Global Academic Journal of Dentistry and Oral Health

Available online at https://www.gajrc.com
DOI: https://doi.org/10.36348/gajdoh.2025.v07i03.001

OPEN ACCESS

ISSN-2706-8994 (P)
ISSN-2707-8868 (O)

Case Report

Hybrid Ceramic Inlay-Onlay: A Case Report

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Article History
Received: 17.06.2025
Accepted: 21.08.2025
Published: 08.09.2025

Abstract: ***Introduction*:** In restorative dentistry, hybrid ceramic inlays and onlays have emerged as promising alternatives to conventional all-ceramic restorations, especially in cases requiring a minimally invasive approach and optimal biomechanical compatibility with natural dentition. Nevertheless, their relatively recent introduction warrants further investigation regarding long-term clinical performance, bondingdurability, and wear behavior compared to established ceramic materials. ***Case report*:** A 38-year-old female patient presented for the restoration of an extensive carious lesion on the lower right second molar (tooth 46). Thepreoperative radiograph revealed that the tooth was endodontically treated. After clinical and radiographic examination, an indirect restoration using a hybrid ceramic inlay- onlay was planned to maximize the conservation of healthy tooth structure while ensuring adequatemasticatory strength. ***Discussion*:** Hybrid ceramics, combining the mechanical strength of ceramics with the flexibility of composites, present attractive properties for restoring posterior teeth by providing durability, aesthetics, and preservation of tooth structure. This unique combination makes them particularly suitable for the restoration of decayed teeth, especially in cases where tooth structure conservation and durability are priorities.

Keywords: Hybrid ceramic, Inlay-onlay, CAD/CAM, Adhesive dentistry, Indirect restoration, Minimally invasive dentistry.

INTRODUCTION

The continuous search for restorative materials that combine mechanical strength, esthetics, and biomimicry has led to the development of hybrid ceramics. These innovative materials represent a new class of CAD/CAM restorative options, designed to merge the advantages of both ceramics and resin composites [1, 2].

Traditional ceramics, such as feldspathic porcelain or lithium disilicate, offer excellent esthetics and durability, yet their inherent brittleness and high elastic modulus may predispose restorations or supporting tooth structures to fracture under functional stress. Conversely, composite resins provide a degree of elasticity closer to dentin, allowing better stress distribution, but they remain susceptible to wear, discoloration, and reduced long-term stability [3].

Hybrid ceramics, also known as polymer-infiltrated ceramic networks (PICNs), were introduced to overcome these limitations. Their unique microstructure—comprising a dominant ceramic matrix reinforced by a polymer network—provides a balance between strength, resilience, and reparability. The presence of the polymer phase increases fracture toughness and resistance to crack propagation, while the ceramic phase ensures esthetic integration and wear resistance.

Furthermore, hybrid ceramics are particularly well-suited for CAD/CAM fabrication, as they can be milled efficiently without additional firing, thereby simplifying the clinical workflow [3, 4].

In restorative dentistry, hybrid ceramic inlays and onlays have emerged as promising alternatives to conventional all-ceramic restorations, especially in cases requiring a minimally invasive approach and optimal biomechanical compatibility with natural dentition. Nevertheless, their relatively recent introduction warrants further investigation regarding long-term clinical performance, bonding durability, and wear behavior compared to established ceramic materials [5].

CASE PRESENTATION

A 38-year-old female patient presented for the restoration of an extensive carious lesion on the lower right second molar (tooth 46). The preoperative radiograph revealed that the tooth was endodontically treated.

After clinical and radiographic examination, an indirect restoration using a hybrid ceramic inlay-onlay was planned to maximize the conservation of healthy tooth structure while ensuring adequate masticatory strength (Figure 1 and 2).

Figure 1: Initial situation

Figure 2: Preoperative radiograph

The preparation of an inlay cavity must be guided by the principles of conservation of tooth structure, while ensuring sufficient resistance and retention for the restoration and adequate space for material thickness. Unlike direct composite restorations, inlays rely on adhesive bonding and require a design that facilitates proper seating, stress distribution, and marginal integrity (Figure 3).

Figure 3: Cavity preparation

Digital impression of the prepared tooth and adjacent structures was realized, allowing clear visualization of the preparation margins (Figure 4).

