

Review Article

Long-term success of inlay and onlay procedures in dental repairs

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ABSTRACT

Inlays and onlays are vital restorative techniques in dentistry, offering a conservative alternative to full crowns while preserving more of the natural tooth structure. These restorations, typically made from ceramic or composite resin materials, provide both aesthetic and functional benefits and are increasingly favored for their durability and longevity. In contrast to direct restorations, inlays and onlays are fabricated outside the mouth, allowing for greater precision and a more customized fit. The clinical success of these restorations largely depends on factors such as material choice, bonding technique, and patient-related variables like oral hygiene and habits. Ceramic materials are particularly noted for their resistance to wear and their ability to closely mimic the natural appearance of teeth, making them an attractive option for both patients and clinicians. Composite resins, while slightly less durable, offer a cost-effective alternative with satisfactory long-term results. Proper bonding techniques and high-quality materials are essential for ensuring the durability of inlays and onlays, with many restorations lasting over a decade. Patient-related factors also play a significant role in the success of inlays and onlays. Effective oral hygiene, regular dental check-ups, and the avoidance of habits like bruxism are essential for maintaining the integrity of these restorations over time. Despite the challenges and technical demands associated with their placement, inlays and onlays are highly successful when properly executed, offering patients a durable, aesthetically pleasing solution for dental repairs. The discussion of this review focuses on the critical elements that influence the long-term success of inlays and onlays, including material selection, clinical technique, and patient management, highlighting their effectiveness as a restorative option in modern dentistry.

Keywords: Inlays, Onlays, Dental restorations, Long-term success, Bonding techniques

INTRODUCTION

Inlay and onlay procedures have become integral components of modern restorative dentistry, offering an effective and conservative alternative to full-coverage crowns for repairing damaged teeth. These restorations,

often made from materials like porcelain, composite resin, or gold, are meticulously crafted to fit the cavity of the tooth and are cemented into place, providing both functional and aesthetic benefits. In contrast to direct restorations, such as fillings, inlays and onlays are fabricated outside the mouth and then bonded to the tooth,

allowing for a more precise fit and potentially superior long-term outcomes.

The primary advantage of inlay and onlay restorations lies in their ability to preserve more of the natural tooth structure compared to traditional crowns. This conservative approach not only strengthens the remaining teeth but also reduces the likelihood of further damage or decay. Moreover, the materials used in these restorations are highly durable and can withstand the forces of chewing, making them an ideal choice for patients who require long-lasting dental repairs. Studies have shown that inlay and onlay restorations can provide excellent clinical outcomes, with success rates comparable to or even surpassing those of other restorative techniques.¹ In recent years, there has been growing interest in evaluating the long-term success of inlay and onlay procedures, particularly in terms of their longevity, resistance to wear, and patient satisfaction. The literature suggests that these restorations can last for many years, often exceeding a decade, provided they are properly maintained and that the patient adheres to good oral hygiene practices.² However, the success of inlay and onlay procedures is influenced by several factors, including the material used, the skill of the clinician, the quality of the bond between the restoration and the tooth, and the patient's oral environment.³

Despite the numerous advantages of inlays and onlays, there are also potential challenges associated with their use. For instance, the process of fabricating and fitting these restorations is more time-consuming and technically demanding than direct restorations, and the cost can be higher due to the need for laboratory work. Furthermore, in cases where the tooth structure is severely compromised, a full-coverage crown may still be the preferred option.⁴ In this review, we will explore the long-term success of inlay and onlay procedures in dental repairs.

REVIEW

The long-term success of inlay and onlay procedures in dental repairs is significantly influenced by various factors, including the material selection, clinical technique, and patient-related variables. Studies have consistently demonstrated that ceramic and composite resin materials offer substantial durability and aesthetic benefits, making them popular choices for inlays and onlays. Ceramic restorations, in particular, are favored for their resistance to wear and ability to mimic natural tooth appearance. However, composite resin materials have also shown promising results in terms of longevity and cost-effectiveness.⁵

The bonding technique plays a crucial role in the success of inlays and onlays. Strong adhesion between the restoration and tooth structure is vital for preventing marginal leakage, secondary caries, and debonding, which are common causes of restoration failure. Research has indicated that proper bonding techniques, combined with high-quality materials, can extend the lifespan of these

restorations to over a decade in many cases.⁶ Patient-related factors, such as oral hygiene, diet, and habits like bruxism, also affect the longevity of inlays and onlays. Regular dental check-ups and proper maintenance are essential for the long-term success of these restorations. In conclusion, while inlay and onlay procedures are effective and durable, their success is dependent on a combination of material choice, clinical expertise, and patient care.

