

Review

Contemporary Endodontic-Restorative Interface Techniques and Materials

Abrar Qasim^{1*}, Rawan Alrehaili², Lama Almohaimeed³, Saleh Algzlan⁴, Mohammed Alanazi⁵, Ali Alnahwi⁶, Raed Hakami⁷, Fahad Alyami⁸, Mousa Qadiri⁹, Saud AlSaif¹⁰, Amani Darweash¹¹

¹ Department of Endodontics, Taif Specialized Dental Center, Taif, Saudi Arabia

² College of Dentistry, Taibah University, Medina, Saudi Arabia

³ College of Dentistry, Qassim University, Buraidah, Saudi Arabia

⁴ Aldulaimiah Primary Healthcare Centre, Ministry of Health, Qassim, Saudi Arabia

⁵ Riyadh First Health Cluster, Ministry of Health, Riyadh, Saudi Arabia

⁶ Eastern Health Cluster, Rafa Medical Complex, Dammam, Saudi Arabia

⁷ Jazan General Hospital, Ministry of Health, Jazan, Saudi Arabia

⁸ College of Dentistry, Najran University, Najran, Saudi Arabia

⁹ Muhayil Specialized Dental Center, Muhayil General Hospital, Muhayil Aseer, Saudi Arabia

¹⁰ College of Dentistry, Riyadh Elm University, Riyadh, Saudi Arabia

¹¹ North Riyadh Dental Center, Ministry of Health, Riyadh, Saudi Arabia

Correspondence should be addressed to **Abrar Qasim**, Department of Physiotherapy, College of Medical Rehabilitation Sciences, Taibah University, Medina, Saudi Arabia. Email: dr.abrarq88@gmail.com

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Abstracts

The field of interface techniques and materials is constantly evolving with advancements in technology and research. In the past, the main focus of therapy was eliminating infection and preventing recontamination. The use of magnification and illumination techniques ensures preparation of access cavities, preserving tooth structure while improving visibility for procedures. Adhesive technology plays a role in establishing an endodontic restorative interface. This review highlights the flexibility of etch and self-etch systems, which can be adapted to various clinical scenarios. These systems do not create a bond but also help seal dentin tubules reducing the risk of micro leakage and bacterial ingress. Ultimately, this fortifies the longevity of treatments. The selection of materials is also explored in this review with composite resins gaining prominence due to their properties and versatility. Nano filled composites for restorations exhibit improved mechanical properties that provide durable solutions. To achieve outcomes, it is crucial to incorporate diagnostic tools, adopt conservative access cavity preparation techniques, carefully select appropriate adhesive systems and make strategic material choices. The review highlights the importance of staying vigilant, following up after treatment and taking an approach to overcome challenges in order to provide patient care. Moving ahead, the review suggests that we continue exploring materials and techniques to improve predictability and clinical outcomes at this junction reflecting our continuous commitment to delivering exceptional dental care.

Keywords: *Endodontics, Restorative Dentistry, Access Cavity, Conservative Access, Adhesive Technology*

Introduction

The field of interface techniques and materials is constantly evolving with advancements in technology and research. In the past the main focus of therapy was eliminating infection and preventing recontamination. However, the success of treatment depends on how we restore the tooth afterward. It's crucial to establish a connection between the treated tooth and restorative materials for term clinical success (1-3). One important aspect is restoring the access cavity. Traditional access cavities were often weakened tooth structure, which compromised its integrity. Now modern techniques prioritize conservative access cavity designs that preserve tooth structure while still providing visibility and access for the endodontic procedure (4, 5). The use of magnification tools and lighting helps achieve precision during access cavity preparation. Additionally, advancements in technology have greatly improved the restorative interface by creating a strong bond, between restorative materials and tooth structure leading to longer lasting restorations (6, 7). The choice between etch and self-etch systems is typically based on the specific clinical scenario and the type of restorative material being used (8, 9). The selection of the material used for restoration is a factor that greatly affects the success of the connection, between treatment and restoration. Composite resins have become increasingly popular due to their appearance and versatility. In particular, nanofilled composites offer improved properties and resistance to wear making them suitable for restoring teeth (10, 11). Glass ionomer cements on the hand are useful in clinical scenarios as they release fluoride helping prevent secondary tooth decay. To provide support and prevent fractures in teeth that have undergone endodontic treatment, fiber reinforced posts have become a standard practice. These posts have an elasticity to dentin reducing the risk of root fractures compared to metal posts. Furthermore, advancements in post systems now include prefabricated shaped posts that simplify the restoration process (12, 13). It is crucial to establish a seal between the filling material in the root canal and the restorative material used. Resin cements play a role in achieving this seal and ensuring a

