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Orthodontic Forced Eruption for Restorative Management in Fixed Prosthodontics: A Case Report

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Abstract

Introduction: Orthodontic forced eruption (OFE) is a non-surgical technique. It helps manage subgingival defects by repositioning the tooth coronally. This case report shows how OFE was used with CAD-CAM zirconia restoration for a deep carious lesion in a 40-year-old male patient.

Case Report: A 40-year-old male had a deep carious lesion on the upper right first premolar. After non-surgical root canal therapy, OFE was performed. A metallic post and core were used to extrude the tooth. After extrusion and stabilization, a CAD-CAM zirconia crown was placed.

Conclusion: OFE, followed by CAD-CAM zirconia restoration, is an effective and conservative solution. It manages subgingival defects with minimal invasion while ensuring both aesthetic and functional results.

Keywords: Orthodontic Forced Eruption; Subgingival Defects; CAD-CAM Zirconia; Crown Restoration; Tooth Extrusion

Introduction

The preservation of natural dentition remains a fundamental goal in modern dentistry, particularly in cases where teeth are compromised by subgingival fractures. When a tooth exhibits a deep crown fracture extending below the gingival margin, restorative management can be challenging due to the difficulty of achieving adequate ferrule effect and proper marginal adaptation. Various treatment options exist, including surgical crown lengthening or extraction followed by implant placement. However, these approaches may have significant drawbacks, such as altered gingival aesthetics, loss of supporting bone, or increased treatment complexity [1-3].

Orthodontic forced eruption (OFE) presents a conservative, non-surgical alternative that facilitates the exposure of sound tooth structure while simultaneously improving the surrounding periodontal tissues. By applying controlled orthodontic forces, the tooth is extruded coronally, allowing the repositioning of gingival and osseous tissues in a more favorable manner. This technique is particularly advantageous in the anterior aesthetic zone, where maintaining gingival symmetry and natural tooth contours is critical for achieving an optimal prosthetic outcome. Nevertheless, OFE has certain limitations compared to surgical methods. It generally requires a longer treatment duration, necessitates patient compliance, and carries a risk of relapse if stabilization is inadequate. Moreover, in cases where the fracture extends significantly below the alveolar bone, surgical intervention may still be unavoidable [4].

The integration of digital dentistry, particularly CAD-CAM technology, has further enhanced the precision and efficiency of restorative procedures following OFE. Computer-aided design and manufacturing allow for the fabrication of highly esthetic and durable zirconia crowns, ensuring excellent marginal adaptation and long-term functional success [5].

This case report describes the comprehensive management of a fractured maxillary anterior tooth using orthodontic forced eruption, followed by prosthetic rehabilitation with a CAD-CAM-fabricated zirconia crown. The combined approach preserved the patient's natural dentition while achieving a predictable and esthetically pleasing outcome.

Case Presentation

Patient Presentation

A 40-year-old male patient presented to the Department of Prosthodontics at the University Hospital of Farhat Hached, Sousse, with a chief complaint of persistent discomfort while chewing and occasional pain exacerbated by cold stimuli due to a severely decayed maxillary left first premolar. He also expressed concerns about the possibility of tooth loss and was particularly worried about the functional and aesthetic consequences of extraction. He strongly desired to preserve his natural tooth and restore its function and aesthetics.

Clinical examination revealed a deep subgingival lesion compromising the remaining coronal structure. The patient reported difficulty maintaining oral hygiene in the affected area due to food impaction and gingival irritation. A radiographic assessment of the maxillary first premolar (tooth #24) showed advanced dental caries with no prior endodontic treatment. Additionally, the preprosthetic surgical space, measured as the distance between the alveolar crest and the most apical extent of the decay, was only 1 mm, making traditional restorative approaches challenging (Figure 1, 2). Given the patient's apprehension about surgical interventions, a conservative approach was considered to meet his expectations while ensuring a predictable long-term outcome.

Figure 1*:* Pre-operative Clinical view

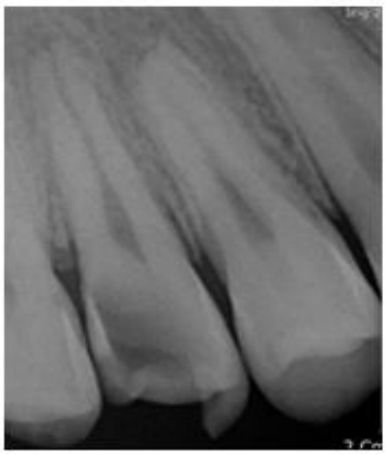

Figure 2: Initial periapical radiograph

The patient was highly motivated and cooperative, with good oral hygiene practices. The healthcare team closely followed his case to ensure optimal treatment planning and execution.

Treatment Planning

Given the deep subgingival location of the carious lesion, a comprehensive treatment plan was developed to preserve the natural tooth and restore its function and aesthetics. The proposed plan included:

- Non-surgical root canal treatment (RCT): To ensure the elimination of infection and maintain endodontic integrity.
- Orthodontic forced eruption (OFE): To elevate the tooth structure coronally, exposing sound tooth structure for optimal restorative margin placement.
- Definitive prosthetic restoration: A full-coverage zirconia crown fabricated using a CAD-CAM system to ensure long-term durability and esthetics.