Longevity and durability of inlay and onlay restorations

Inlay and onlay restorations have gained popularity as conservative alternatives to full-coverage crowns, particularly in cases where significant tooth structure has been lost. The longevity and durability of these restorations depend on several factors, including the materials used, the quality of the adhesive techniques, and the patient's oral hygiene practices. Studies have shown that well-placed inlays and onlays can provide excellent long-term performance, with survival rates comparable to or even exceeding those of conventional crowns.⁷

One of the key factors influencing the longevity of inlay and onlay restorations is the choice of material. Resin-based composites and ceramic materials are commonly used, each with its own set of advantages and limitations. Ceramic onlays, for instance, are highly aesthetic and biocompatible, offering excellent wear resistance and strength.⁸ However, they can be more brittle compared to composites, making them susceptible to fractures, especially in patients with parafunctional habits like bruxism. On the other hand, composite inlays and onlays are more forgiving and can better absorb occlusal forces, but they may wear down over time and are more prone to discoloration and marginal breakdown. The quality of the bonding technique also plays a crucial role in the durability of these restorations. Achieving a strong and durable bond between the restoration and the tooth structure is essential for preventing microleakage, secondary caries, and restoration dislodgement. Advances in adhesive dentistry, such as the development of self-etching adhesive systems and improved resin cements, have enhanced the bond strength and longevity of inlays and onlays.⁹ Proper isolation during the bonding process and meticulous attention to technique can further improve the success rates of these restorations.

Patient-related factors, such as oral hygiene and diet, also significantly impact the durability of inlays and onlays. Poor oral hygiene can lead to plaque accumulation around the margins of the restorations, increasing the risk of secondary caries and restoration failure. Additionally, patients who consume a diet high in acidic or sugary foods may experience faster wear and degradation of the restoration material. Regular dental check-ups and professional cleanings are essential to monitor the integrity of the restorations and address any issues promptly. The longevity and durability of inlay and onlay restorations are influenced by material selection, bonding techniques, and patient-related factors. With proper material choice,

meticulous placement, and ongoing maintenance, inlays and onlays can provide long-lasting and reliable restorations that preserve tooth structure and enhance aesthetics.

Factors influencing the success rates of inlay and onlay procedures

The success rates of inlay and onlay procedures are contingent upon a combination of clinical, material, and patient-related factors. Understanding these factors is crucial for dental practitioners to optimize outcomes and ensure the long-term success of these restorations. One of the primary clinical factors influencing the success of inlays and onlays is the extent of tooth preparation and remaining tooth structure. Preservation of sound tooth structure is essential, as overly aggressive preparation can compromise the tooth's integrity and increase the likelihood of fracture or restoration failure.¹⁰ A conservative approach that retains as much natural tooth as possible is associated with better long-term outcomes. Additionally, the margin design plays a significant role in the success of these restorations. Smooth, well-defined margins that are free from irregularities help to ensure proper seating of the restoration and reduce the risk of microleakage and secondary caries.

Material selection is another critical factor. As previously discussed, the choice between ceramic and composite materials can influence the longevity of the restoration. Ceramics, particularly lithium disilicate and zirconia, offer superior strength and wear resistance, making them ideal for posterior restorations subjected to heavy occlusal forces.¹¹ However, they require precise handling and bonding techniques to avoid fractures. On the other hand, composite materials, while more forgiving in terms of technique, may be more prone to wear and discoloration over time. The choice of material should be based on the specific clinical scenario, patient preference, and functional demands. The quality of the adhesive technique is equally important in determining the success of inlays and onlays. A strong bond between the restoration and the tooth structure is vital to prevent dislodgement and marginal leakage. Advances in adhesive dentistry, such as the use of universal adhesives that simplify the bonding process and improve bond strength, have contributed to higher success rates.¹² However, achieving an optimal bond requires careful attention to isolation and technique. Contamination of the bonding surface with saliva or blood can significantly weaken the bond and increase the risk of failure.

