Reestablishing biologic width with forced eruption

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Maintenance of gingival health is one of the keys for the longevity of teeth, as well as for the longevity of restorations. In this context, the biologic width functions as a barrier against the entrance of microorganisms into the internal medium of the periodontal ligament and into the gingival and osseous connective tissue. This clinical case describes a technique to reestablish the biologic width of a central incisor using forced extrusion and done without post-treatment corrective surgery. *(Quintessence Int 2003;34:xxx–xxx)*

Key words: biologic width, forced eruption, forced extrusion, tooth tractioning, treatment of biologic width

CLINICAL RELEVANCE: Use of an eruption technique is shown to be valid in treating cervical fracture of an anterior tooth by providing adequate biologic width prior to final restoration. **[Au: Edits ok?]**

Maintenance of gingival health constitutes one of the keys for tooth and dental restoration longevity. In this context, the biologic width acts as a barrier to prevent penetration of microorganisms into the periodontium. The biologic width comprises the space between the osseous crest and base of the pocket. It is formed by the connective tissue insertion and the junctional epithelium, both measuring approximately 1.0 mm. For the biologic width to be preserved, a minimum of 2.0 to 3.0 mm of healthy supraosseous root is necessary circumferentially.[1,2] Without adequate biologic width, a chronic inflammatory response may be induced, resulting in gingivitis or periodontitis.

There are many ways to compromise the biologic width. The most common causes involve placing restorative margins too close to the alveolar bone. **[Au: Edits to previous sentence ok?]** This can result from dental fracture, cervical root resorption, primary or secondary caries, endodontic perforation, or cavity over-preparation.[3] In the past, many of these situations were treated by dental extraction.[4] Other more conservative treatment methods are available and include surgical crown lengthening and tooth extrusion.[5] These treatment modalities require knowledge and planning in order to obtain maximum longevity.

Tooth traction (extrusion), first described by Heithersay in 1973,[6] has repeatedly demonstrated its benefits in certain cases by recovering biologic width, and has advantages when compared to surgical procedures.[7] The purpose of this article is to describe a tractioning technique for a maxillary central incisor with compromised biologic width.

CASE REPORT

A 29-year-old woman presented to Federal University of Santa Catarina, Department of Operative Dentistry, with a fractured maxillary right central incisor (Figs 1 and 2). The tooth was endodontically treated and had a large resin restoration temporarily cemented. Upon

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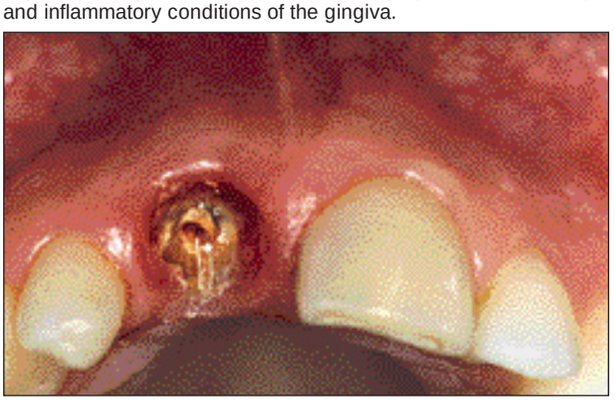
Fig 1 Slight extrusion of the crown of the right central incisor.

Fig 2 Compromised biologic width is apparent.

Fig 3 *(left)* Periapical radiograph revealing proximity of fracture to the osseous crest and conical root form of right central incisor.

Fig 4 *(below)* Incisal view reveals subgingival fracture margin and inflammatory conditions of the gingiva.



removal of the fragment, clinical examination revealedthe biologic width to be compromised. The periapical radiograph (Fig 3) showed proximity of the fracture to the osseous crest. The incisal view (Fig 4) showed the fracture margin to be subgingival.

After analysis of factors such as the height of the smile line, age **[Au: Patient age?]**, root anatomy, endodontics, and financial resources, it was suggested to the patient that the tooth be treated by means of extrusion to permit fabrication of a single-unit fixed partial denture that would result in improved esthetics and adequate biologic width.