Endodontic and Orthodontic Management

After the completion of non-surgical RCT, the tooth was prepared for orthodontic extrusion. (Figure 3, 4)

Figure 3: Post-endodontic periapical xray of tooth 24

Figure 4: After coronal preparation of the 24

The forced eruption was achieved using a customized endodontic attachment, consisting of a metallic post and core placed within the root canal. This provided a stable anchor for the application of orthodontic forces (Figure 5).

Figure 5(a, b): custom cast post and core +tunnel(before and after the casting)

A **sectional fixed appliance** was used, incorporating a stainless steel archwire with an offset to facilitate controlled coronal movement of the tooth. Light continuous forces were applied to minimize root resorption and ensure a gradual extrusion process. The patient was monitored periodically to assess the progress of extrusion and ensure optimal soft and hard tissue adaptation. (Figure 6).

Figure 6: Clinical view of Orthodontic forced eruption

Orthodontic Extrusion Outcome and Stabilization

After the necessary extrusion was achieved, the tooth was stabilized using a passive orthodontic wire for a retention period of approximately 8 weeks. This allowed for adequate adaptation of the periodontal fibers and bone remodeling, reducing the risk of relapse.

A minor gingivoplasty was performed to harmonize the gingival contour and ensure an ideal emergence profile for the final prosthesis.

Figure 7: Post-operative Radiographic view

Final Prosthetic Rehabilitation

Once tissue stabilization was confirmed, the tooth was prepared for a full-coverage zirconia crown, designed and fabricated using CAD-CAM technology. The digital workflow allowed for precise marginal adaptation, optimal occlusal morphology, and

enhanced esthetic integration with the surrounding dentition. The final crown was cemented using a resin-modified glass ionomer cement, ensuring both retention and biocompatibility (Figure 8, 9).

Figure 8: Final preparation with fiber post and core, which replaced the metallic post and core

Figure 9: Zirconia frame work fitting

Clinical Outcome and Follow-Up

At the 6-month follow-up, the patient reported satisfaction with both function and aesthetics. Clinical examination showed a stable prosthetic restoration with well-adapted soft tissues, no signs of periodontal inflammation, and no mobility. Radiographic evaluation confirmed adequate bone support around the extruded tooth, with no signs of pathological root resorption (Figure 10).

Figure 10: Final result

Discussion

The orthodontic forced eruption (OFE) technique offers several advantages over traditional surgical methods for managing subgingival defects. While it is particularly beneficial for preserving tooth structure and improving crown height, a comparison with other available treatment options is crucial for a comprehensive understanding of its benefits [6].

One common alternative to OFE is surgical crown lengthening. This procedure involves the removal of gingival and possibly osseous tissue to expose more tooth structure for restorative purposes. While crown lengthening can be effective, it may lead to the loss of supporting bone and changes in the gingival architecture, especially in the aesthetic zone. This is a particular concern in anterior teeth, where the preservation of natural contours and aesthetics is essential. Additionally, surgical crown lengthening can result in altered gingival aesthetics and may involve a more invasive recovery process compared to the conservative nature of OFE [7-8].

In cases where the tooth is severely compromised, some clinicians may opt for extraction followed by implant placement. While implants offer long-term stability and functionality, this approach is more invasive, involves additional surgery, and often requires significant healing time. Moreover, implants in the aesthetic zone may not always match the natural contours of the surrounding tissues, and the process of bone grafting or augmentation may be necessary to ensure a stable implant placement. Compared to this approach, OFE preserves the natural tooth and the surrounding tissues, offering a more conservative solution with fewer risks associated with bone loss or aesthetic discrepancies [9].

In this particular case, OFE was chosen due to the patient's desire to preserve the natural tooth and minimize invasive procedures. The minimal preprosthetic space (1 mm) between the alveolar crest and the decay level made traditional crown placement challenging. The use of OFE provided the best solution to restore the tooth structure and achieve optimal functional and aesthetic outcomes without the need for more invasive interventions.

While OFE offers distinct advantages, it is essential to note its limitations, including the need for patient cooperation, the extended duration of treatment, and the potential risks if not performed with proper care. Ultimately, the choice between OFE and alternative treatment options depends on the specific clinical situation, the patient's desires, and the long-term prognosis of each method [10].

Conclusion

Orthodontic forced eruption (OFE) represents an invaluable treatment modality for managing subgingival defects and preserving natural tooth structure. The technique not only enhances the restorative space but also ensures functional and aesthetic outcomes while minimizing the need for invasive surgical procedures. This case report demonstrates the successful application of forced eruption followed by CAD-CAM zirconia restoration in a patient with advanced carious lesions.

Looking ahead, future studies should focus on evaluating the long-term outcomes of OFE, particularly in terms of its impact on periodontal health, tooth stability, and the longevity of prosthetic restorations. Additionally, the integration of CAD-CAM technology with OFE offers promising opportunities for enhancing the precision and predictability of restorative treatments. Research could further explore the benefits of combining these techniques, including the use of advanced materials like biomimetic restorations, to optimize both functional and aesthetic results. Furthermore, studies could investigate the role of 3D printing and other innovative technologies in streamlining the process and expanding the applications of OFE in clinical practice.

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