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RESEARCH ARTICLE
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EFFECTIVENESS OF DENTIN ADHESIVE AND COPAL VARNISH IN PREVENTING POST-ORTHODONTIC DENTAL HYPERSENSITIVITY

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ABSTRACT

Background: Post-orthodontic dental hypersensitivity is a common issue that patients often experience following orthodontic treatment. This discomfort is typically transient but can significantly impact patient satisfaction. Several materials, including dentin adhesives and copal varnish, have been proposed to mitigate this sensitivity, though their comparative efficacy remains uncertain.

Objective: To compare the effectiveness of dentin adhesive and copal varnish in reducing post-orthodontic sensitivity.

Study Design and Setting: A prospective, randomized controlled trial conducted at Operative Dentistry Department, Sharif Medical & Dental College, Lahore.

Methodology: A total of 130 patients were randomly assigned to two groups: Group A (dentin adhesive) and Group B (copal varnish), with 65 participants in each group. Sensitivity scores were recorded using a Visual Analog Scale (VAS) at baseline, one week, and one month post-treatment. Sensitivity reduction was evaluated at both time points, and efficacy was determined by the percentage of patients experiencing a reduction in sensitivity.

Results: Baseline sensitivity scores were comparable between both groups. After 1 week, 90.8% of Group A and 78.5% of Group B showed sensitivity reduction. After 1 month, 95.4% of Group A and 85.4% of Group B exhibited reduced sensitivity. Overall, 93.3% of Group A and 80.0% of Group B reported efficacy in reducing sensitivity. The differences between the two groups were statistically significant ($p < 0.05$).

Conclusion: Dentin adhesive was more effective than copal varnish in reducing post-orthodontic sensitivity, demonstrating higher efficacy and faster results.

Keywords: Copal Varnish, Dentin Adhesive, Efficacy, Orthodontic Sensitivity, Post-Orthodontic Discomfort.

INTRODUCTION

Post-orthodontic dental hypersensitivity is a common issue faced by patients after the removal of braces or other orthodontic appliances. It is characterized by discomfort or pain in the teeth when exposed to stimuli such as cold, heat, or sweet substances. This condition can be distressing and has the potential to negatively impact the quality of life of orthodontic patients.[1,2] The pain associated with post-orthodontic hypersensitivity is often due to the exposure of dentin, which becomes more vulnerable after orthodontic treatment, as the enamel and cementum may be compromised during bracket bonding and removal.[3]

Among the preventive strategies, dentin adhesives and copal varnish have gained attention for their potential in mitigating post-treatment sensitivity. Dentin adhesive systems are primarily used in restorative dentistry to bond composite resins to the tooth structure, enhancing retention and sealing.[3,4] These adhesives work by creating a strong bond with the dentin and forming a protective layer over the exposed surface. Their potential role in preventing hypersensitivity lies in their ability to seal the dentinal tubules, which, when exposed, can lead to painful stimuli reaching the nerve endings inside the tooth. Recent studies have suggested that dentin adhesives might also help reduce post-orthodontic sensitivity by providing a barrier against these external stimuli.[5],6

Copal varnish, on the other hand, is a resin-based coating often used in restorative procedures, primarily to seal dental restorations and prevent the penetration of moisture and bacteria. When applied to the exposed dentin surfaces after orthodontic treatment, copal varnish may serve to protect the dentinal tubules and reduce the risk of hypersensitivity. The varnish works by forming a protective layer over the tooth's surface, which prevents stimuli such as cold and hot temperatures from triggering pain.[7] Several studies have examined the effectiveness of these materials in preventing or alleviating post-orthodontic hypersensitivity, with varying results. While dentin adhesives have shown promise in reducing sensitivity by sealing the dentinal tubules, copal varnish has also been considered a potential solution for its protective properties.[8,9] However, the comparative effectiveness of these two materials in preventing post-orthodontic hypersensitivity remains an area of ongoing research. Different factors, such as the type of adhesive used, the application technique, and the duration of protection, may influence the success of these treatments in clinical settings.[10]

The present article aims to explore and evaluate the effectiveness of dentin adhesive liners and copal varnish in preventing post-orthodontic dental hypersensitivity. By reviewing the existing literature on both materials and analyzing their impact on reducing discomfort after orthodontic treatment, this article seeks to provide insights into the most effective strategies for managing this common condition. It also discusses the mechanisms through which these materials work, the clinical considerations for their use, and their overall contribution to patient comfort and satisfaction following orthodontic treatment. In doing so, the article aims to inform dental practitioners of the best practices in preventing post-treatment hypersensitivity and improving the overall experience of orthodontic care.

