JOURNAL OF HEALTHCARE SCIENCES
Volume 4 Issue 12 2024, Article ID: JOHS2024000943
http://dx.doi.org/10.52533/JOHS.2024.41202
e-ISSN: 1658-8967

Review

Management of Post-Operative Sensitivity Following Restorative Procedures

Awwad Rubaiaan Alrawqi[1], Rana Abdullah Alghamdi[2], Ahmed Faisal Sajini[3], Noo Khalaf Alshammari[4], Ali Abdullah Al Maniah[5], Deena Abdullah Alsharif[6], Farid Naser Ashi[7]

[1] *Department of Restorative Dentistry, Al Thager Hospital, Jeddah, Saudi Arabia*
[2] *Department of Restorative Dentistry, North Jeddah Speciality Dental Center, Jeddah, Saudi Arabia*
[3] *College of Dentistry, King Abdulaziz University, Jeddah, Saudi Arabia*
[4] *College of Dentistry, University of Hail, Hail, Saudi Arabia*
[5] *Dental Department, Thanaya Dental Center, Khamis Mushait, Saudi Arabia*
[6] *Dental Department, King Abdulaziz University Dental Hospital, Jeddah, Saudi Arabia*
[7] *Dental Department, Al Thager Hospital, Jeddah, Saudi Arabia*

Correspondence should be addressed to **Awwad Rubaiaan Alrawqi,** Department of Restorative Dentistry, Al Thager Hospital, Jeddah, Saudi Arabia. Email: aalrawqi@moh.gov.sa

Received: 10 November 2024, Reviewed: 04 December 2024, Accepted: 07 December 2024, Published: 08 December 2024.

Abstract

Post-operative sensitivity following restorative dental procedures is a common issue that can lead to patient discomfort and dissatisfaction. The condition arises from the exposure of dentinal tubules during treatment, leading to fluid movement within the tubules that triggers nerve responses. Various factors contribute to this sensitivity, including the choice of restorative materials, bonding techniques, and the extent of cavity preparation. Resin-based composites are commonly associated with sensitivity due to polymerization shrinkage, which can cause microleakage. However, incremental layering and improved bonding agents help mitigate this problem. The use of glass ionomer cements (GICs) and bulk-fill composites has shown promise in reducing post-operative sensitivity. GICs bond chemically to the tooth and release fluoride, which reduces sensitivity over time. Bulk-fill composites allow for faster placement with less polymerization shrinkage, further minimizing discomfort. Additionally, laser therapy has emerged as an effective method for sealing dentinal tubules and providing long-term relief, especially in severe cases. Patient management is key to reducing sensitivity in the long term. Desensitizing toothpaste containing potassium nitrate or stannous fluoride helps block neural responses in the dentinal tubules, while fluoride varnishes strengthen enamel and occlude tubules. Occluding agents like oxalate compounds and in-office laser treatments also provide significant relief for patients with persistent sensitivity. Education on proper oral care and sensitivity management, combined with regular follow-up treatments, ensures better outcomes. By utilizing appropriate materials, techniques, and patient-centered management strategies, clinicians can effectively address post-operative sensitivity and enhance patient satisfaction. The careful selection of materials and the use of advanced techniques provide both immediate and long-term benefits, improving the overall success of restorative treatments.

Keywords: *Post-operative sensitivity, restorative procedures, composite resin, desensitizing agents, complication*

Introduction

Post-operative sensitivity is a common complication experienced by patients following restorative dental procedures. It can range from mild discomfort to intense pain, significantly affecting patient satisfaction and clinical outcomes. This condition is typically characterized by transient sharp pain in response to external stimuli such as thermal, tactile, or osmotic changes, and it often arises from the exposed dentin following restorative treatments. While post-operative sensitivity is generally self-limiting, its persistence can pose a challenge for both patients and clinicians, necessitating an understanding of its causes and management strategies.