At a subsequent appointment, a cast metal core pattern was fabricated in acrylic, with two supporting retentive rods, one facial and the other palatal (Fig 5). An alginate impression of the maxillary arch also was taken. During the time interval necessary to have the core cast, the coronal fragment was temporarily cemented. After an electric scalpel had been lightly applied to stop secretions, the cast metal core was cemented in the interior of the root with zinc oxide phosphate cement (Fig 8). The fractured crown was adapted to the metal core as a provisional restoration (Figs 7 and 8).

A plastic full-coverage maxillary appliance, thermovacued on the stone model, was adjusted to the patient's dentition. The acrylic plate was adjusted in the area of the central incisor to allow visualization of the tooth to be extruded. The tooth was reduced about 2.0 mm on its incisal edge, to allow for axial movement during forced eruption (Fig 8). With the acrylic plate in position and the tooth reduced incisally, the patient was instructed in application of the orthodontic elastic, first on the palatal retention rod and then on the vestibular rod (Fig 9). Size and thickness of the elastic are directly related to the desired speed of eruption. The use of a light-pressure elastic for the first 3 days proved to be the best option for the initiation of movement. At the same appointment, the marginal gingiva was anesthetized and a circumferential incision which penetrated the periodontal ligament was made to reduce coronal movement of gingival tissues (Fig 10). The patient was instructed to change the elastic daily.

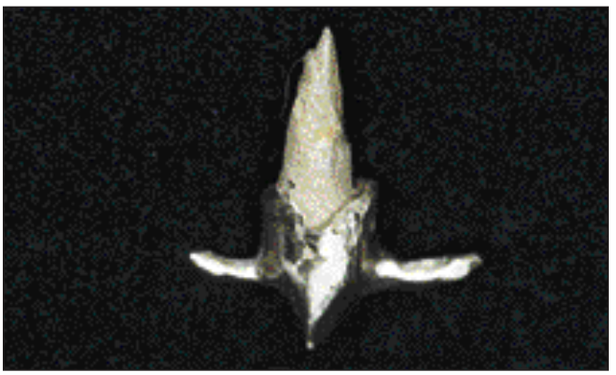


Fig 5 Cast metal post and core with two supporting retentive rods, one vestibular and the other palatal.

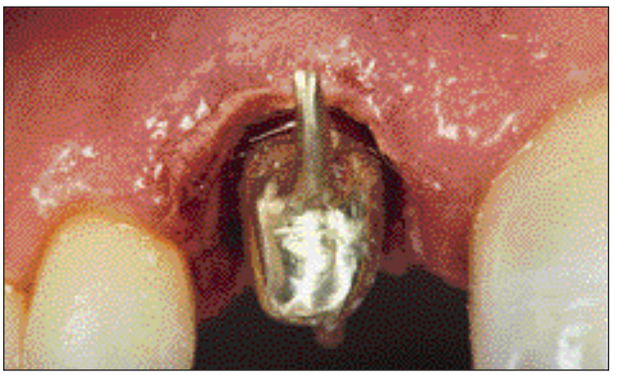


Fig 6 Cemented cast metal post and core.

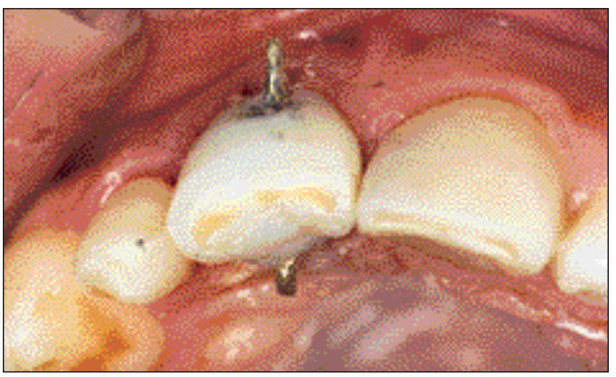


Fig 7 Incisal view showing the retentive rods.

Fig 8 The tooth was reduced approximately 2.0 mm on the incisal edge, to allow for axial movement of forced eruption.