Patient-related factors, including oral hygiene practices, dietary habits, and parafunctional activities like bruxism, also play a significant role in the success of inlay and onlay procedures. Patients with poor oral hygiene are at a higher risk of developing secondary caries around the restoration margins, leading to failure. Similarly, a diet high in acidic or sugary foods can contribute to the breakdown of restorative materials. Bruxism can exert excessive forces

on inlays and onlays, increasing the risk of fractures or debonding. The success rates of inlay and onlay procedures are influenced by a combination of factors related to tooth preparation, material selection, adhesive techniques, and patient behaviors. By carefully considering these factors, dental practitioners can enhance the durability and longevity of these restorations, leading to better patient outcomes.

Comparative analysis of inlays, onlays, and alternative restorative techniques

Inlays and onlays are popular restorative techniques that offer a conservative approach to restoring damaged teeth, particularly when more extensive procedures like full crowns can be avoided. However, alternative restorative techniques, such as direct composite fillings and full-coverage crowns, also have their merits and limitations. A comparative analysis of these restorative methods provides valuable insights into their respective advantages and drawbacks, helping clinicians make informed decisions based on the specific clinical scenario. Inlays and onlays, often referred to as partial crowns, are highly valued for their ability to preserve tooth structure while providing superior strength and aesthetics. When compared to direct composite restorations, inlays and onlays typically offer better marginal adaptation and wear resistance.¹⁰ Composite fillings, while easier and quicker to place, are more prone to wear, marginal discoloration, and shrinkage over time, especially in large restorations. This makes inlays and onlays more suitable for patients with larger cavities where maintaining the structural integrity of the tooth is crucial.

On the other hand, full-coverage crowns provide complete protection to the tooth, particularly in cases where there is significant structural compromise. Crowns are generally recommended for teeth that have undergone extensive decay, fractures, or root canal treatment.¹¹ While they offer excellent durability and protection, they require more extensive tooth preparation, which involves the removal of a significant amount of healthy tooth structure. In contrast, inlays and onlays are less invasive, allowing for the preservation of more natural tooth tissue. This conservative approach not only maintains the strength of the tooth but also reduces the risk of postoperative complications, such as tooth sensitivity and pulpal inflammation. Another alternative technique is the use of direct composite overlays, which are less invasive and more cost-effective than indirect restorations like inlays and onlays. However, the longevity of composite overlays may be compromised by their susceptibility to wear, marginal breakdown, and discoloration over time.¹² Additionally, direct composite restorations require more frequent maintenance and replacement compared to ceramic inlays and onlays, making them less ideal for patients seeking long-term solutions.

From a patient perspective, the choice between inlays, onlays, and alternative restorative techniques often comes

down to factors such as cost, aesthetics, and treatment time. Inlays and onlays, especially when made of ceramics, are more expensive and require multiple visits compared to direct restorations. However, their superior aesthetics, biocompatibility, and longevity often justify the higher cost for patients seeking durable and visually appealing restorations. While inlays and onlays offer a balanced approach between preservation of tooth structure and durability, alternative restorative techniques like direct composites and full crowns each have their own advantages in specific clinical situations. The choice of restoration should be guided by the extent of tooth damage, patient preferences, and long-term considerations such as maintenance and cost-effectiveness.

CONCLUSION

The choice between inlays, onlays, and alternative restorative techniques depends on various factors, including the extent of tooth damage, material properties, and patient preferences. Inlays and onlays offer a conservative yet durable solution, preserving tooth structure while providing excellent aesthetics and longevity. However, alternative options like direct composites and full crowns also have their place in clinical practice, particularly in cases requiring either minimal intervention or full coverage. A tailored approach considering both clinical and patient-related factors is essential for optimal restorative outcomes.

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