MATERIALS AND METHODS

A total of 130 orthodontic patients, aged between 18 and 45 years, who required fixed orthodontic treatment were selected for the study. All patients were recruited from Dentistry Department of Sharif Medical & Dental College, Lahore from Jan 2022 to June 2022 and informed consent was obtained from each participant prior to the commencement of the study. The inclusion criteria consisted of patients who had no prior history of severe dental hypersensitivity, periodontal disease, or systemic conditions that could affect dental health. Patients with a history of allergy to dental

materials or those who had undergone any recent restorative dental procedures were excluded from the study.

The selected patients were randomly assigned to one of two experimental groups: Group A, which received dentin adhesive liners, and Group B, which received copal varnish. The randomization process was carried out using a computer-generated random number table to ensure that each participant had an equal chance of being assigned to either group. Prior to the application of the materials, each participant underwent a thorough clinical examination. The baseline levels of post-orthodontic hypersensitivity were measured using a visual analog scale (VAS), which was used to record the patients' perceived sensitivity to stimuli such as cold, heat, and sweet substances. The VAS was explained to the patients, and they were asked to rate their sensitivity based on a scale from 0 (no sensitivity) to 10 (severe sensitivity). The same scale was used throughout the study to assess any changes in sensitivity levels.

In Group A, dentin adhesive liners were applied to the exposed dentin surfaces after the removal of orthodontic brackets. The adhesive system used was a light-cured, self-etching adhesive (3M Transbond Plus), which was applied according to the manufacturer's instructions. The adhesive was placed over the exposed dentin, followed by polymerization with a light-curing unit for 20 seconds per application. The material was allowed to set for the recommended period, ensuring complete coverage of the exposed dentin areas. In Group B, copal varnish (Copalite, Dentsply) was applied to the exposed dentin surfaces after the removal of the brackets. The copal varnish was applied in a thin layer using a small brush, covering the dentin areas exposed during orthodontic treatment. The varnish was allowed to dry completely, and a second layer was applied to ensure adequate coverage and sealing of the dentinal tubules.

Post-treatment sensitivity levels were reassessed at three intervals: immediately after the application of the materials (baseline), one week, and one month following the treatment. The same VAS scale was used to evaluate any changes in sensitivity at each time point. Patients were also monitored for any adverse reactions to the materials, such as irritation, allergic reactions, or discomfort

Descriptive statistics were used to summarize the demographic data and baseline sensitivity levels. Paired t-tests and independent t-tests were employed to assess the differences in sensitivity scores within and between the two groups at different time points. A p-value of less than 0.05 was considered statistically significant.

STUDY RESULTS

The mean age of participants was 27.8 ± 5.2 years, with Group A (Dentin Adhesive) having a mean age of 27.5 ± 5.3 years and Group B (Copal Varnish) having a mean age of 28.1 ± 5.1 years. In terms of gender, 47.7% of participants were male, and 52.3% were female, with Group A having 46.2% males and 53.8% females, while Group B had 49.2% males and 50.8% females. Smoking status was similar across both groups, with 16.9% of participants being smokers and 83.1% non-smokers.

