

Restoring the Unrestorable - A Combination of Orthodontic Tooth Extrusion and Restorative Dentistry

Dr. Rishi Manan
Sr. Lecturer

Dr. Nikhil Bahuguna
Asso. Professor

Dr. Varun Raj Kumar
PG Student

Department of Conservative Dentistry & Endodontics, Institute of Dental Studies & Technologies, Kadrabad, Modinagar, U.P.

Introduction

Restoring a broken central incisor still remains a dentist's biggest challenge. The factors challenging the practitioner are the recreation of contact and contour, normal and accurate anatomy and absolutely normal aesthetics. And if these considerations are coupled with minimized tooth structure and improper bone and soft tissue support for conventional restorative modalities, the challenge becomes even tougher. Achieving the ideal tissue drape is often considered the most difficult aspect of this restorative process. Since the gingival contours follow the underlying osseous crest, the presence of adequate alveolar bone at the implant site is paramount.

Losing a tooth in the smile zone is not only an aesthetic compromise but also a psychological loss of losing one's own natural body organ. All the efforts should be made to restore and preserve the natural tooth as long as it is possible in everyday practice, the dentists sometimes see cases of sub-gingival trauma or carious lesions. Possible options include extraction and prosthetic restoration (by a bridge) or surgical lengthening of the crown, as well as orthodontic extrusion. The last of these options provides undeniable benefits for the patient.

Orthodontic Extrusion

Movement of a tooth by extrusion involves applying traction 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.

The employment of this treatment approach to augment hard and soft tissue is based upon the principle that the periodontal fibers are secured to the bone. When placed under tension, the result is deposition of new bone. The result is an increase in vertical height of the existing defect. Additionally, a coronal migration of the overlying periodontal tissue and marginal gingiva occurs.

Orthodontic extrusion is not new. In 1993, Salama and Salama reported that teeth with a hopeless prognosis could be extruded for 6 weeks, and retained an additional 6 weeks prior to extraction and implant placement. Simon, et al further explained the retention time. At 2 weeks, they reported radiolucent areas filled with immature bone, osteoid, and a normal periodontal ligament.

By week 7, normal bone formation was confirmed histologically. A 2008 article reviewed by Korayme, et al established the following guidelines with orthodontic extrusion-

- Light, constant extrusion forces are recommendable; 15g for anterior teeth/ 50g for posterior teeth.
- The rate should be steady and slow, no more than 2.0 mm per month. A retention and stabilization of no less than one month for every month of active extrusion.
- Overlay wires were recommended to avoid tipping of the adjacent teeth.

Indications for Orthodontic Extrusion

Orthodontic extrusion is indicated in the following situations (Fig. 1)-

- For treatment of a sub-gingival or infra-osseous lesion of the tooth between the cement-enamel junction and the coronal third of the root (e.g., caries, oblique or horizontal fractures, perforations caused by a pin or post, internal or external root resorption), especially when there are aesthetic considerations.
- For treatment of a restoration impinging on the biological width.
- For reduction of angular bone defects and isolated periodontal pockets, for pre-implant extraction to maintain or re-establish the integrity of an alveolar ridge.
- For orthodontic extraction where surgical extraction is contraindicated (e.g., in patients receiving chemotherapy or radiotherapy)
- For treatment of trauma, or impacted teeth (canines).

Contraindications to Orthodontic Extrusion

Extrusion is contraindicated in patients with the following conditions-

- Ankylosis or hyper-cementosis (the extra load would cause intrusion of the anchor teeth)
- Vertical root fracture
- Root proximity and premature closure of embrasures (Fig. 2).

Additional contraindications come into play when extrusion is used for prosthetic purposes-

- Short roots, which do not allow for adequate support of the restoration (that is, when the crown root ratio is less than 1:1)
- Insufficient prosthetic space
- Exposure of the furcation.

These criteria are not absolute and do not apply if the purpose of orthodontic extrusion is to increase the quantity of bone in a ridge

before placing a dental implant.

Advantages

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). As well, extrusion does not involve loss of bone or periodontal support, as commonly occurs during extraction. Simple surgical crown lengthening involves additional resection of bone of the teeth adjacent to the tooth that is to be lengthened, and such osteotomy can sometimes be avoided by use of orthodontic extrusion. Finally, this simple technique requires a relatively easy movement of the tooth.

Disadvantages

Wearing an orthodontic device, as is required for orthodontic extrusion, may cause esthetic problems and may adversely affect oral hygiene. As well, 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 re-modelling are the objectives) may discourage some patients. Indeed, some authors recommend 4 weeks of retention for every millimeter of extrusion. At the end of the procedure, conservative periodontal surgery may be necessary to correct any discrepancy that has developed between adjacent periodontal levels.

Extrusion and Endodontics

In some cases, the tooth to be extruded must be treated endodontically to prevent sensitivity and exposure of the pulp during the occlusal reduction required during the extrusion. A canal that cannot be adequately treated (because of sub-gingival fracture and lack of an adequate operative field) can be filled with calcium hydroxide before extrusion and subsequent treatment. However, when the tooth must be extracted and the purpose of extrusion is to obtain an optimal ridge (e.g. In cases of pre-implant extraction), pulpectomy may be sufficient. Moreover, if the tooth is to be saved and its pulp kept intact, slow orthodontic extrusion, over a period of 3 to 6 months, is the preferred method of reducing the risk of pulpal necrosis; rapid extrusion could be traumatic to the pulpal tissue. A histologic study demonstrated odontoblastic degeneration after 1 week of activation and pulpal fibrosis after 4 weeks in a tooth subject to an extrusion force of 50g. The authors assumed that the pulpal reaction would differ depending on the diameter of the apical foramen. Pulp prolapse would be due to ischemia secondary to rapid movement. During rapid extrusion, a pseudo-

apical lesion (an apical radiolucency) appears, which must be differentiated from a true lesion of endodontic origin. However, a tooth that has undergone incomplete root canal treatment, although asymptomatic, could eventually develop a true apical lesion because of inflammatory mediators involved in the root apex during orthodontic movement.

