



CASE REPORT/CASO CLINICO

Surgical extrusion: A reliable technique for saving compromised teeth. A 5-years follow-up case report



Estrusione chirurgica: una tecnica predicibile per il recupero di denti compromessi. Un caso clinic con controllo a 5 anni

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KEYWORDS

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Abstract

Aim: To present a long term follow up clinical case in which a compromised anterior tooth was saved by a surgical extrusion procedure.

Summary: Although different techniques have been suggested for clinical crown lengthening in the anterior zone, some of them have limitations in terms of aesthetics and procedural requirements. The current case report demonstrates how a simplified surgical extrusion procedure was successfully performed for saving a severely damaged anterior tooth; furthermore, it is possible to apply the technique described in this case using minimum and simple armamentarium like a scalpel, elevators, forceps and splinting flexible cord.

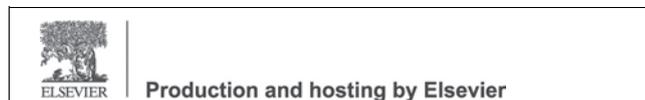
Key-learning points: Saving severely compromised anterior teeth is possible by applying surgical extrusion techniques when crown-root ratio allows it. Risk of root resorption or ankylosis is minimum.

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PAROLE CHIAVE

Frattura coronale;
Allungamento di corona clinica;
Estrusione chirurgica;
Riposizionamento chirurgico;
Ampiezza biologica.

Riassunto

Obiettivo: Presentare un caso clinico con controllo a 5 anni in cui un dente anteriore compromesso è stato recuperato con una procedura di estrusione chirurgica.

Riassunto: Sebbene siano state suggerite diverse tecniche per l'allungamento della corona clinica nella zona anteriore, alcune di esse presentano limitazioni in termini di estetica e competenza nelle procedure. Il presente case report dimostra come una procedura di estrusione chirurgica semplificata sia stata eseguita con successo per salvare un dente anteriore gravemente danneggiato. Va sottolineato che la tecnica descritta in questo caso può essere portata a termine utilizzando un armamentario minimo e molto semplice come un bisturi, leve, pinze e uno splintaggio flessibile.

Key learning points: E' possibile salvare elementi dentari gravemente compromessi applicando tecniche di estrusione chirurgica quando il rapporto corona-radice lo consente. Il rischio di riassorbimento della radice o anchilosi è minimo.

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Introduction

Nowadays that dental implants are popular options for replacing natural teeth, it is not always necessary to perform heroic efforts to save severely damaged teeth¹; however, retain patient's natural dental organs should be one of the main goals of dentists around the world.

Although different techniques have been suggested for clinical crown lengthening procedures to provide good conditions to restore severely damaged teeth, all of them have some limitations in aesthetic terms. In aesthetic zone, crown lengthening requires a more complex diagnostic and planning process, because, when choosing a surgical crown lengthening technique, special care should be taken or it could cause asymmetry of the gingival line.^{2,3}

A high percentage of traumatic injuries occur most frequently in the anterior zone, mostly in central and lateral maxillary incisors.^{4,5} When these injuries happen, sometimes is not possible to restore the affected tooth without additional dental procedures for obtaining adequate supra-gingival structure.

Different terminologies have been used for surgical extrusion: it is also known as intra-alveolar transplantation, intentional replantation and forceps eruption.⁶⁻⁸ A surgical tooth extrusion technique was described in 1978,⁹ while the first case report was published in 2002.¹⁰ Despite of its first description long time ago, this technique still remains rarely performed among practitioners.

Surgical extrusion is defined as the procedure in which the remaining tooth structure is repositioned at a more coronal/supra-gingival position in the same socket in which the tooth was located originally.^{8,11} The main principle is to place the affected tooth in a more coronal position for providing acceptable conditions to achieve the reestablishment of healthy supra-coronal tooth structure; this last point is important to be able to create a good restoration, that will maintain the biologic width healthy.^{1,3} Thus, this technique can be used successfully to treat severely damaged teeth, especially in the anterior esthetic zone.

A resume of the main steps involved in the technique described are: syndesmotomy, luxation of the tooth using periostomes and/or elevators, extrusion of the root with

forceps, immobilization of the root for two to three weeks in the new position using a semi-flexible splinting cord or interdental sutures, post placement and final restoration.^{1,3,6,7,12} The technique can be successfully applied with minimal chair side procedures, no needed of special surgical skills, good esthetics, low incidence of failure and easy acceptance from the patient.

Case series and reports are categorized as low evidence literature^{13,14} because causal relationships between intervention and outcome cannot be definitely established without a control group. Nevertheless, clinical reports can influence clinical decision making during dental clinical practice,¹³ as well as open interest in new techniques, clinical approaches and investigation lines. Therefore, the aim of this report is to show a long-term follow up of a clinical case in which a compromised anterior tooth was saved by a surgical extrusion procedure.