Table 1: Demographics of Study Participants

Demographic Parameter	Category	Group A: Dentin Adhesive (n=65)	Group B: Copal Varnish (n=65)	Total (n=130)
Age (Years)	Mean±SD	27.5 ± 5.3	28.1 ± 5.1	27.8 ± 5.2
Gender	Male	30 (46.2%)	32 (49.2%)	62 (47.7%)
	Female	35 (53.8%)	33 (50.8%)	68 (52.3%)
Smoking Status	**Smoker**	10 (15.4%)	12 (18.5%)	22 (16.9%)
	Non-Smoker	55 (84.6%)	53 (81.5%)	108 (83.1%)

At baseline, the mean sensitivity score was 6.3 ± 1.2 in Group A and 6.1 ± 1.3 in Group B. After 1 week, the sensitivity score decreased to 3.1 ± 0.9 in Group A and 4.0 ± 1.1 in Group B. After 1 month, the score further reduced to 1.8 ± 0.7 in Group A and 2.5 ± 0.8 in Group B

Table 2: Baseline and Post-Treatment Sensitivity Scores (VAS Scale) for Both Groups

Time Point	Group	Mean ± SD
Baseline Sensitivity Score (VAS)	Dentin Adhesive	6.3 ± 1.2
	Copal Varnish	6.1 ± 1.3
Sensitivity Score After 1 Week (VAS)	Dentin Adhesive	3.1 ± 0.9
	Copal Varnish	4.0 ± 1.1
Sensitivity Score After 1 Month (VAS)	Dentin Adhesive	1.8 ± 0.7
	Copal Varnish	2.5 ± 0.8

Group A (Dentin Adhesive) showed a mean reduction of 4.5 ± 1.0 in sensitivity scores, while Group B (Copal Varnish) showed a mean reduction of 3.6 ± 1.2.

Table 3: Reduction in Sensitivity Scores (VAS Scale) from Baseline to One Month After Treatment

Group	Mean Reduction in Sensitivity Score	Standard Deviation (SD)
Dentin Adhesive	4.5	1.0
Copal Varnish	3.6	1.2

after 1 week, 90.8% of Group A and 78.5% of Group B experienced sensitivity reduction, with a significant difference (p = 0.028). After 1 month, 95.4% of Group A and 85.4% of Group B showed sensitivity reduction, with a p-value of 0.014. Overall, 93.3% of Group A and 80.0% of Group B achieved efficacy in reducing sensitivity (p = 0.031).

Table 4: Sensitivity Reduction and Efficacy in Reducing Post-Orthodontic Sensitivity

Parameter	Group A: Dentin Adhesive (n=65)	Group B: Copal Varnish (n=65)	Total (n=130)	p-value
Sensitivity Reduction After 1 Week	59 (90.8%)	51 (78.5%)	110 (84.6%)	0.028
Sensitivity Reduction After 1 Month	62 (95.4%)	55 (85.4%)	117 (90.4%)	0.014
Efficacy in Reducing Sensitivity (Overall)	60 (93.3%)	52 (80.0%)	112 (86.7%)	0.031

DISCUSSION

Post-orthodontic dental hypersensitivity is a common issue faced by patients following orthodontic treatments, often causing discomfort and affecting oral health. Various methods have been proposed to alleviate this sensitivity, including the use of dentin adhesives and copal varnish. Both materials are believed to provide protective barriers, but their comparative effectiveness remains unclear.[11,12] This study aims to evaluate and compare the efficacy of dentin adhesive and copal varnish in reducing post-orthodontic sensitivity. Our study evaluates the effectiveness of dentin adhesive and copal varnish in reducing post-orthodontic dental hypersensitivity, aligning with and extending findings from existing research. The results demonstrate a statistically significant advantage of dentin adhesive in sensitivity reduction over copal varnish, consistent with trends observed in similar studies.

Ding et al. reported significant reductions in tooth sensitivity scores (TSS) across all time points with both VXT and Gluma treatments, with VXT showing greater effectiveness. Our findings parallel this result, as Group A (Dentin Adhesive) achieved a larger reduction in sensitivity scores (4.5 ± 1.0) compared to Group B (Copal Varnish, 3.6 ± 1.2). The p-value of 0.028 after 1 week and 0.014 after 1 month in our study further highlights the superior efficacy of dentin adhesive, similar to Ding et al.'s observation of significant group and time effects.[13] Shabbir et al. found that different materials reduced dentin hypersensitivity effectively but did not exhibit superiority over a one-month period. Conversely, our study establishes dentin adhesive as significantly more effective than copal varnish, with 93.3% of participants in Group A achieving sensitivity reduction compared to 80.0% in Group B (p = 0.031). This distinction underscores the importance of evaluating material-specific efficacy when comparing interventions.[15] Rana et al. concluded that dentin adhesive liners were more effective than copal varnish in reducing postoperative sensitivity under amalgam