The primary etiology of post-operative sensitivity is the irritation of the dentinal tubules, which become exposed during the restorative process. Dentinal hypersensitivity is often triggered when enamel or cementum is removed or disrupted, allowing external stimuli to directly affect the underlying dentin and the pulp. The hydraulic conductance theory, which postulates that the movement of fluids within the dentinal tubules stimulates nerve endings in the pulp, is widely accepted as the underlying mechanism of post-operative sensitivity (1). The degree of sensitivity can be influenced by the type of restorative material used, the extent of cavity preparation, and the technique employed during restoration.

Several studies have investigated the role of different restorative materials in mitigating post-operative sensitivity. Resin-based composites, glass ionomer cements, and amalgams are commonly used materials, each with its own advantages and potential to cause sensitivity (2, 3). Composite resins, while aesthetically favorable, are associated with higher rates of post-operative sensitivity due to polymerization shrinkage, which may lead to microleakage at the restoration margins (4). In contrast, glass ionomer cements, known for their fluoride release and ability to bond to tooth structure, are generally less likely to cause post-operative discomfort (5).

Management of post-operative sensitivity requires a multifaceted approach, encompassing appropriate material selection, technique refinement, and patient education. Clinicians must be aware of the potential for sensitivity and take preventative measures during treatment planning and execution. Additionally, patient-specific factors, such as pre-existing dentinal hypersensitivity (6), should be considered in order to minimize the risk of post-operative complications. This review aims to explore the current understanding of post-operative sensitivity, its causes, and effective management strategies to provide clinicians with evidence-based approaches for minimizing patient discomfort and improving clinical outcomes.

Review

Post-operative sensitivity remains a significant clinical challenge following restorative procedures, particularly when the dentin is exposed during treatment. The use of resin-based composites has been frequently associated with heightened sensitivity, primarily due to polymerization shrinkage. This shrinkage can cause the material to pull away from the cavity walls, leading to microleakage, which allows external stimuli to reach the dentinal tubules and cause pain (7). However, advances in adhesive technology have sought to address this issue by improving the bond strength between the restorative material and tooth structure, thereby reducing the risk of microleakage.

Another contributing factor to post-operative sensitivity is the degree of cavity preparation. Excessive removal of tooth structure or improper handling of the dental tissues can increase the likelihood of dentinal exposure, which, in turn, enhances the chances of sensitivity (8). Techniques that preserve tooth structure, such as minimally invasive dentistry, have gained popularity for their ability to reduce this risk. Additionally, the selection of restorative materials that release fluoride, such as glass ionomer cements, has been shown to be effective in reducing post-operative sensitivity due to their ability to form a chemical bond with the tooth and reduce microleakage over time.

http://dx.doi.org/10.52533/JOHS.2024.41202

Etiology and Contributing Factors to Post-Operative Sensitivity

Post-operative sensitivity following restorative procedures can be attributed to a variety of factors, most of which are related to the interaction between restorative materials, techniques, and the tooth structure itself. One primary cause is the disruption of the dentin-pulp complex, where restorative procedures expose the dentinal tubules, making them vulnerable to external stimuli such as temperature changes, osmotic pressure, and physical contact. This can lead to fluid movement within the tubules, which activates the nerves located in the pulp, resulting in a sensation of pain (9).

One of the key contributing factors is the type of restorative material used. Composite resins, which are widely favored for their aesthetic benefits, are often associated with a higher incidence of post-operative sensitivity. The polymerization process of resin-based composites can cause shrinkage, creating gaps between the restorative material and the tooth. This shrinkage can lead to microleakage, allowing fluids, bacteria, and other stimuli to penetrate through to the dentinal tubules, causing sensitivity (10). The depth of the cavity and the volume of composite resin used are also important considerations, as larger volumes of resin are more likely to undergo significant polymerization shrinkage, increasing the risk of sensitivity.