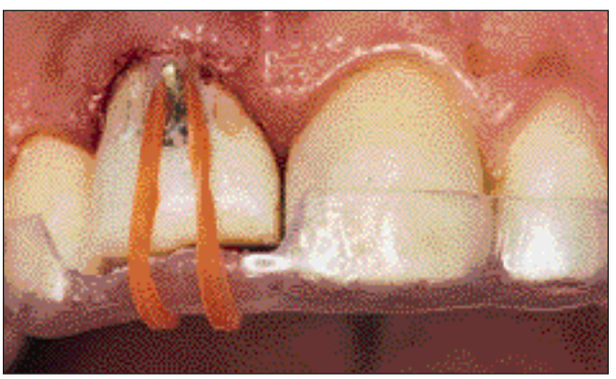


Fig 9 Acrylic plate with cutout made in the area of the central incisor to enhance visualization of the tooth to be extruded and light pressure elastic in place for initiation of traction.

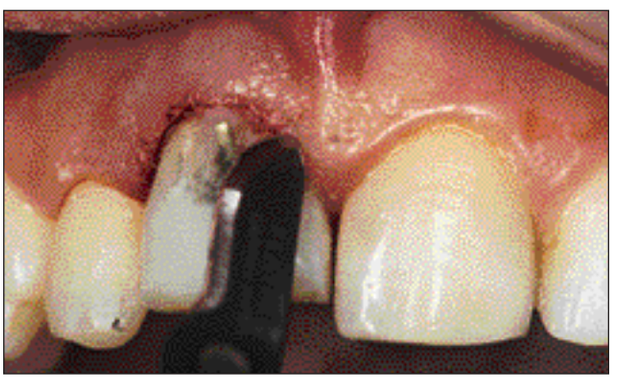


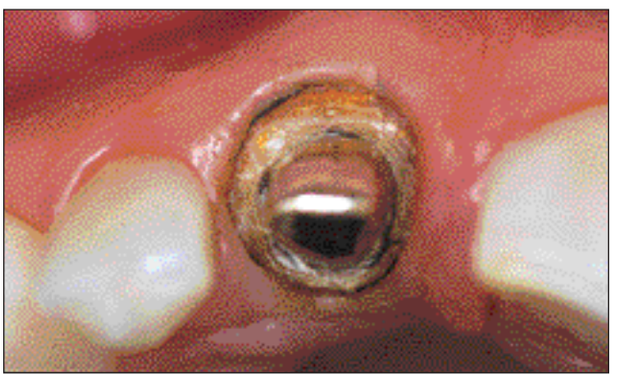
Fig 10 A circumferential incision being made for greater speed of traction and reduced accompaniment of gingival tissues and bone with the tractioned tooth.

After the first 3 days, a thicker elastic was provided. With the exception of meals, continuous use of the plate and elastic was recommended.

With return visit evaluations and telephone contacts during the first 15 days of traction, the patient was monitored on the continuous use and daily change of elastics. After the necessary movement of the tooth (approximately 3 mm) to recover the biologic width had been attained (Fig 11), a 2-month retention period was planned for the patient to prevent the tooth from returning fully or partially to its original position. A well-adapted provisional restoration, splinted to the adjacent teeth, was placed to provide for patient comfort and cleansability (Fig 12). The acrylic provisional remained for 6 months, because of personal reasons of the patient (Fig 14) .

Fig 11 After a period of 15 days, the necessary 2.0 mm to recover the biologic width was accomplished. It is possible to see the more incisal position of the vestibular rod when comparing it to its position in Fig 8. The incisal edge was progressively reduced.

Fig 12 A well-adapted provisional, splinted to the adjacent teeth was placed to enhance patient comfort and periodontal health and to prevent the tooth from returning fully or partially to its original position.



Figs 13 and 14 The final view of the preparation for a metal-ceramic crown and improved health of the gingival margin.