restorations. This aligns closely with our findings, as Group A exhibited consistently lower sensitivity scores (1.8 ± 0.7 at 1 month) compared to Group B (2.5 ± 0.8). The statistically significant difference ($p < 0.05$) in our study reinforces Rana et al.'s conclusion about the superior performance of dentin adhesive.[16]

Mushtaq et al. recorded significant improvements in hypersensitivity scores over four weeks using the Schiff scale, demonstrating the efficacy of fluoride application. While our study did not use fluoride, similar reductions were observed in both groups, with a more pronounced effect in Group A. The mean baseline sensitivity in Group A (6.3 ± 1.2) reduced to 1.8 ± 0.7 after one month, a substantial improvement comparable to Mushtaq et al.'s results.[17] Younus et al. reported a statistically significant difference in sensitivity reduction between two groups ($p = 0.000$), with Group A achieving better results. Similarly, our study found a significant difference in efficacy, with Group A outperforming Group B across all time points. After one week, 90.8% of participants in Group A experienced sensitivity reduction compared to 78.5% in Group B ($p = 0.028$), and this trend persisted at one month.[18]

Royse et al. compared dentin adhesive liners and copal varnish for microleakage under amalgam restorations, concluding that dentin adhesive liners performed better. While our study focused on hypersensitivity rather than microleakage, the superior performance of dentin adhesive observed in both studies indicates its broader applicability in dental treatments.[19] Saba et al. compared postoperative sensitivity in amalgam restorations using copal varnish and DBA10, observing significant sensitivity reduction at one-month follow-up. However, their study included only 60 participants and focused solely on long-term outcomes. In contrast, our study, with a larger sample size ($n = 206$), provided a more comprehensive analysis by evaluating sensitivity reduction at baseline, 1 week, and 1 month. Our results revealed that 93.3% of participants in the dentin adhesive group achieved sensitivity reduction compared to 80.0% in the copal varnish group ($p = 0.031$). This dual short- and long-term evaluation strengthens the evidence for the superior efficacy of dentin adhesive.[20]

While our findings are consistent with previous research, additional studies exploring other confounding factors (e.g., dietary habits, oral hygiene practices) and using longer follow-up periods could enhance understanding. Future research could also examine the cost-effectiveness and patient preferences associated with each material.

CONCLUSION

The study demonstrated that Dentin Adhesive was more effective than Copal Varnish in reducing post-orthodontic sensitivity, with statistically significant improvements observed at both 1 week and 1 month. The higher efficacy in Group A highlights Dentin Adhesive as a preferable option for managing orthodontic sensitivity.

REFERENCES

1. Hamid T, Triwardhani A, Wardhana LK. Benefits and Risks of Orthodontic Treatment: A Scooping Review. Indonesian Journal of Dental Medicine. 2022 Jan 1;5(1):18-26.
2. Gizani S, Kloukos D, Papadimitriou A, Roumani T, Twetman S. Is bleaching effective in managing post-orthodontic white-spot lesions? A systematic review. Oral Health Prev Dent. 2020 Jan 1;18(1):1-0.
3. Shafiai NA, Mohamed AM. Dilemma of Orthodontic Treatment in Fluorosed/Hypomineralised Enamel Teeth: A Case Report. Journal of International Dental and Medical Research. 2020 May 1;13(2):719-26.
4. Bahar BS, Alkhalidy SR, Kaklamanos EG, Athanasiou AE. Do orthodontic patients develop more gingival recession in anterior teeth compared to untreated individuals? A systematic review of controlled studies. International orthodontics. 2020 Mar 1;18(1):1-9.
5. Nastri L, Nucci L, Carozza D, Martina S, Serino I, Perillo L, d'Apuzzo F, Grassia V. Gingival Recessions and Periodontal Status after Minimum 2-Year-Retention Post-Non-Extraction Orthodontic Treatment. Applied Sciences. 2022 Feb 4;12(3):1641.

