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A multidisciplinary approach to treat subgingivally fractured canine: endodontics, forced orthodontic extrusion, periodontal and prosthetic rehabilitation

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ABSTRACT

Management of traumatized anterior teeth with subgingival crown or root fracture pose a great challenge to the clinician. The aim is to make the subgingival fracture line supragingival which will ultimately facilitate its treatment with ease. One such modality of treatment is described in this case report which involves a multidisciplinary approach for the management of infrabony root fractures.

Keywords: Subgingival fracture, Orthodontic Extrusion, Root Canal Therapy, Crown lengthening procedure, Biologic width.

INTRODUCTION

Subgingival carious lesions or fracture lines are often encountered by the clinicians in the current scenario. The management of such lesions involve extraction of the remaining tooth structure and prosthetic rehabilitation (by a FPD or RPD) or surgical crown lengthening of the crown and/or orthodontic extrusion followed by prosthetic rehabilitation. The orthodontic extrusion provides undeniable benefits for such patients.

INDICATIONS FOR ORTHODONTIC EXTRUSION

Esthetics

- Treatment of a subgingival lesion of the tooth between the cementoenamel junction and the coronal third of the root
- Infrabony lesion of the tooth between the cementoenamel junction and the coronal third of the root.
- Caries
- Oblique or horizontal fractures
- Perforations caused by a pin or post,
- Internal or external root resorption.

Biologic

- Treatment of a restoration impinging on the biological width
- Reduction of angular bone defects and isolated periodontal pockets [5].

Prosthetic

- Pre-implant extraction to maintain or re-establish the integrity of an alveolar ridge

Orthodontic

- Orthodontic extraction where surgical extraction is contraindicated (e.g., in patients receiving chemotherapy-bisphosphonates or radiotherapy) [6].
- Treatment of trauma [7,8] or impacted teeth [9].

CONTRAINDICATIONS FOR ORTHODONTIC EXTRUSION

- Ankylosis or hypercementosis [10]
- Vertical root fracture
- Root proximity and premature closure of embrasures
- Short roots, which do not allow for adequate support of the restoration [11] (i.e., when the crown–root ratio is less than 1:1)
- Insufficient prosthetic space
- Exposure of the furcation.

ADVANTAGES OF ORTHODONTIC EXTRUSION

Orthodontic extrusion is a conservative procedure that allows retention of a tooth without the disadvantages of a fixed bridge (e.g., the mutilation of adjacent dental tissue that typically occurs during bridge fabrication).

DISADVANTAGES OF ORTHODONTIC EXTRUSION

- May cause esthetic problems
- May adversely affect oral hygiene.
- The duration of treatment (4 to 6 weeks of extrusion and 4 weeks to 6 months of retention for implant cases in which tissue and bone remodelling are the objectives [5]) may discourage some patients.
- At the end of the procedure, conservative periodontal surgery may be necessary to correct any discrepancy that has developed between adjacent periodontal levels [12].

CASE REPORT

A 30-years old male patient was referred to the Department of Conservative Dentistry and Endodontics, with his injured front tooth in a road traffic accident leading to its fracture a few months before. Clinical examination showed horizontal coronal fracture of upper left canine (#23) involving pulp. Prosthetic rehabilitation became difficult due to the fractured line was extended below gingival margin on the palatal side. About 2 mm and 0.5mm of the tooth structure was seen intact in labial and palatal side. There was no mobility seen with remaining tooth structure. Radiographic examination revealed a fully formed apex without any periapical lesion or any sign of additional root fracture. Patient was advised with the option of extraction or a multi-disciplinary treatment. Patient was convinced for multi-disciplinary treatment option.

Proper informed consent of the patient was taken. Root canal therapy was carried out in two subsequent appointments. At the first appointment, root canal was filled with $Ca(OH)_2$ for proper disinfection of canal space. Obturation was completed in the next appointment. Orthodontic extrusion was planned subsequently.

Orthodontic extrusion was planned subsequently. After the tooth was asymptomatic for a week, rapid orthodontic extrusion was carried out. Most of the successful orthodontic extrusion cases are usually done by implementing the fixed mechano-therapy but the patient was unwilling to undergo as it would require longer time duration of about 15months. Hence, it was decided to extrude the tooth with a removable *Modified*-labial bow incorporating a J-Hook. So after a week of completion of root canal therapy, more than half of the coronal gutta percha was removed for placement of J-Hook; fabricated with 0.036 inch rigid stainless steel wire and extrusion would be done by applying traction forces through this attachment. It was planned to extrude the tooth for about 3 mm depending upon the position of the fracture line. *Modified*-labial bow was fabricated with a rigid stainless steel 20 gauge wire with a J-

Hook bent inwards. Adams clasps on first molars was the retentive component of the appliance. Heat cure acrylic resin was used for fabrication of the base plate. Force was exerted on the root with the help of an elastic module engaged between the two J-Hooks. A force of 30 grams was applied, measured using a Dontrix gauge. The elastic module was changed every 7 days until the desired amount of extrusion was achieved. The time period required to obtain the adequate extrusion was 40 days. A stabilization period of 30 days followed the orthodontic extrusion.