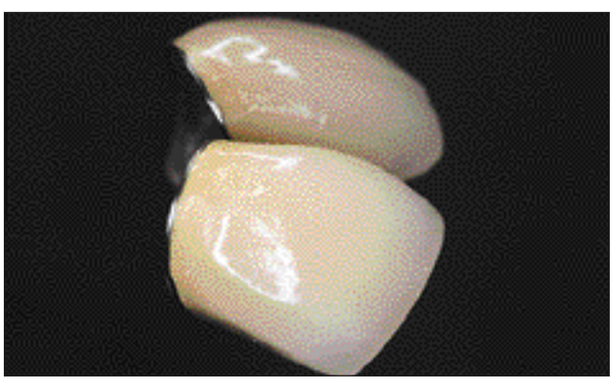


Fig 15 Cervical collar of the metal crown to improve adaptation to the root.

Six months after insertion of the provisional, the patient returned to have the definitive restoration fabricated. Following removal of the provisional and refining of the preparation, an impression of the tooth was made with polyvinylsiloxane **[Au: Edit ok?]**material (Express, 3M Dental) (Figs 13 and 14). A metal-ceramic restoration was designed with morphology similar to that of the provisional. Due to the fibrotic characteristics of the gingival tissue and margin placement, the cervical collar of the crown was fabricated in metal, to improve its adaptation (Fig 15). Final cementation (Fig 16) and a final radiograph (Fig 17) revealed good gingival margin and recovered biologic width, which allowed periodontal health to be maintained.

DISCUSSION

Extrusion is one of the techniques available for treating problems in the cervical region of the root that compromise biologic width. Advantages of the traction technique presented here include ease, simplicity, and low cost. A possible disadvantage is the need for a multidisciplinary approach. Depending on the technique selected, more than one professional might be involved in the procedure, which may increase cost.

Extrusion is usually performed by means of fixed orthodontic appliances utilizing arch wires or elastics attached to the tooth,[6,8] but it can also be accomplished with the use of occlusal plates and elastics.[9] In

Figs 16 and 17 Final result and final radiograph reveal good gingival margin and recovered biologic width.

selected cases, traction can be carried out using only the adjacent teeth to fasten a support rod for the elastic, without the need of appliances or plates.[10,11] Traditional orthodontic approaches to extrusion may result in improved esthetics and comfort for the patient. However, wearing orthodontic appliances can be as unpleasant as using a plate, and might be considered unesthetic. An advantage of the plate is that these devices are simple to build and allow for simple oral hygiene.

Performing a fibrotomy around the root prior to and during extrusion is recommended to allow for a faster movement of the root in an axial direction and to stop the gingival and ultimately osseous tissues from following the movement of the root.[12] If these fiberotomies are not performed, the area may require surgery in order to correct the movement of gingival and osseous tissues.**[Au: Edits to previous sentence ok?]**[13–15] In this case, extrusion was chosen to avoid the time and possible disappearance of the papilla that can accompany surgery.

Selection of cases for extrusion is directly related to local factors, such as shape and length of the root, degree of compromise of biologic width, and the type of force and technique utilized. The term "forced eruption" might be erroneously interpreted if an excessive force is applied. In fact, the safety limit is not easy to establish, and the use of excessive force might be responsible for some root resorption.[7] Retention is necessary to stop the tooth from returning to its original position,[16] but recommendations for the retention period may vary.[3] The bone deposition that occurs at the root apex during extrusion is capable of offsetting or even canceling the return movement of the tooth. **[Au: Edits to previous sentence ok?]** In the majority of cases, a 2-month stabilization period will suffice.[6]

A final crown-root ratio of 1:1 is suggested to assure that the tooth has adequate support.[3] Another consideration during tooth extrusion is the need to prepare a crown having a large cervical excess to offset the smaller diameter of the root after extrusion.[15] This problem did not occur in the case presented, probably due to traction movement of only 2.0 to 3.0 mm. The final crown profile seen in Fig 16 does not show compensatory excesses in crown contour for the root diameter.

CONCLUSION

The use of the tractioning technique has been demonstrated to be valid in treating cervical fracture of an anterior tooth to reestablish biologic width. Placing an occlusal plate simplifies treatment, although a more frequent re-evaluation and renewed motivation of the patient is often necessary. Problems, such as the need for post-traction surgery or the need to over contour the final restoration to accommodate a smaller cervical diameter of the root, were not found in this treatment.

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