long-lasting bond. The choice between self-resin cements and conventional ones depends on factors such as whether a post is present the type of restorative material used and the clinical situation at hand. Bioactive materials have gained attention recently due to their potential in enhancing connections, between treatments and restorations (14, 15). Bioceramics, like mineral trioxide aggregate (MTA) and cements based on calcium silicate, have displayed potential in filling root canals because of their ability to promote healing, in tissues and effectively seal the area. These materials have the ability to enhance the long-term success of treatments. In summary, modern techniques and materials used in the interface, between endodontics and restorative dentistry have undergone advancements. These developments are fueled by progress in technology restorative materials and a deeper understanding of the biomechanics involved. The focus is on conservative access cavity designs, use of systems and selecting suitable restorative materials to ensure long lasting success, for teeth that have undergone endodontic treatment. Moving forward it is important for research to continue exploring materials and techniques that can further improve predictability and clinical outcomes in this interface. This review provides an overview of the state of Contemporary Endodontic Restorative Interface Techniques and Materials.

Methodology

A detailed examination was carried out on December 4, 2023, analyzing articles, from the Cochrane Library, PubMed and Scopus. The purpose was to investigate the state of the interface between endodontics and restorative dentistry. The analysis involved searching for keywords such as "endodontics," "dentistry," "Techniques and materials." The objective was to gather information on the techniques and materials used in this field. Specifically, the focus was, on studies conducted in English since 2008.

Discussion

The way dentistry is practiced has evolved with the use of techniques and materials, for restorative interfaces. Dentists now focus on preserving tooth

structure as possible by using conservative access cavity designs instead of large invasive preparations. They also rely on magnification and illumination tools to ensure procedures that not only lead to successful endodontic treatments but also maintain the long-term strength of the tooth. Adhesive technology plays a role in creating a bond, between different components. The use of etch and self-etch systems allows dentists to adapt to various clinical situations while also sealing the dentin tubules reducing the risk of bacterial leakage (8). This improved bond strength, observed in life practices confirms how adhesive technology helps strengthen restorative treatments over time. The use of materials, for purposes has evolved to meet the needs of both aesthetics and functionality. Composite resins and nanofilled composites are commonly used in restorations to strike a balance between visual appeal and mechanical durability. These restorations not only imitate teeth but also withstand the pressure of biting forces reducing the risk of wear and fractures. Fiber reinforced posts have also evolved as an option for post systems as they have elasticity to dentin and minimize the chances of root fractures. The introduction of made posts with anatomical shapes has made the restoration process more efficient by considering practical aspects. Bioactive materials like mineral trioxide aggregate (MTA) and calcium silicate-based cements have transformed interfaces by promoting healing in periapical tissues and emphasizing a more biologically harmonious approach in managing endodontic cases. In terms of resin cements dental professionals appreciate their sealing and bonding properties. The choice between self-traditional resin cements depends on clinical factors highlighting the importance of personalized approaches to achieve optimal results. The successful performance of resin cements in preventing microleakage and enduring oral challenges confirms their effectiveness in interfaces.

