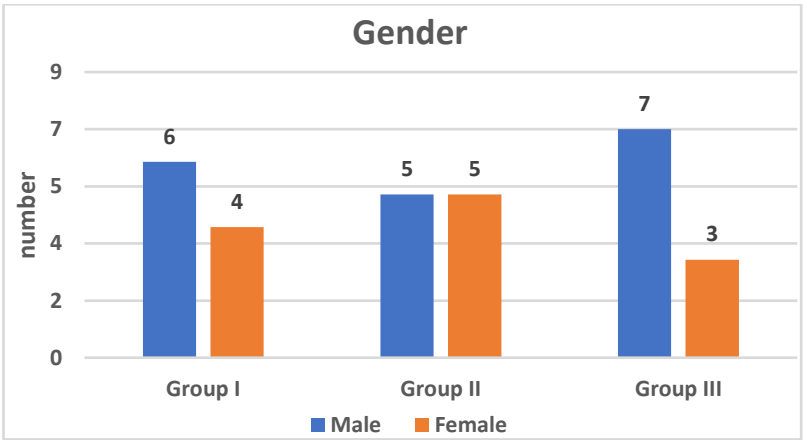
Table 1: Demographic and Baseline Characteristics of Study Participants

Characteristic	Group I (GLUMA), n=10	Group II (FGM Desensibilize KF), n=10	Group III (Control), n=10	Overall p-value*	Post-hoc Pairwise p-values**
Age (years)	27.4 ± 3.8	28.1 ± 4.2	26.9 ± 3.5	0.742	I vs II: 0.891; I vs III: 0.742; II vs III: 0.634
Gender (Male/Female)	6/4	5/5	7/3	0.632***	-
Baseline VAS (Pre-preparation)	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	1.000	-

*One-way ANOVA; **Tukey's HSD post-hoc test (for age only); ***Chi-square test for categorical variables; p > 0.05 indicates no statistically significant difference between groups at baseline



Graph 1(a): Demographic and Baseline Characteristics of Study Participants



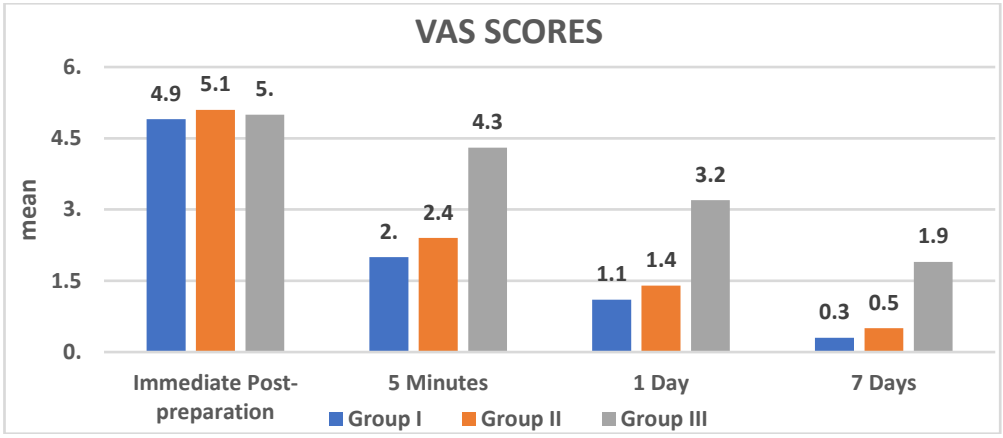
Graph 1(b): Demographic and Baseline Characteristics of Study Participants

Table 2 and Graph 2 demonstrated a significant reduction in VAS scores over time within all three groups (p < 0.001). Groups I and II showed a rapid and sustained decrease in dentinal hypersensitivity from 5 minutes to 7 days, whereas the control group exhibited a slower reduction.

Percentage reduction in VAS scores was highest in Group I (93.9%), followed by Group II (90.2%) and Group III (62.0%) at 7 days, indicating greater effectiveness of the desensitizing agents.