Extrusion and Prosthodontics

The mesiodistal diameter of the root, which is naturally “strangled” at the cemento-enamel junction of single-rooted teeth, is reduced with progression of the extrusion (especially in the case of conical roots), which involves expansion of interproximal gingival embrasures. The contour shape of the crowns must not be exaggerated to compensate for this reduction in diameter. Similarly, embrasures should not be filled to prevent an over contour, which could adversely affect the marginal periodontium.

Orthodontic extrusion with crown lengthening

Orthodontic extrusion with crown lengthening is indicated when sufficient supra-gingival tooth structure is not present for a post-and-core restoration and gingival and/or bone levels are not ideal (e.g. An infra-bony pocket exists or the tissue surrounding the non-vital tooth is more apical). Although surgery is required and treatment time is increased as opposed to rapid orthodontic extrusion with fibrotomy, crown lengthening can produce an aesthetic result by creating a more ideal gingival level or bone contour while preserving the crown-root ratio for subsequent post-and-core restoration.

Techniques

1. One technique involves placing orthodontic brackets on the buccal aspect of the teeth adjacent to the tooth that is to undergo extrusion in a passive position that will not cause any orthodontic movement of the anchor teeth (Fig. 3). The bracket on the target tooth is positioned more apically than the

brackets on the adjacent teeth; the difference in distance represents the desired extrusion.

2. Another strategy consists of inserting a rigid wire into the restorations of the anchor teeth. A metal wire, 0.7 mm in diameter, hooked at one end, is cemented into the canal of the tooth that is to undergo extrusion. An elastic connects the hook to the rigid anchor wire to activate the mechanism (Fig. 4a and 4b). The elastic is changed every 2 weeks.

This method can be difficult to use on posterior teeth because occlusion can interfere with the mechanism. If the anchor teeth have not been restored, a rectangular stainless steel arch wire (0.018 or 0.019 in. x 0.025 in.) can be folded and affixed with composite to the buccal aspect of each tooth (Fig 5a & 5b).

3. A temporary crown cemented on a final post can be used as a traction attachment point.

Case Report

A 25 year old patient reported with a history of trauma in the upper front tooth region in the Department of Conservative Dentistry & Endodontics. During the course of oral examination and evaluation, the diagnostic radiograph revealed Elli’s Class III fracture and on clinical examination a sub-gingival fracture was seen on the palatal side. The pulp vitality test was conducted, which gave a negative response. The palatal segment was mobile and was extracted on the same day. The height of the fracture was not suitable for crown lengthening, therefore Orthodontic Extrusion was planned. The pre-operative radiograph was taken and Root Canal Therapy was completed. Orthodontic extrusion was done by placing the bracket along with ligation of the orthodontic wire and traction was applied to extrude the tooth to the desired position. Satisfactory extrusion was accomplished in a time span of 6-8 weeks. After which periodontal surgical procedure was done (Circumferential Supracrestal Fibrotomy) to prevent the relapse. Then resin post was fabricated and

composite core was made. Crown preparation was done for the placement all-ceramic crown, shading matching was done using a Vita shade guide and followed by crown cementation.

Conclusions

In spite of the technical difficulties and sensitivity of technique, orthodontic extrusion still remains an accessible and a beneficial technique for the patient who wishes to retain the natural tooth giving the patient the confidence of living a natural organ that an artificial substitute. It can also be used as a methodology if only to keep the bone ridge volume intact and thereby to maximize the benefits of future replacements such as dental implants.

References

For a complete list of references are available on request at editor@healtalkt.com

Legends

- Fig.1 Examples of indications for orthodontic extrusion- a) sub-gingival or infra osseous dental lesion, such as a fracture; b) restoration impinging on the biological width; c) reduction of localized angular bone defects; d) pre-implant extraction; e) trauma or impacted teeth.
- Fig.2 Root proximity, a major contra indication for orthodontic extrusion of a molar.
- Fig.3 System of orthodontic brackets attached by a nickel titanium wire.
- Fig.4 A & B - Orthodontic wire embedded in the restorations adjacent to the tooth that is to be extruded. Movement is effected by anelastic that is changed regularly.
- Fig.5 A & B - Orthodontic wire cemented by composite to the buccal aspect of the anchor teeth. An elastic activates the extrusion in the vertical axis only.
- Fig.6 Pre Op picture showing the fracture upper left central incisor, buccal view
- Fig.7 Pre Op picture showing palatal view of the fractured tooth. Note the sub-gingival margin of the fractured tooth preventing the proper placement of the finish line.
- Fig.8 Buccal view showing the orthodontic set up in place. Note the high position of the bracket on the tooth to be extruded and the Temporary composite build up on the tooth to provide adequate bulk.
- Fig.9 The tooth preparation for a full coverage crown following post and core exhibiting a proper ferrule effect.
- Fig.10 All ceramic crown cemented with the involved upper left central incisor.