Report

In the present case report, a simplified surgical extrusion procedure is described where an upper lateral incisor with severely compromised structure was treated successfully.

A 37 years old female patient suffered a traumatism at the level of anterior-superior teeth. The patient arrived at the office with a fractured upper left central incisor. The tooth had a previous root canal treatment, a pre-fabricated metal post and a composite build-up (Fig. 1). After removing the post and the build-up material, it was evident the lack of supra-gingival sound tooth structure to perform a predictable and reliable long time lasting restoration (Fig. 2): ferrule effect was not possible to be obtained in such conditions.¹⁵ The next steps were to evaluate the radicular length and the width of remaining radicular and coronal walls and to consider the possible different treatment options to save the tooth. After a complete evaluation, it was decided to perform a surgical tooth extrusion to obtain a proper supra-gingival sound structure, thus offering to the patient a reliable long-term result.⁸

Clinical procedures were performed as follows: after disinfection of the affected area using a wet gauze with 2% chlorhexidine, syndesmotomy was made using a 15c scalpel and luxation of the tooth was achieved using a fine elevator



Figure 1 Preoperative radiograph; the root length is enough for extruding the tooth approximately 3–4 mm to gain supra-gingival structure without compromising the crown-root ratio.



Figure 2 Clinical scenario after removing the core build-up material and the prefabricated metal post. Lack of supra-gingival tooth structure is evident.

applying luxating forces just at the first 3–4 mm of the radicular structure to prevent damaging to the periodontal ligament that will remain in an infra-bony position. After that the tooth got lost from the socket, it was extruded approximately 4 mm (Figs. 3 and 4): extrusion was made using forceps and the tooth was grabbed only at the zone of the radicular portion that was supposed to stay in a supra-bony position after the procedure.

When the tooth was in the desired position, a slight pressure was applied in bucco-lingual direction with a gauze



Figure 3 Clinical picture of the tooth during the extrusion procedure.



Figure 4 Post-operative radiograph; it is possible to evaluate at apical level the quantity of mm extruded as a radiolucent area.

embedded with chlorhexidine to obtain hemostasis before splinting. Even though, interdental sutures for stabilizing the tooth are the most reported type of splinting material,¹⁶ in this case it was decided to use 0.8 mm diameter monofilament nylon fishing cord; it has the advantages that is cheap and easy to be obtained, offers a semi-rigid splinting and is easy to keep clean by the patient. The splint was placed using an auto-adhesive flowable composite, easy to be applied when a dry environment is difficult to be maintained for long time (Fig. 5). The splinting time was 15 days, as this splinting lapse is advisable for providing tooth stability and decreasing risk of ankylosis.^{16,17} It has been reported that mobility can decrease after a period of 3–4 weeks after the



Figure 5 Splinting the involved element to the adjacent teeth; a monofilament nylon fishing cord was used.

splint is removed.⁸ Even though bone grafting have been reported for improving tissue repair at apical level, benefits have not been clearly demonstrated^{9,18}; in this case it was not used any bone grafting material because the main purpose was to keep the technique as simple as possible. Patient got instructions of cleaning the area in a regular basis, using a soft brush for not affecting gingival tissue repair.

Orthograde endodontic retreatment was made 15 days after the extrusion with the splinting cord in place. After rubber dam placement, the canal was desobturated using a K3XF 35.06 file (Kerr Endodontics, Orange, CA, US) at 1200 rpm without using any kind of solvent, disinfection was made using 20 mL of 5.25% sodium hypochlorite and 3 mL of 17% EDTA as final irrigating solution. Continuous wave of compaction technique of gutta-percha and resin based sealer was used for filling the root canal. During the same appointment, a fiber post was placed to provide proper height to the core preparation; the fiber post was cemented using a dual-cure composite cement inside the canal and SonicFill composite (Kerr Endodontics, Orange, CA, US) was used as core build-up material to reconstruct the missed coronal tooth structure (Figs. 6 and 7).

Crown preparation was made 30 days after the surgical extrusion procedure, confirming that a proper ferrule height and thickness was effectively present. The tooth was then temporized and a final full metal-ceramic crown restoration was placed three months after the initial procedure to provide enough time for the periodontal tissues to heal and thus avoiding post-restorative gingival migration.^{19,20} Cuspal covering restorations (overlay or complete crowns) are the most indicated final restorative options in the cases in which a severe loss of tooth structure was present.¹⁶ The radiographic control taken the day of the final restoration placement showed signs of periapical healing (Fig. 8). It has been reported that it is possible to see a normal periodontal ligament contour three months after the procedure,^{8,19} while periapical healing and resolution of radiolucency is commonly observed 6 months after with minor loss of marginal bone,⁸ commonly related to bone damage during the extrusion procedure. After five years follow up, a complete periodontal tissue repair was observed (Fig. 9). Slight radiographic signs of superficial root resorption are present at distal apical level. The tooth remained asymptomatic, without mobility and in completely aesthetic and biological function.