Table 2: Intragroup Comparison of VAS Scores Over Time with Post-hoc Pairwise p-values

Time Point	Group I (GLUMA)	Group II (FGM Desensibilize KF)	Group III (Control)
Immediate Post-Preparation	4.9 ± 1.2	5.1 ± 1.3	5.0 ± 1.1
5 Minutes Post-Application	2.0 ± 0.8*	2.4 ± 0.9*	4.3 ± 1.2
1 Day Post-Application	1.1 ± 0.7*	1.4 ± 0.8*	3.2 ± 1.0*
7 Days Post-Application	0.3 ± 0.5*	0.5 ± 0.5*	1.9 ± 0.9*
Within-group p-value (Overall)^	<0.001	<0.001	<0.001

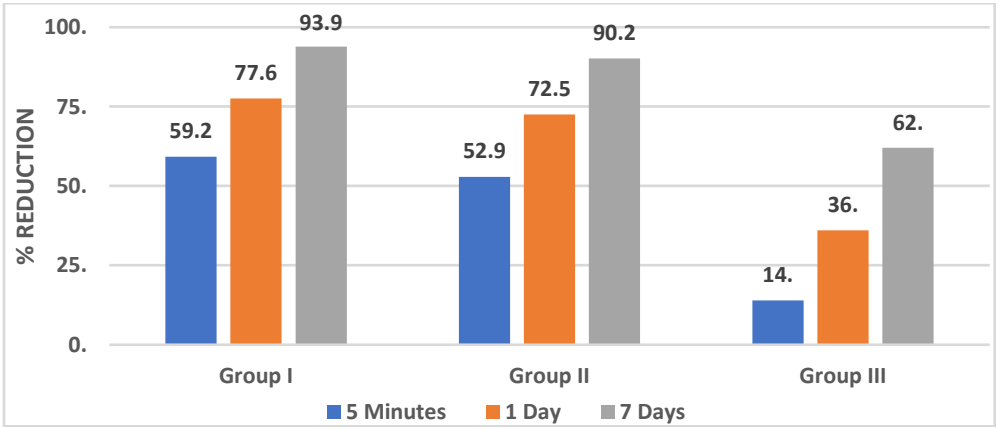


Graph 2: Intragroup Comparison of VAS Scores Over Time

Table 3 and Graph 3 showed that all three groups demonstrated a progressive increase in percentage reduction from immediate post-preparation to 5 minutes, 1 day, and 7 days. Group I exhibited the highest percentage reduction at all time intervals (59.2%, 77.6%, and 93.9%), followed by Group II (52.9%, 72.5%, and 90.2%), while Group III showed the lowest reduction (14%, 36%, and 62%) in the effectiveness of the desensitizing agents.

TABLE 3 :Percentage Reduction from Immediate Post-Preparation

Time Point	Group I (GLUMA)	Group II (FGM Desensibilize KF)	Group III (Control)
5 Minutes	59.2%	52.9%	14.0%
1 Day	77.6%	72.5%	36.0%
7 Days	93.9%	90.2%	62.0%



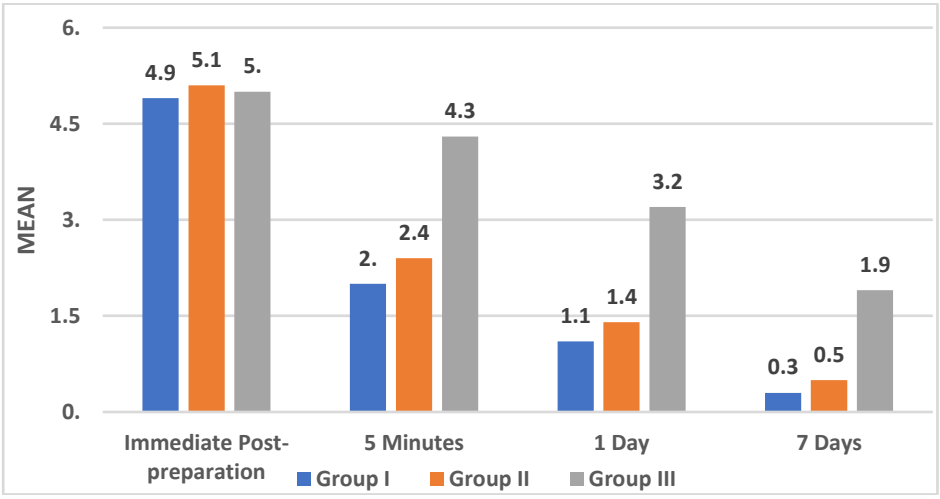
Graph 3 :Percentage Reduction from Immediate Post-Preparation

