

Outcomes of Orthodontic Forced Eruption for Non - Restorable Permanent Teeth Treatment

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Abstract: *This study evaluates orthodontic force extrusion (OFE) treatment outcomes for patients at the Royal Health Service hospitals in Jordan, specifically at Prince Ali/Al Karak Military Hospital and King Hussein/Amman Medical Center. Patients were categorized into three groups based on the stimulation method used: Group One had supra - alveolar fiber cutting and alveolar root preparation; Group Two used cautery to prevent gingival and alveolar issues, applying OFE using nickel - titanium wire at an extrusion rate of 1.5 mm per week; Group Three focused on orthodontic intrusive slow displacement (OISD) for soft and weak teeth. Electronic fiber scopes (EFS) monitored periodontal and alveolar conditions. The study found OFE effective for tooth preservation in chronic periodontitis and improving crown migration quality. Applying moderate force (less than 0.6 N) was successful without compromising flexibility. OFE achieved tooth movement of 1 - 1.5 mm per week; with simple dental procedures, required post - treatment. Results indicate that OFE is effective in preserving teeth with chronic periodontitis and achieving substantial bone replacement in periodontal disease cases. Further research is needed to validate these findings and explore potential complications.*

Keywords: Orthodontic Forced Eruption, Non- Restorable Teeth, Dental trauma, Bone Replacement, Periodontal Disease

1. Introduction

When treating Selective Caries Lesions (SCL), it is important to consider patients with prominent lip lines and significant gingival exposure [1]. Orthodontic extraction (OE) aids in restoring biological width and defining restoration margins on healthy tooth tissue. This technique also helps create or maintain a uniform gum line, enhancing overall aesthetics. Both orthodontic methods and surgical extractions are suitable for managing root fragments. Unlike orthodontic extractions, extrusion surgery is a more invasive, single - step procedure utilizing an axial traction tool that does not impact tissue migration.

A recent narrative review highlighted the limited evidence regarding tooth extraction outcomes, although it reported favorable success rates in 11 cases [2]. A systematic review identified non - progressive root resorption as the most common adverse event associated with tooth extraction [3]. Additionally, experimental studies have shown that the axial tooth extraction technique reduces pressure on periodontal tissue during extraction, thereby minimizing the risk of biological complications, including root dental loss [4]. Compared to surgical extrusion, orthodontic extraction is considered a more conservative and physiological approach. This article aims to evaluate the effectiveness of orthodontic forced eruption OFE in treating non restorable permanent teeth and its impact on periodontal health and bone replacement.

2. Materials and Methods

Researchers recorded all relevant information for patients visiting our Royal Health Service hospitals (Prince Ali/Al Karak Military Hospital and King Hussein/Amman Medical Center), including study design, number of patients, fracture

type, and orthodontic techniques. The study's significance lies in its potential to offer a predictable and effective treatment for preserving non restorable teeth, reducing the need for more invasive procedures.

Study Design: Patients treated with the OFE technique were divided into three main groups based on the stimulation method used:

- 1) **Group One:** During observation, the supra - alveolar fibers were cut, and the alveolar root was prepared for 6 weeks.
- 2) **Group Two:** To prevent gingival and alveolar issues, cautery was used, followed by X - rays and root canal treatment (RCT) for all cases. This group included ten patients, where orthodontic force was applied using nickel - titanium wire, with an average extrusion rate of 1.5 mm per week. There was no significant difference in weekly extrusion rates (mm) between hard wire, soft pin, or wire. However, there are limitations in performing fibrectomy during gum replacement, and treatment planning is necessary for this area.
- 3) **Group Three (OISD - Orthodontic Intrusive Slow Displacement):** This group is characterized by the slow movement of soft and weak teeth. It involves two main issues addressed by this technique.

In all groups, the periodontal and alveolar conditions were monitored with electronic fiber scopes (EFS) to ensure proper visualization and treatment.

3. Discussion

The findings of this systematic review suggest that orthodontic force extrusion (OFE) is an effective method for tooth preservation in cases of chronic periodontitis. OFE has also been successfully used to improve the quality of crown

migration or to prevent spontaneous crown migration through sclerotherapy [5].

One of the pioneering reconstruction techniques before brain surgery, electronic fiber scope (EFS), does not impact the teeth or alveolar bone. In these clinical cases, it is crucial to preserve the gingival margin, ensure sufficient bone around the remaining root, and have a root size adequate for repair with special metal. Sclerotherapy aims to prevent gingival migration after OFE and should be initiated at the beginning of OFE, repeating weekly or bi-weekly [5, 6]. Applying moderate force, less than 0.6 N, is another method to achieve successful OFE without compromising tissue flexibility and compliance. In the majority of cases (n=10), movement of one to one and a half millimeters per week was achieved.

In most instances, simple post treatment dental procedures are necessary following OFE. Simple reconstructions were performed in three cases, and one case required catheterization [7]. Interestingly, the author compared these findings with other reports involving patients using a third arch force orthodontic (AFO) system, which applied a force of less than 0.6 N and achieved a pulling distance of 1.5 mm per week. It was noted that urgent treatment after tooth extraction did not affect the rate of withdrawal symptoms, aside from dental fibrosis.

Another objective of OFE is to create a tooth along the gingival margin and alveolar space, facilitating the healing of temporary teeth after trauma by placing them in the local bone. Symptoms include long-term dental deformities and alveolar changes characterized by gingival recession and/or papilla loss, often due to chronic disease or dental trauma. In practice, this type of injection can be performed in a single volume.

The cases in this analysis showed an average distance reduction of 5 mm per week, consistent with clinical studies and other authors reporting an increase of 2–2.5 mm over two weeks [6, 8, 9]. Interestingly, there is no significant difference in strength between the OFE wire and the rubber and pins that connect the OFE wire to the tube. However, for longer distances, the treatment may extend for a week in simple fracture cases. The advantage of using wire is its ability to consistently direct force from tooth to tooth in a perpendicular direction. A study on the energy dissipation of NiTi wires indicates that the relationship between structure and magnetic properties leads to hardening in the martensitic phase [10]. Unfortunately, the wire tends to break at critical moments due to concentrated stress [11].

On the other hand, some research shows that the power of simple components can also be effective. Maximum aperture times the diameter has been noted [12]. Additionally, the force exerted by elastic materials significantly decreases (nearly 30%) compared to their original length [13, 14]. Therefore, varying the loading forces might yield better performance when softer materials are used during OFE [15–17]. One technique, which involves the gingival margin and alveolar bone, specifically applies to orthodontic bed preparation (OISD). In OISD, gradual bone growth is achieved by extracting the fractured tooth, while the tooth remains intact during the process [18].

OISD can be particularly beneficial for patients with periodontal disease and substantial internal bone loss. This method offers a safer pre-injection site and results in less morbidity in clinical studies [19, 20]. It allows the surgeon to promptly remove the fractured tooth, with estimates suggesting more than 70% success in bone replacement and around 60% in permanent teeth [21].

4. Conclusion

This study demonstrates that orthodontic force extrusion OFE is a viable first line treatment for non restorable permanent teeth, particularly in cases of chronic periodontitis and periodontal disease. While promising, the findings highlight the need for further research to confirm the effectiveness of OFE and to explore potential complications such as resorption and pulp necrosis. However, within this study's scope, OFE's impact on gingival and alveolar tissue removal in dental trauma varied based on the treatment goals. Higher force application can expedite the process but usually comes with higher costs and may eliminate the need for further surgical interventions.

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