

Prosthetic Rehabilitation Of A Hemisectioned Mandibular Molar Using A Graphene Nanoreinforced Bipolymer Crown – A Case Report

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Abstract:

Hemisection is a conservative approach that preserves the healthy portion of a compromised molar by removing the diseased root [6,7]. This case report details the functional rehabilitation of a hemisectioned right mandibular first molar using a graphene nanoreinforced biopolymer crown. Graphene-based dental materials have gained popularity due to their antimicrobial properties, biocompatibility, and superior mechanical strength, making them a promising alternative in prosthetic dentistry [4,9]. A modified crown design was employed, incorporating an occlusal rest on the adjacent molar along with retentive and reciprocal arms to enhance stability and optimize functional stress distribution [2,5]. This case highlights the advantages of graphene-based prosthetic solutions in maintaining periodontal health, ensuring functional longevity, and preserving structural integrity in compromised teeth [1,3].

Key Word: Hemisection, Graphene crown, Mandibular molar, Nanoreinforced biopolymer crown

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I. Introduction

Molar hemisection is a valuable treatment option for cases where one root is compromised due to periodontal disease, periapical pathology, or structural damage [6,7,8]. This conservative approach allows retention of natural tooth structure, ultimately improving long-term function [8]. The success of hemisection depends on careful prosthetic planning, ensuring adequate support and proper load distribution [3,7]. Graphene-based materials have gained recognition in dentistry for their high strength, lightweight properties, and antimicrobial activity [4,9,12]. These characteristics make graphene an excellent choice for prosthetic restorations, particularly in teeth with periodontal challenges [4,10]. In this case, a graphene nanoreinforced biopolymer crown was selected to restore a hemisectioned mandibular molar, providing both functional and biological advantages [2,5].

II. Case Report

A 42-year-old female patient reported to the department seeking prosthetic rehabilitation for a hemisectioned tooth and her previous history revealed a severe periapical lesion affecting the distal root of tooth 46 [6]. Endodontic treatment was performed, followed by hemisection to remove the compromised distal root while preserving the mesial portion for prosthetic restoration [6,7]. The patient was advised to wait one month before prosthetic rehabilitation to ensure healing and periodontal stability. Follow-up evaluation confirmed the absence of mobility, indicating successful healing. (Figure 1).

Prosthetic Rehabilitation

Step 1: Core Build-up and Tooth Preparation

Composite resin was used to reconstruct the coronal portion of the retained mesial half of tooth 46 [2]. Following the core build-up, the tooth was prepared for full-coverage restoration, and an occlusal rest seat was prepared on the adjacent tooth 47 for added support [5]. A final impression was obtained using putty and light-body silicone with the putty-wash technique. A chairside provisional crown was fabricated from tooth-colored acrylic resin and cemented temporarily with zinc oxide eugenol (ZOE) cement [2,5]. (Figure 2).

Step 2: Fabrication of Graphene Nanoreinforced Biopolymer Crown

The definitive crown was designed using CAD/CAM technology and milled from a graphene nanoreinforced biopolymer disc (G-CAM). The modified crown design incorporated an occlusal rest with reciprocal and retentive arms on tooth 47 to enhance stability, distribute lateral forces on the remaining root, and improve mechanical retention [2,5]. Figure 3).

Step 3: Cementation of Final Restoration

After one week, the provisional crown was replaced with the definitive graphene nanoreinforced crown. Both the tooth and crown surfaces were prepared with acid etching (tooth: 37% phosphoric acid; crown: 5% hydrofluoric acid) and luted with dual-cure resin-based cement to achieve optimal adhesion [2,4]. (Figure 4)

Follow up after eight months revealed satisfactory bone formation and evidence of adequate healing in the treated area. (Figure 5)