Table 4 and Graph 4 showed no significant difference in VAS scores among the groups immediately after tooth preparation ($p = 0.832$). However, significant intergroup differences were observed at 5 minutes, 1 day, and 7 days ($p < 0.001$). Both desensitizer groups demonstrated significantly lower VAS scores than the control group, while no significant difference was found between Groups I and II at any follow-up interval. These findings indicate that both desensitizing agents were equally effective and significantly superior to the control in reducing dentinal hypersensitivity.

Table 4: Intergroup Comparison of VAS Scores with Post-hoc Pairwise p-values

Time Point	Group I (GLUMA)	Group II (FGM Desensibilize KF),)	Group III (Control)	F-value *	p-value*	Post-hoc Pairwise p-values (Tukey's HSD)		
						I vs II	I vs III	II vs III
Immediate Post-Preparation	4.9 ± 1.2	5.1 ± 1.3	5.0 ± 1.1	0.186	0.832	0.891	0.742	0.634
5 Minutes Post-Application	2.0 ± 0.8	2.4 ± 0.9	4.3 ± 1.2	21.67	**<0.001**	0.486	**<0.001**	**<0.001**
1 Day Post-Application	1.1 ± 0.7	1.4 ± 0.8	3.2 ± 1.0	18.94	**<0.001**	0.612	**<0.001**	**<0.001**
7 Days Post-Application	0.3 ± 0.5	0.5 ± 0.5	1.9 ± 0.9	24.58	**<0.001**	0.538	**<0.001**	**<0.001**

*One-way ANOVA; Tukey's HSD post-hoc test for pairwise comparisons; Statistically significant p-values (<0.05) are highlighted in bold; Values expressed as Mean ± Standard Deviation



GRAPH 4: Intergroup Comparison of VAS Scores

DISCUSSION

Dentinal hypersensitivity following vital tooth preparation remains one of the most common postoperative complications encountered during fixed prosthodontic treatment. Exposure of dentinal tubules during tooth preparation increases dentinal permeability, allowing external stimuli to induce fluid movement within the tubules, thereby activating pulpal nerve endings according to Brännström's hydrodynamic theory. This mechanism forms the biological basis for the use of dentinal desensitizing agents to reduce postoperative discomfort.[4]

The present randomized clinical study compared the effectiveness of two dentinal desensitizing agents with a control group in reducing dentinal hypersensitivity following vital tooth preparation. The demographic variables, including age and gender distribution, were statistically comparable among the three groups, indicating successful randomization and eliminating demographic bias. Baseline VAS scores were identical among all groups, confirming that all participants started the study under similar clinical conditions.

The findings of the present study demonstrated a statistically significant reduction in dentinal hypersensitivity within all three groups over the observation period. However, both desensitizer groups exhibited a significantly greater reduction in pain scores compared with the control group from 5 minutes onwards, and this improvement continued through the 7-day

follow-up period. These findings indicated that the application of dentinal desensitizing agents immediately after tooth preparation effectively minimizes postoperative sensitivity.