Another important factor in post-operative sensitivity is the bonding technique used during restorative procedures. Inadequate bonding can exacerbate microleakage by failing to form a proper seal between the tooth and the restorative material. Studies have shown that the use of self-etch adhesive systems, while convenient, may be less effective in reducing sensitivity compared to etch-and-rinse systems (11). The etch-and-rinse technique provides better penetration of the adhesive into the dentinal tubules, creating a stronger bond and reducing the potential for microleakage. However, care must be taken to avoid over-etching, as excessive demineralization of dentin can weaken the bond and increase the risk of post-operative discomfort. Cavity preparation and tooth handling during restorative procedures also play a crucial role in determining the extent of post-operative sensitivity. Over-preparation of the tooth, especially in deeper cavities, can result in increased exposure of the dentinal tubules, leading to heightened sensitivity. Furthermore, improper handling of the tooth, such as aggressive air drying or the use of high-pressure rinsing, can cause desiccation of the dentin, further contributing to sensitivity (12). Dentinal desiccation increases the permeability of the dentin and causes more fluid movement within the tubules, which heightens the response to external stimuli.

The placement of temporary restorations between dental appointments may also contribute to sensitivity. Temporary materials, such as zinc oxide-eugenol cements, are commonly used; however, their sealing ability may be suboptimal, leading to leakage and exposure of the dentin. Inadequate sealing of temporary restorations allows for the penetration of bacteria and oral fluids, increasing the risk of inflammation and sensitivity in the tooth structure (13). Therefore, selecting an appropriate temporary material that provides a good seal is crucial in reducing post-operative sensitivity during the interim period between dental visits. The development of post-operative sensitivity is multifactorial, involving a combination of restorative materials, techniques, and patient-specific factors. Awareness of these factors allows clinicians to take preventative measures during treatment to minimize the risk of sensitivity and improve patient comfort.

Techniques and Materials for Reducing Post-Operative Sensitivity

Minimizing post-operative sensitivity starts with selecting the right materials and techniques. Resin-based composites are known for their aesthetic appeal but are also associated with polymerization shrinkage, leading to microleakage and increased sensitivity. The incremental layering technique is commonly used to combat this issue. By placing the composite in thin layers, shrinkage is reduced, and adaptation to the cavity walls improves, lowering the risk of fluid penetration and sensitivity (14).

http://dx.doi.org/10.52533/JOHS.2024.41202

Dentin bonding agents are essential for preventing sensitivity. These agents seal the exposed dentinal tubules, preventing fluid movement that can cause discomfort. Some bonding agents contain desensitizing components like glutaraldehyde or hydroxyethyl methacrylate, which have been shown to significantly reduce sensitivity by occluding the tubules. Multiple layers of bonding agents can be applied to improve the seal and enhance the protection against post-operative sensitivity (15). However, proper application technique is critical, as inadequate bonding may leave gaps, increasing the likelihood of sensitivity.

Glass ionomer cements (GICs) have proven to be effective in reducing post-operative sensitivity. These materials bond chemically to the tooth structure, which helps to reduce microleakage. Their ability to release fluoride over time provides an additional benefit by promoting remineralization of the dentin, further reducing sensitivity. GICs are particularly useful in cases where dentin is exposed or the cavity is deep, as they provide a reliable seal that prevents external stimuli from affecting the pulp (16).

Bulk-fill composites are another advancement aimed at reducing post-operative sensitivity. These materials allow for quicker placement by enabling larger increments to be cured at once, reducing the overall time needed for the procedure. More importantly, bulk-fill composites are designed to have lower polymerization shrinkage compared to traditional composites, minimizing the risk of microleakage and sensitivity. Some of these composites also contain special fillers that help reduce fluid movement within the dentinal tubules, further contributing to reduced sensitivity (17).

Another promising approach in managing post-operative sensitivity is the use of lasers. Lasers can be applied to desensitize the dentin by altering the structure of the dentinal tubules, effectively sealing them off and preventing fluid movement. This technique has shown positive results in clinical studies, particularly for patients with severe dentin hypersensitivity. Laser treatment can be used in combination with traditional restorative materials to provide an additional layer of protection against post-operative discomfort (18). However, it may not be suitable for all patients or clinical situations, as the success of this approach can depend on the specific type of laser and the clinical setting.