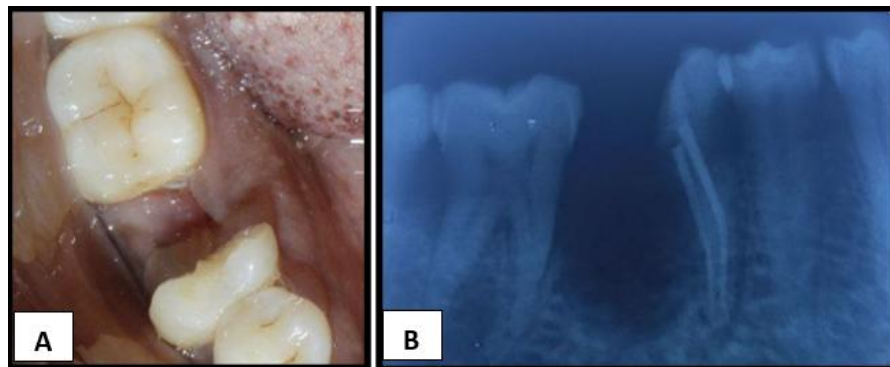


Figure:1 Endodontic management and hemisection done (A) Clinical (B) Radiograph

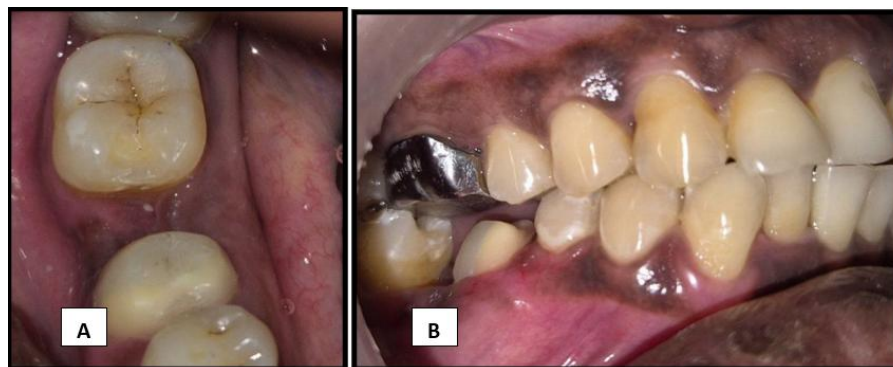


Figure: 2 Core build up (a) Occlusal view (b) Lateral view

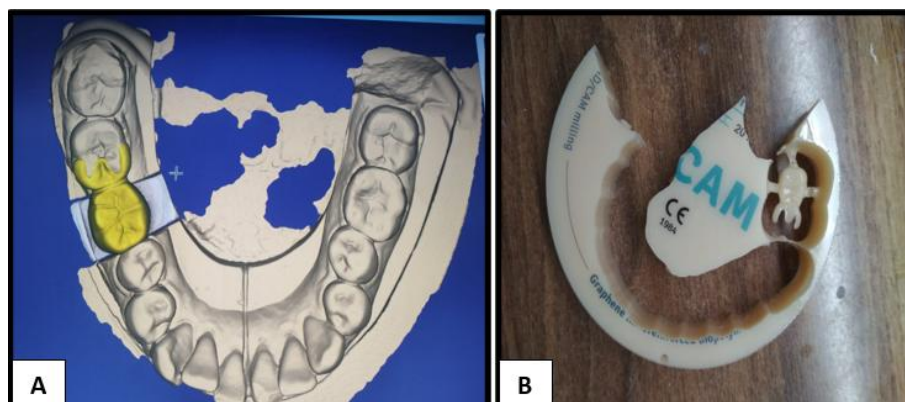


Figure: 3 Graphene CAD CAM (A) Designing (B) Milling

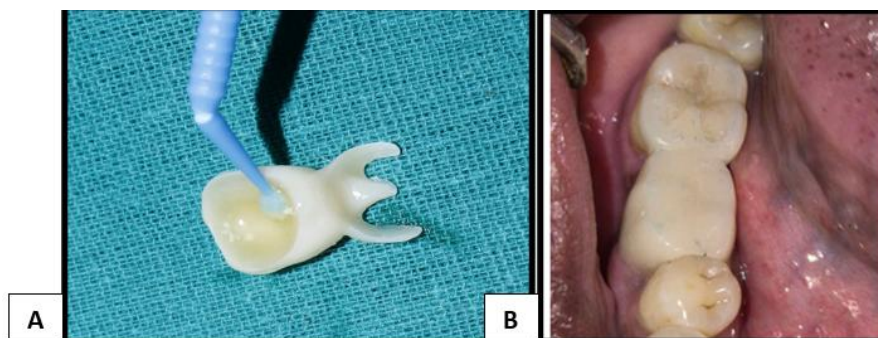


Figure: 4 (A) Surface preparation of graphene crown (B) Permanent cementation

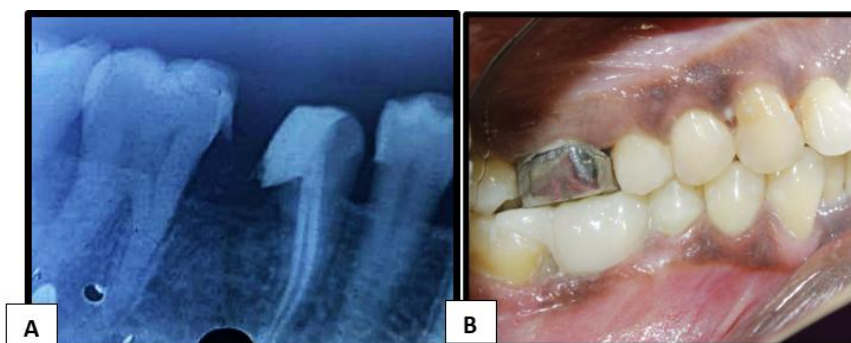


Figure: 5 Follow up (A) Radiograph (B) Clinical

III. Discussion

Hemisection preserves a partially compromised molar, offering functional and esthetic benefits while avoiding extraction [6,7,8]. Success depends on careful case selection, periodontal stability, and proper prosthetic rehabilitation [8].

Graphene nanoreinforced biopolymer crowns provide antimicrobial, biocompatible, and mechanical advantages that support long-term prognosis [4,9]. Their antibacterial effect reduces bacterial adhesion, minimizing secondary infections and promoting periodontal health [4,10]. Biocompatibility prevents inflammatory responses, improving adaptation of the prosthesis and reducing soft tissue irritation [4].

The modified crown design, incorporating an occlusal rest, reciprocal arm, and retentive features on the adjacent molar, facilitated better force distribution and reduced stress on the remaining root [2,5]. Use of a provisional crown prior to final restoration allowed functional adaptation and soft tissue healing, contributing to a stable outcome [2,5].

Compared to conventional ceramic or metal restorations, graphene nanoreinforced crowns provide an optimal balance of strength, esthetics, and biological benefits [4,9]. Their lightweight nature enhances patient comfort while ensuring long-term function [9].

IV. Conclusion

This case demonstrates successful prosthetic rehabilitation of a hemisectioned mandibular molar using a graphene nanoreinforced biopolymer crown. The incorporation of graphene presents multiple advantages, including antimicrobial protection, enhanced biocompatibility, and superior mechanical properties, making it a promising alternative to conventional restorative materials [4,9]. By integrating innovative materials like graphene, clinicians can significantly improve the longevity and success of prosthetic restorations in periodontally and endodontically compromised teeth. Further clinical studies and long-term follow-up are recommended to fully validate the potential of graphene-based restorations [10].

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