The superior performance of the desensitizer groups observed in the present study is consistent with the systematic review by da Rosa et al. (2013)[7], who concluded that currently available dentin desensitizing agents effectively reduce dentinal hypersensitivity by either occluding dentinal tubules or reducing neural excitability. Similarly, Kim et al. in 2024 evaluated a universal adhesive containing mesoporous bioactive glass in a randomized split-mouth clinical trial and reported significant reductions in hypersensitivity following application compared with baseline. Their study demonstrated that immediate tubule sealing and bioactive mineral deposition effectively reduced pain perception. The rapid decrease in VAS scores observed within 5 minutes in the present study supports their findings, suggesting that immediate dentinal tubule occlusion plays a major role in postoperative pain reduction.[8]

The results of the present study also correlates the systematic review by Al-Haddad et al. who reported that bioactive glass-based desensitizers consistently produce significant reductions in dentinal hypersensitivity in both short-term and medium-term clinical evaluations. Their review further suggested that bioactive materials perform better than conventional desensitizing agents. Although the current study did not specifically evaluate bioactive glass, the observed sustained reduction in hypersensitivity over seven days also supports the overall conclusion that effective desensitizing materials provide lasting clinical benefits.[9]

Likewise, Corrêa TH, da Rosa WL, Lund RG concluded that several dentinal desensitizing agents demonstrate long-term clinical efficacy with significant reductions in pain scores. The present study similarly demonstrated progressive reduction in hypersensitivity throughout the observation period, with the greatest improvement observed at the seventh day, thereby reinforcing the long-term effectiveness of desensitizer application after vital tooth preparation.[10]

The findings of the present study are also in agreement with the randomized clinical trial conducted by Shabbir et al. in 2024, who evaluated seventh-generation bonding agents as dentin desensitizers. They reported significant decreases in dentinal hypersensitivity immediately after application and during subsequent follow-up visits.[11]

Pradeep and Sharma in 2010 also compared potassium nitrate with fluoride varnish for the management of dentinal hypersensitivity and found that both materials significantly reduced in postoperative pain compared with baseline values. Although the materials evaluated differed from those in the present study, the consistent reduction in hypersensitivity further validates the effectiveness of desensitizing therapy irrespective of the specific material employed.[12]

The present study also coincides with the observations of N Gupta who emphasized that exposed dentin during tooth preparation is the principal cause of postoperative sensitivity and that the use of appropriate desensitizing agents significantly improves patient comfort.[13]

Similarly, Shenoy and Anas[14] reviewed post-cementation sensitivity in vital abutments and concluded that dentinal sealing immediately after tooth preparation is one of the most effective preventive strategies against postoperative hypersensitivity. The marked reduction in VAS scores observed in both experimental groups in their study further supports this recommendation.

Dodiya et al. evaluated dentinal hypersensitivity following vital tooth preparation using desensitizing agents in a randomized clinical trial. Their study demonstrated significant reduction in postoperative sensitivity among patients receiving desensitizers compared with controls. Similar observations were obtained also in the present study, where both experimental groups showed statistically lower VAS scores than the control group at all follow-up intervals after desensitizer application.[15]

The present study possesses several clinical strengths. It employed a prospective randomized design, standardized tooth preparation procedures, identical evaluation intervals, and validated pain assessment using the Visual Analogue Scale. These methodological considerations enhance the reliability and clinical applicability of the findings.

Limitations

However, certain limitations should be acknowledged. The sample size was relatively small, the follow-up period was limited to seven days, and only immediate postoperative sensitivity was evaluated. Long-term follow-up after final cementation and assessment of additional desensitizing materials with larger multicenter trials would provide more comprehensive evidence regarding their long-term clinical performance.

CONCLUSION

Within the limitations of this prospective randomized clinical study, the application of dentinal desensitizing agents following vital tooth preparation significantly reduced postoperative dentinal hypersensitivity compared with the control group. Both GLUMA and FGM Desensibilize KF demonstrated a rapid and sustained reduction in VAS scores from 5 minutes to 7 days after application. GLUMA demonstrated a greater reduction in VAS scores at all follow-up intervals, with a 93.9% reduction in hypersensitivity at 7 days compared with 90.2% for FGM Desensibilize KF. Therefore, GLUMA exhibited the most favourable overall clinical performance and may be considered the preferred desensitizing agent for minimizing postoperative sensitivity and improving patient comfort during fixed prosthodontic treatment.

Conflict of interest: The authors declare no conflict of interest.

Funding: No external funding was received for this study.

Ethical Approval: The study was approved by the Institutional Ethics Committee bearing number SDCH/SS-PROSTHO/IEC/12/2026.

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