After 30 days, the crown structure was evaluated. The clinical crown height on the labial side was 3 mm whereas on the palatal aspect it was 2mm. The restoration, being in an esthetic zone, margins of the restorations was planned subgingivally. Bone sounding was performed to measure the biologic width. It was found that the biologic width was 2 mm on the labial side with 1 mm sulcus depth and a biologic width of 1 mm on the palatal side with a sulcus depth of 0.5 mm. Crown lengthening procedure was performed to increase the clinical crown height. Minor gingival recontouring was done on the labial aspect. Ostectomy was performed on the palatal aspect. About 1.5 mm of the crestal bone was removed on the palatal aspect and final reshaping was done to achieve the physiological contours. The flap was sutured at the tooth bone junction. Suture removal was done after 7 days. Healing was found to be uneventful. After 2 weeks, the clinical crown height was approximately 4mm on the labial aspect and 3.5 mm on the palatal aspect. The sulcus depth was 1.75 mm on the labial side and 1.5 mm on the palatal side.

Post space was prepared upto # 3 Peeso reamer. Fibre post of appropriate size was cemented using dual core resin cement. Core build up was done using composite core material. Crown preparation was done with shoulder finish line 0.5 mm in the gingival sulcus. #00 gingival retraction cord was placed in the sulcus and putty wash impression was made using condensation silicone impression material.

Fig.1: Preoperative Radiograph

Fig. 2: Obturation

Fig.3: Space created for J-Hook placement

Fig.4: Orthodontic appliance

Fig 5: Orthodontic appliance on cast

Fig 6: J-hook placement within canal

Fig 7: Orthodontic appliance fitted to J-hook

Fig 8: After orthodontic extrusion with 23

Fig 9: Composite core build up with 23

Fig 10: Crown prosthesis with 23

DISCUSSION

If the fracture line is positioned both below alveolar bone and gingival free margin, and if the length of the root segment is sufficient enough to support a coronal restoration, then the root can be endodontically treated and orthodontically extruded to elevate the fracture plane above the gingival margin. These procedures enable more favorable prosthodontic coronal restoration by securing its good sealing and esthetics, and moreover, preserving a good periodontal tissue health [13].

Placing restorative margins within the biologic width frequently leads to gingival inflammation, clinical attachment loss and bone loss. This is thought to be due to the destructive inflammatory response to microbial plaque located at such depths. Thus, it is important to maintain health of periodontium during restoration in subgingival areas. Ingber *et al.* suggested that a minimum distance of 3 mm is required from the restorative margin to the alveolar crest to permit adequate healing and restoration of the tooth that is biologically acceptable [14].

Movement of a tooth by extrusion involves applying tractional forces in all regions of the periodontal ligament to stimulate marginal apposition of crestal bone. Because the gingival tissue is attached to the root by connective tissue, the gingiva follows the vertical movement of the root during the extrusion process. Similarly, the alveolus is attached to the root by the periodontal

ligament and is in turn pulled along by the movement of the root [15].

Forces of 15 g for the single and slender root of a lower incisor and 60 g for a molar are sufficient for slow extrusion. Some authors recommend that the maximum force for a slow movement should not exceed 30 g, [16, 17]. Where as rapid extrusions are accomplished with forces higher than 50 g [18]. Rapid orthodontic extrusion is carried out at higher forces; hence, longer retention periods are required to stabilize the tooth for remodeling and adaptation of the periodontium to the newly acquired tooth position.

Orthodontic extrusion forces coronal migration of the root and increases the bone ridge as well as the quantity of attached gingiva, in particular when weak to moderate forces are applied. R. Williams, 1991 stated that margin of restoration should not be deeper than 0.5 mm into the sulcus. If sulcus is between 0.5 mm to 1.0 mm then the margin of restoration should not enter the crevice but terminate just at or above the gingival margin.

CONCLUSION

Management of subgingival and infrabony fracture lines poses a great challenge to the clinician in many aspects. Orthodontic extrusion is a simplistic method of treating the fracture line but is of limited value due to the duration of treatment. A multidisciplinary approach is necessary for the restoration of tooth fractured at a subgingival level because the margin of restoration should be supragingival to facilitate its treatment. In this case report, a treatment modality for forced eruption therapy that minimizes treatment time and increases ease of use is described. The use of this technique for forced eruption may help the general dentist to have a better esthetic result and better patient appreciation.

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