Figure 6 Post-operative radiograph; root canal retreatment and fiber post placement were done in the same appointment, 15 days after the surgical extrusion procedure.



Figure 7 Clinical picture of the tooth after post placement, core build-up reconstruction and splinting removal.

Discussion

The basic principle for biologic width care says that there should be at least 2–3 mm of tooth between the bone and the margin of the final restoration.²¹ If biologic width is invaded during restorative procedures, they may lead to periodontal breakdown.²² When crown lengthening is planned to increase the length of affected available teeth for restorative preparations, some anatomic and biologic considerations need to be done. Different techniques have been proposed for clinical crown lengthening procedures; particularly in anterior esthetic regions the preservation of gingival margin and interdental papilla is required in order to obtain satisfactory final esthetic outcome.^{19,21,23}



Figure 8 Radiograph of the final full-crown in place, three months after the initial procedure; it is possible to note the periapical healing without changes on radicular surface.



Figure 9 Five years follow-up radiograph; it is possible to observe the complete periapical bone healing, a continuous periodontal ligament space and a superficial root resorption at the apical distal level.

Surgical extrusion represents the separation of bone-root periodontal attachment using surgical instruments such as fine elevators, periostomes, forceps, scalpel, for placing the tooth in a more coronal position with the aim to obtain supra-gingival sound structure to be able to perform a proper long-time lasting final restoration, without risk of damaging periodontal tissues and invading biologic width.^{3,16,18} This procedure is indicated in cases of crown-root fracture (involving enamel, dentine and cementum with or without the pulp compromised),²⁴ root fracture (involving cementum, dentine and pulp),²⁵ carious lesions extending near to the alveolar bone crest that appear to be un-restorable,²⁶ cervical root resorption and teeth with lack of supra-gingival tooth structure to provide an adequate ferrule effect.^{16,27} In cases where sub-gingival labial fracture occurs, rotation of the tooth by 180 degrees may also be indicated to reduce the quantity of tooth needed to be extruded,¹⁶ because when tooth is rotated it requires less extrusion to provide access to the margins of the fracture on the facial aspect.⁸ In some cases it is important to limit the extrusion quantity to maintain an adequate coronal–radicular ratio.

One of the surgical extrusion techniques published involves flap elevation with careful exposure of the apex, but this technique is not recommended for the anterior zone and nowadays more conservative approaches are advisable.⁸ Root extraction studies have reported that the use of vertical axial traction forces produces significantly less cementoblast loss on root surfaces than extracting teeth with forceps.²⁸ One of the disadvantages of the technique suggested in the present report for luxating the tooth is that, if the clinician is

not gentle while applying pressure, a possibility exists of exerting too high compressive forces to the periodontal ligament at apical and coronal radicular level; it may cause a damage to the cementoblasts and periodontal ligament cells at some points around the radicular surface, increasing as a consequence the risk of superficial root resorption.^{28,29} However, superficial root resorption is not progressive in nature and primarily associated with the surgical technique^{8,30} and functional repaired surface resorption have been observed and reported in some root segments. Higher rates of root resorption have been seen in cases in which the root canal treatment was made before the extrusion procedure.⁸

Even though bone grafting have been reported for improving tissue repair at apical level^{9,18} benefits have not been clearly demonstrated. On the other hand, apical rupture of periodontal tissues leads to formation of a coagulum apical to the root apex, which subsequently leads the formation of a fibrous scaffold with ultimate maturation into cancellous bone^{31,32}; for this reason, bone grafting was not considered as a treatment option in the present case.

Some advantages of the surgical extrusion technique are: less operative and overall treatment time compared to orthodontic extrusion, a relatively easy procedure with less cost compared with conventional crown lengthening techniques, a short chair time, patient recovery is not complicated and long term cooperation from the patient is not required.^{1,8,12,23} Possible adverse events associated to the technique presented in the present case report may be: root fracture during the extrusion procedure, superficial root resorption, marginal bone loss, persistent tooth mobility,

tooth loss due to compromised periodontal attachment or inadequate crown-root ratio and tooth ankylosis (not common with this technique because all the procedures are performed under a controlled environment).^{1,16} Further limitations related to this procedure may be: patient acceptance, difficulty for the temporization of the tooth, poor patient oral hygiene (mainly during the first post-operative week) and bleeding control when an adhesive splint is placed.¹⁶

Conclusion

The 5-years follow-up of the case of surgical extrusion presented in this report showed a complete healing of the periapical tissues, with only a radiographic evidence of a small superficial root resorption in the distal area of apical third. Clinically, the tooth remains asymptomatic, without mobility and in completely aesthetic and biological function, demonstrating a satisfactory outcome of the clinical technique presented.

Clinical relevance

The technique showed in the present case report demonstrated to be a possible valid alternative treatment for the maintenance of compromised teeth.

Conflict of interest

The authors have no conflict of interest to declare.

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