Clinical Manifestation

The practical implementation of techniques and materials, at the interface between endodontics and restorative dentistry is crucial in practice as it

greatly influences the success and longevity of treatments (2, 16). This section explores how these techniques are applied in scenarios highlighting their impact on patient outcomes. One major aspect is seen in the approach to preparing access cavities. In the past, traditional access cavities often involved removing an amount of tooth structure, which compromised the strength of the tooth. However, with techniques dentists now adopt conservative designs for access cavities (4, 17). This approach aims to preserve tooth structure while ensuring visibility and access for endodontic procedures. As a result, an invasive access cavity is created that contributes to maintaining the term structural integrity of the tooth. The use of technology plays a role in this context. In practice, dentists choose systems based on specific case requirements. Both etch and self-etch adhesive systems provide flexibility for achieving a bond, between restorative materials and tooth structure. Applying these systems not only ensures a durable bond but also helps seal off dentin tubules reducing the risk of microleakage and preventing bacteria from entering. Clinicians directly observe the influence of systems, on the effectiveness of treatments as stronger bonding plays a significant role, in ensuring the long-term durability of the restoration. The process of restoring teeth that have undergone treatment often involves selecting the materials for the job. Composite resins, known for their properties and versatility are commonly used in settings. Dentists appreciate how these resins seamlessly blend with the natural tooth structure providing both aesthetic advantages. The result is restorations that closely resemble teeth leading to increased satisfaction and confidence, in their smiles. When it comes to restorations, nanofilled composite resins have gained popularity due to their mechanical properties. This means that these restorations can withstand the forces exerted during chewing reducing the risk of wear and fractures. The use of materials in posterior areas demonstrates ongoing efforts to balance aesthetics with durability in load bearing regions. Another aspect of this process is the selection of post systems for restoring treated teeth. Fiber reinforced posts, which have an elasticity to dentin help distribute stress evenly

within the tooth structure. Dentists have observed a decrease in root fractures when using fiber posts compared to metal ones. This leads to resistance, against forces experienced while chewing (18, 19). Bioactive materials like mineral trioxide aggregate (MTA) and calcium silicate-based cements have shown their efficacy in promoting the healing of tissues (20, 21). Clinicians have observed a decrease, in complications after surgery. Improved results when these bioactive materials are used in root canal filling. The proof of their effectiveness can be seen in X-ray assessments, which show healing responses and reduced periapical problems. In real world practice, resin cements play a role in creating a seal between the filling material and the restorative material. Dentists appreciate how easy these cements are to handle and their reliable bonding properties, which contribute to the success of the tooth restoration process. This success is evident in restorations that have leakage and are resilient against challenges. To sum up dentist's witness firsthand the impact of techniques and materials on patient outcomes from access procedures to selecting adhesive systems, restorative materials and post systems. By incorporating materials into treatments healing responses are further improved. Ultimately these techniques and materials result in restorations that not only restore tooth functionality but fulfill patient's aesthetic expectations ensuring long term success for treated teeth.

Management

Managing techniques and materials at the interface between endodontics and restorative dentistry is a task that requires a thorough and patient focused approach in today's dental practices. Starting with an assessment and diagnosis dentists use diagnostic tools like digital X rays and cone beam computed tomography (CBCT) to accurately evaluate the condition of the tooth determine the extent of decay and identify any potential cracks or fractures. These tools provide information about the root canal system and tissues around the tooth's apex laying the groundwork, for a treatment plan. An important aspect of managing procedures is adopting techniques when preparing access cavities. The key