Digital bite registration for occlusion validation, ensures accurate articulation of maxillary and mandibular arches (Figure 5).

Figure 4: Optical impression

Figure 5: Occlusion validation

Figure 6: 3D-printed model derived from an optical impression showing the milled inlay-onlay

The placement of the operative field is a fundamental step in restorative and prosthetic dentistry, as it directly influences the quality and long-term success of the treatment. Its main purpose is to ensure optimal isolation of the working area while providing a safe environment for both patient and operator (Figure 7).

Figure 7: Placement of the operative field using a rubber dam, providing optimal isolation and ideal conditions for the fabrication of an indirect restoration

Figure 8: Final result

The hybrid ceramic restoration proved to be functional and aesthetic. The patient reported satisfaction with the comfort and natural appearance of the restoration. A 6-month follow-up showed stable tissue integration without signs of marginal leakage or sensitivity.

DISCUSSION

Hybrid ceramic inlays and onlays combine the advantages of ceramics (aesthetics, biocompatibility) and composites (resilience, ease of repair). This technique allows for durable restorations while minimizing aggressiveness to the tooth, which is especially important in posterior teeth subjected to high mechanical stresses. CAD/CAM technology facilitates precision and reduces treatment time.

Indirect restorations such as inlays and onlays offer a conservative and aesthetic alternative to traditional amalgam or composite fillings [6].

Hybrid ceramics, combining the mechanical strength of ceramics with the flexibility of composites, present attractive properties for restoring posterior teeth by providing durability, aesthetics, and preservation of tooth structure [3].

They represent innovative dental restorative materials that combine the mechanical strength and esthetic qualities of traditional ceramics with the flexibility and reparability of composite resins. This unique combination makes them particularly suitable for the restoration of decayed teeth, especially in cases where tooth structure conservation and durability are priorities [7].

These materials offer excellent biocompatibility, wear resistance, and color stability, making them ideal for both anterior and posterior restorations. Their ability to absorb functional stresses reduces the risk of fractures, which is crucial in load-bearing areas such as molars [8, 4].

Restorations using hybrid ceramics can be fabricated via computer-aided design and manufacturing (CAD/CAM), ensuring precise fit and optimal morphology. The bonding procedure is critical for the long-term success of these restorations and typically involves surface conditioning of both the restoration and the tooth structure.

Inlay preparation for hybrid ceramic restorations follows a minimally invasive, adhesive-based philosophy, preserving as much sound tissue

as possible while ensuring material thickness and proper bonding conditions.

Accurate impression making is a critical step in the success of indirect restorations, as any distortion or inaccuracy directly compromises the fit, marginal adaptation, and long-term prognosis of the prosthesis. Traditional elastomeric impressions, although widely used, are technique-sensitive and susceptible to dimensional changes due to material shrinkage, improper handling, or disinfection procedures.

The introduction of optical impressions through intraoral scanning has revolutionized restorative dentistry, particularly in the context of CAD/CAM-fabricated inlays, onlays, crowns, and veneers. Digital impressions offer several advantages.

Optical scans provide high-resolution 3D images of the prepared tooth, adjacent structures, and occlusion, ensuring precise adaptation of the restoration.

They eliminate the need for impression trays and materials, reducing patient discomfort and procedural time. Digital data can be easily shared with dental laboratories or CAD/CAM systems, improving workflow integration and reducing the risk of errors.

Clinicians can instantly assess preparation design, margin clarity, and occlusal clearance on-screen, allowing corrections before milling or printing.

Digital files can be archived without degradation, enabling future reference or reproduction if needed.

In the context of hybrid ceramic inlays and onlays, optical impressions are particularly advantageous, as they ensure accurate marginal definition and facilitate seamless integration into chairside CAD/CAM workflows, where restorations can be designed, milled, and delivered in a single appointment.

Overall, hybrid ceramics provide a reliable, aesthetic, and minimally invasive option for restoring decayed teeth, enhancing both functional outcomes and patient satisfaction. However, a meticulous bonding protocol is essential to ensure long-term success.

CONCLUSION

The use of hybrid ceramic inlays and onlays is a reliable and aesthetic option for restoring posterior teeth with moderate to extensive loss of substance. This clinical case illustrates the value of this technique in preserving dental tissue and achieving patient satisfaction.

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