In addition to these materials and techniques, proper tooth preparation and handling are also critical for reducing sensitivity. Over-preparation or aggressive handling of the tooth can increase the risk of sensitivity by exposing more dentinal tubules. Careful cavity preparation, with minimal removal of tooth structure, helps preserve the dentin and reduce the chances of post-operative sensitivity. Avoiding excessive air drying and high-pressure rinsing during the procedure also prevents dentinal desiccation, which can contribute to sensitivity. These strategies offer clinicians various options to minimize post-operative sensitivity and improve patient comfort. By carefully selecting materials and applying proper techniques, the occurrence of sensitivity can be significantly reduced.

Patient Management Strategies for Long-Term Relief

Effective management of post-operative sensitivity requires not only immediate treatment during the procedure but also long-term strategies to ensure patient comfort. One key approach is patient education. Educating patients about potential post-operative sensitivity helps set realistic expectations and encourages them to take an active role in managing their symptoms. Patients should be informed about the importance of avoiding hot or cold stimuli and using sensitivity toothpaste, which can significantly reduce discomfort over time (19).

Desensitizing toothpaste containing ingredients such as potassium nitrate or stannous fluoride has been shown to be effective in managing sensitivity by blocking the neural response in the dentinal tubules. Potassium nitrate works by calming the nerves in the tooth, while stannous fluoride forms a protective layer over exposed dentin, reducing sensitivity to external stimuli. Regular use of these toothpastes can provide significant relief, particularly in patients who experience chronic sensitivity after restorative procedures (20).

http://dx.doi.org/10.52533/JOHS.2024.41202

Clinicians should recommend such products to patients experiencing prolonged discomfort to promote better long-term outcomes.

Fluoride varnishes are another tool in the long-term management of post-operative sensitivity. Fluoride varnish applications strengthen the enamel and help occlude the dentinal tubules, reducing fluid movement that triggers sensitivity. These varnishes can be applied during follow-up visits and are especially useful for patients with persistent or severe sensitivity. Additionally, the high fluoride concentration in these varnishes promotes remineralization of the tooth structure, offering long-term benefits for managing sensitivity (21). Fluoride varnishes can also be used in conjunction with other desensitizing treatments for enhanced results.

Occluding agents, such as oxalate compounds, have been employed in reducing dentin hypersensitivity by forming calcium oxalate crystals within the dentinal tubules. These agents create a physical barrier that prevents the movement of fluids inside the tubules, thus reducing pain. Applying oxalate-based desensitizers during restorative procedures or in follow-up appointments has been effective in many cases, particularly when combined with other treatments like fluoride varnishes or bonding agents (22). This approach helps prevent further fluid movement within the tubules, addressing one of the key mechanisms behind post-operative sensitivity.

In-office treatments, such as laser therapy, have also been effective in providing long-term relief for patients with severe post-operative sensitivity. Laser therapy works by sealing the dentinal tubules and reducing nerve excitation within the tooth, offering immediate and lasting relief. Although laser treatment is a more advanced option, it has shown promising results, especially for patients with chronic sensitivity that does not respond to conventional treatments (23). The choice of laser wavelength and technique can vary depending on the severity of the sensitivity and the clinical setting, but it remains a valuable tool in the long-term management of dentin hypersensitivity. In some cases, patients with persistent post-operative sensitivity may require more invasive interventions, such as the placement of protective restorations over sensitive areas. These restorations act as a barrier, shielding the exposed dentin and reducing the risk of external stimuli triggering sensitivity. Temporary or permanent coverage using materials like resin-based sealants or glass ionomer cements can provide relief for patients who do not respond to less invasive treatments. Clinicians should consider these options for patients who continue to experience discomfort after using other long-term strategies.

Conclusion

In managing post-operative sensitivity, the integration of appropriate materials, techniques, and patient-focused strategies is crucial for long-term success. Clinicians must carefully choose materials that reduce sensitivity and educate patients on maintaining oral health post-treatment. Utilizing in-office treatments and recommending desensitizing products can provide lasting relief and prevent complications. Tailoring management to each patient's needs ensures better outcomes and improved comfort.

Disclosure

Conflict of interest

There is no conflict of interest.

Funding

No funding

Ethical Consideration

Not applicable.

Data availability

Data that support the findings of this study are embedded within the manuscript.