is to preserve healthy tooth structure as possible while still having good visibility, for the endodontic procedures. Dentists use magnification and illumination tools to ensure access cavity preparation. This careful approach not only helps maintain the long-term strength of the tooth, it also reduces the risk of fractures, which lays the foundation for subsequent restorative treatments. Choosing the systems is crucial for a successful connection between endodontics and restorative dentistry. Dentists should consider factors such as the type of material, clinical conditions and potential future needs when making decisions. Whether using etch or self-etch adhesives following established bonding protocols is essential. These protocols include isolation, effective moisture control and systematic application of agents to create a strong and durable bond between the restorative material and tooth structure. The selection of materials plays a role in overall management strategies. Composite resins are commonly used in practice due to their properties and versatility. When it comes to restorations nanofilled composites are gaining popularity because they offer improved properties and increased resistance to wear. The choice between indirect restorations depends on factors, like how many teeth are missing the forces applied during biting and what the patient prefers. This careful consideration when selecting materials shows how dental care is constantly changing and improving. When dealing with damaged teeth, there is a need for decision making regarding post systems and core build up. To prevent root fractures, it is preferable to use fiber reinforced posts that have properties to dentin. At the time the core builds up phase is crucial to establish a foundation for the final restoration and ensure a reliable bond between the post and restorative material. This comprehensive approach highlights how endodontic and restorative procedures are interconnected. An interesting development in practice involves the use of bioactive materials in endodontics. Materials like mineral trioxide aggregate (MTA) and calcium silicate based cements offer qualities such as biocompatibility and the ability to support healing of tissues (22). When used in root canal obturation, they contribute to outcomes by promoting tissue

regeneration and reducing inflammation. This bioactive aspect introduces a perspective on managing cases focusing not only on functional rehabilitation but also on biological harmony. Resin cements play a role in achieving a seal between the root canal filling material and restorative material. The choice, between self-conventional resin cements depends on specific case requirements. It's important for clinicians to adhere to placement techniques and ensure adaptation to prevent microleakage and establish a durable bond. The successful application of resin cement can be seen in restorations that have complications after the procedure and remain strong, in the demanding oral environment. It is important to follow up and monitor the progress of treatment in the term as a part of managing the situation. Regular recalls are important, for assessing the stability of restorations identifying signs of failure and monitoring the healing process around the root tip. By combining evaluations with examinations, we can detect complications early on and take timely action to ensure successful endodontic restorative treatments. This commitment to vigilance reflects our dedication to patient care and our goal of achieving long term treatment success. Effective clinical management requires an approach to addressing challenges and complications associated with techniques and materials. These challenges may include operative sensitivity, restoration fractures or issues related to the adhesive interface. As clinicians we need to be equipped with diagnosis skills and targeted management strategies that may involve modifying the treatment plan selecting materials or enhancing post-operative care protocols. Patient education and obtaining consent are aspects of our clinical management approach. Transparent communication about the details of the chosen treatment plan—such as the materials and techniques used—empowers patients to participate in their health management actively. The integration of technology further enhances how we manage interfaces. By utilizing tools like CAD/CAM systems we can streamline the fabrication process, for restorations that fit well and look aesthetically pleasing. Furthermore, the use of cutting-edge imaging technologies such, as scanners and CBCT

plays a role, in both treatment planning and identifying intricate anatomical details. To summarize the effective clinical management of restorative interface techniques and materials requires an advanced approach that prioritizes the needs of patients. Clinicians stay updated on the advancements utilize technology and prioritize educating patients to handle the complexities of managing endodontic restorative interfaces. This enables them to achieve the outcomes in the ever-evolving field of modern dental practice. This comprehensive approach showcases their dedication to providing patient care while continuously seeking advancements, in science and technology.

Conclusion

To summarize, the changing field of endodontic restorative interface techniques and materials shows a collective effort to improve patient outcomes by focusing on precision, adaptability and biological compatibility. The practical application of conservative access cavity designs, technologies and careful selection of restorative materials demonstrates a shift towards minimally invasive yet robust approaches. Managing this interface underscores the interconnected nature of restorative procedures emphasizing the need for a patient centric approach. Clinicians navigate a landscape that incorporates materials and cutting-edge technology to provide optimal care. Looking ahead, these techniques and materials are expected to evolve through research and technological advancements. The pursuit of solutions to enhance predictability, durability and aesthetics in the restorative interface remains a driving force in dental practice today. This review offers an overview of the state of knowledge in this field while encouraging exploration and innovation to elevate contemporary dental standards continually.

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

Author contribution

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

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