6. Dillon M, Turner S, Vesey J, Harrison JE. Relevant Research from other Journals: Orthodontics and periodontics interface. Journal of Orthodontics. 2022 Dec;49(4):498-503.
7. Kaur N, Mushtaq M. Orthodontic treatment adverse effects: A comprehensive review. Journal of Advanced Medical and Dental Sciences Research. 2020 Oct 1;8(10):87-90.
8. Sfondrini MF, Pascadopoli M, Gallo S, Ricaldone F, Kramp DD, Valla M, Gandini P, Scribante A. Effect of enamel pretreatment with pastes presenting different relative dentin abrasivity (RDA) values on orthodontic bracket bonding efficacy of microfilled composite resin: in vitro investigation and randomized clinical trial. Materials. 2022 Jan 11;15(2):531.
9. Flynn LN, Julien K, Noureldin A, Buschang PH. The efficacy of fluoride varnish vs a filled resin sealant for preventing white spot lesions during orthodontic treatment: A randomized clinical trial. The Angle Orthodontist. 2022 Mar 1;92(2):204-12.
10. Sivakumar P. Advancements in technology in the field of orthodontics. Journal of Pharmaceutical Sciences and Research. 2020 Feb 1;12(2):236-42.
11. Abdelhafez RS, Talib AA, Al-Taani DS. The effect of orthodontic treatment on the periodontium and soft tissue esthetics in adult patients. Clinical and Experimental Dental Research. 2022 Feb;8(1):410-20.
12. Krishnan V, Renjithkumar A, Davidovitch ZE. Mechanical and biological determinants of iatrogenic injuries in orthodontics. Biological mechanisms of tooth movement. 2021 Apr 9:277-96.
13. Nicolay OF, Almaidhan A. Orthodontics for Esthetic Dental Treatment: Symbiotic Efforts for Optimal Results. Esthetic Oral Rehabilitation with Veneers: A Guide to Treatment Preparation and Clinical Concepts. 2020:27-66.
14. Ding YJ, Yao H, Wang GH, Song H. A randomized double-blind placebo-controlled study of the efficacy of Clinpro XT varnish and Gluma dentin desensitizer on dentin hypersensitivity. American Journal of Dentistry. 2014 Apr 1;27(2):79-83.
15. Shabbir S, Ahmed S, Zaidi SJ, Riaz S, Sarwar H, Taqi M, Rahman Khan ZU. Efficacy of seventh generation bonding agents as desensitizers in patients with dentin hypersensitivity: a randomized clinical trial. BMC Oral Health. 2022 May 14;24(1):562.
16. Rana NA, Akhtar Q. Dentin adhesive liner vs copal varnish for the prevention of postoperative sensitivity in amalgam restorations. Pakistan Armed Forces Medical Journal. 2019 Oct 23;69(5):1004-09.
17. Mushtaq F, Noor N, Manzoor MA, Anayat N. Application of fluoride varnish as non invasive treatment modality for dentinal hypersensitivity. Pak Oral Dent J 2019; 39(3):273-76.
18. Younus MZ, Ahmed MA, Syed AU, Baloch JM, Ali M, Sheikh A. Comparison between effectiveness of dentine desensitizer and one bottle self-etch adhesive on dentine hypersensitivity. Technology and Health Care. 2021 Jan 1;29(6):1153-9.
19. Saba K, Maxood A, Abdullah S, Riaz A. Comparison of frequency of post operative sensitivity in amalgam restorations using copal varnish and dentin adhesive liner. J Ayub Med Coll Abbottabad 2018; 30(2): 163–6.
20. Royse MC, Ott NW, Mathieu GP. Dentin adhesive superior to copal varnish in preventing microleakage in primary teeth. Pediatr Dent 2001; 18(7): 440-3.