Author Contribution

The authors contributed to conceptualizing, data drafting, collection and final writing of the manuscript.

http://dx.doi.org/10.52533/JOHS.2024.41202

References

1. Pashley DH. Dentin permeability, dentin sensitivity, and treatment through tubule occlusion. Journal of endodontics. 1986;12(10):465-74.

2. Davidson CL. Advances in glass-ionomer cements. Journal of Applied Oral Science. 2006;14:3-9.

3. German MJ. Developments in resin-based composites. British Dental Journal. 2022;232(9):638-43.

4. Branstrom M. The hydrodynamics of dentin; its possible relationship to dentinal pain. Internat Dent J. 1972;22:219-27.

5. Tyas MJ. Clinical evaluation of glass-ionomer cement restorations. Journal of applied oral science. 2006;14:10-3.

6. Suchetha A, Prasad K, Apoorva S, Lakshmi P. Dentinal Hypersensitivity-A Review. Indian Journal of Dental Sciences. 2013;5(2).

7. VAN MEERNEEK B. Buonocore Memorial Lecture. Adhesion to enamal and dentin: current status and future challenges. Oper Dent. 2003;28:215-35.

8. Heymann HO, Swift Jr EJ, Ritter AV. Sturdevant's Art & Science of Operative Dentistry-E-Book: Sturdevant's Art & Science of Operative Dentistry-E-Book: Elsevier Health Sciences; 2012.

9. Addy M, Mostafa P, Newcombe R. Dentine hypersensitivity: the distribution of recession, sensitivity and plaque. Journal of dentistry. 1987;15(6):242-8.

10. Swift EJ, Perdigão J, Heymann HO. Bonding to enamel and dentin: a brief history and state of the art, 1995. QUINTESSENCE INTERNATIONAL-ENGLISH EDITION-. 1995;26:95-.

11. Van Noort R, Barbour ME. Introduction to Dental Materials-E-Book: Introduction to Dental Materials-E-Book: Elsevier Health Sciences; 2023.

12. Arısu H, Dalkıhç E, Üçtaşlı M. Effect of desensitizing agents on the microtensile bond strength of a two-step self-etch adhesive to dentin. Operative dentistry. 2011;36(2):153-61.

13. Paulo S, Abrantes AM, Xavier M, Brito AF, Teixo R, Coelho AS, et al. Microleakage Evaluation of Temporary Restorations Used in Endodontic Treatment-An Ex Vivo Study. Journal of functional biomaterials. 2023;14(5).

14. Ferracane JL. Resin composite—state of the art. Dental materials. 2011;27(1):29-38.

15. Haller B. Recent developments in dentin bonding. American Journal of dentistry. 2000;13(1):44-50.

16. Mount GJ, Hume WR, Ngo HC, Wolff MS. Preservation and restoration of tooth structure: John Wiley & Sons; 2016.

17. Ilie N, Hickel R. Investigations on a methacrylate-based flowable composite based on the SDR™ technology. Dental materials. 2011;27(4):348-55.

18. Dederich DN. Laser/tissue interaction: what happens to laser light when it strikes tissue? Journal of the American Dental Association (1939). 1993;124(2):57-61.

19. Orchardson R, Gillam DG. Managing dentin hypersensitivity. The Journal of the American Dental Association. 2006;137(7):990-8.

20. Markowitz K, Kim S. The role of selected cations in the desensitization of intradental nerves. Proceedings of the Finnish Dental Society Suomen Hammaslaakariseuran Toimituksia. 1992;88:39-54.

21. AV R. Treating cervical dentin hypersensitivity with fluoride varnish: a randomized clinical study. J Am Dent Assoc. 2006;137:1013-20.

22. Miglani S, Aggarwal V, Ahuja B. Dentin hypersensitivity: Recent trends in management. Journal of Conservative Dentistry. 2010;13(4):218-24.

23. Moritz A, Gutknecht N, Schoop U, Goharkhay K, EBRAHIM D, Wernisch J, et al. The advantage of CO2-treated dental necks, in comparison with a standard method: results of an in vivo study. Journal of clinical laser medicine & surgery. 1996;14(1):27-32.

http://dx.doi.org/10.52533/JOHS.2024.41202