

Immediate loading in anterior region using the clinical crown of the lost natural tooth: A case report

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Abstract

One of the major current challenges in Dentistry is oral rehabilitation after tooth loss due to trauma. Esthetic and functional results, together with periodontal health, define success and prognosis. Implant dentistry provides the resources for the placement of osseointegrated screw-retained implants or cemented prostheses to replace missing teeth. Careful use of provisional prostheses preserves the harmonious architecture of gingival tissues and affects final treatment results positively. This study describes a clinical case of root fracture of the right maxillary central incisor (tooth #11) due to dental trauma. The tooth was extracted, an immediate implant was placed and the provisional prosthesis was fabricated using the clinical crown of the fractured tooth. The use of a fractured tooth for provisional restorations is a viable technique that has good esthetic and functional results and preserves gingival and dental balance.

Keywords: Dental implants. Immediate loading. Tooth fracture. Single implant.

How to cite this article: Gomes FV, Volkart FB, Mayer L. Immediate loading in anterior region using the clinical crown of the lost natural tooth: a case report. *Dental Press Implantol.* 2012 Oct-Dec;6(4):66-74.

» The authors report no commercial, proprietary or financial interest in the products or companies described in this article.

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Submitted: June 18, 2012

Revised and accepted: July 9, 2012

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Introduction

One of the greatest challenges in dentistry is the rehabilitation of patients whose dental function, phonetics, comfort or health of the stomatognathic system is compromised. Osseointegrated implant dentistry has filled this gap and created an important treatment option,¹ for which success is estimated at 95%^{2,3} both in immediate and non-immediate loading.⁴

Numerous patients lose teeth due to facial and oral trauma, particularly in the anterior maxilla, which has a greater anatomic projection and is particularly susceptible to this type of injury.⁵ Therefore, adequate oral rehabilitation, often immediate, should be provided to restore not only esthetics, but also function and the necessary occlusal balance.¹

The restoration of a single tooth in the anterior maxilla is challenging, particularly when esthetics is compromised due to trauma to permanent teeth.^{6,7} In such cases, the fractured tooth should be carefully removed, if not already avulsed, to preserve the remaining bone walls. After that, an osseointegrated implant should be placed in the socket to ensure that the prosthesis will be held in an ideal position to restore function and esthetics.

Immediate loading has been used in the clinical routine of implant dentistry because of its high predictability.⁸ Using this technique, an osseointegrated implant can be implanted and loaded using a provisional structure so that function is restored immediately after the procedure. In addition to comfort and esthetics, there are psychological and functional advantages over the use of partial removable provisional prosthesis.⁹

Provisional prostheses for immediate-loading implants may be manufactured using several techniques. The purpose of this prosthetic treatment step is not only the patient's social rehabilitation and well-being, but also the functional restoration of occlusion and esthetics,

as well as the preservation of an adequate gingival and bone structure.^{10,11,12} An alternative to provisional prostheses, particularly when treating the anterior maxilla, is the use of the crown of the fractured tooth. This technique may preserve original anatomy and provide good esthetic results, because the natural crown has the same color as the other teeth.

This study describes a clinical case of root fracture of the right maxillary central incisor (tooth #11) due to dental trauma in a car accident. After the tooth was extracted, an immediate implant and a provisional prosthesis, manufactured using the clinical crown of the fractured tooth, were immediately placed.

Case report

A 30-year-old white woman presented with injury to the anterior maxilla resulting from trauma in a car accident seven days before. At the time of the accident, the patient focused her attention on the treatment of the injury to soft tissues and did not realize that the tooth #11 was presenting slight mobility. One week later, increased mobility made her seek dental assistance.

After a careful exam of her trauma history and evaluation of clinical and radiographic findings, a fracture was diagnosed in the middle third of the root of the element #11 (Fig 1). When told about the diagnosis and the fact that the root would have to be extracted, the patient was very upset, but agreed to follow the treatment plan, which required the surgical removal of the fractured portion of the root, the immediate placement of an osseointegrated implant and a provisional prosthesis for implant loading.

At the same time, the patient demanded that the fact that she had lost a tooth should be kept confidential and that no one in her social circles should ever know about it, because she felt that knowledge of such loss would be even

worse than the accident itself. That request was a sign of the level of demand and the difficulty of the case, particularly because it affected a area of high esthetic risk. To obtain the best esthetic and functional results possible, as well as to respond to the patient's expectations of having the provisional match her natural teeth, a careful local and general risk analysis was conducted,^{13,14} and plans were made to use the crown of the fractured tooth as the provisional prosthesis for implant loading.

Surgery began with the extraction of the coronal portion of the incisor (tooth #11) with forceps and of the root with a periosteal elevator operated gently to avoid trauma, handling periodontal tissues carefully and not using mucoperiosteal separation (Fig 2). Immediately after extraction, the socket was irrigated with saline solution and the walls were carefully examined to check their integrity on all surfaces. An osseointegrated implant was then placed respecting its correct three-dimensional positioning, a determinant factor to preserve gingival esthetics^{15,16,17} (Fig 3). Proper locking was achieved at over 40 N/cm², and the implant was immediately loaded.



Figure 1 - Preoperative image of a patient who had a horizontal fracture in middle third of the root of right maxillary central incisor. Clinical exam revealed crown mobility. Edema remains in upper lip as late as 7 days after trauma.

To manufacture the implant-supported provisional restoration, the crown of tooth #11 was prepared into a facet (Fig 4), which was then rebased over a provisional using a light curing resin (Fig 5). The quality of the polishing of light-curing resin surfaces, when compared with that of acrylic resins, makes cleaning easier and, consequently, promotes gingival health in the region. However, the cervical contour of



Figure 2 - Surgery to extract the fractured tooth #11 was gently performed using a periosteal elevator. **A)** Oblique root fracture extending to about 3 mm below bone crest on buccal face. **B)** Region to which root fracture extended: about 5 mm from gingival margin.



Figure 3 - Osseointegrated implant insertion and correct three-dimensional positioning.



Figure 4 - Freshly extracted central incisor (tooth #11) with separate crown and root portions and, later, preparation of provisional prosthesis using the crown of extracted tooth.



Figure 5 - **A**) Provisional abutment insertion in immediate postoperative phase. **B**) Adjustment of occlusion and proximal contacts of provisional prosthesis fabricated using a facet made with the crown of tooth #11.

the provisional is responsible for tissue stability at the gingiva-tooth-implant interface^{18,19} (Fig 6).

Occlusal adjustments were made in the provisional restoration to ensure that it was free of protrusive and latero-protrusive contacts that might lead to trauma and complicate osseointegration during the primary peri-implant bone remodeling phase and might, consequently, result in implant failure.

After 90 days, the definitive restoration was initiated. At that moment, the gingiva was healthy and the concave arch and gingival papillae were not negatively affected (Figs 7 and 8). Stability of peri-implant soft tissues and of emergence profile was favored by the use of the crown of the natural tooth and by its cervical anatomy.¹⁸

As the original gingival architecture was preserved, the transference of the emergence profile was made with vinyl polysiloxane impression material to fabricate a pillar and a Cercon® zirconium crown (Fig 9). A careful selection of



Figure 6 - Lateral view of tooth #11 prepared using a high-speed diamond-tipped drill under constant irrigation. Note the quality of fit, adequate emergence profile and provisional finish that ensured gingival health compatible with patient's esthetic and functional needs.

colors and the analysis of the photos of the adjacent tooth, sent to the laboratory, allowed for the post installation and all-ceramic crown cementing at the same time, using a dual-cured resin cement (RelyX™ ARC) (Fig 10).

At the same time, the lateral incisors (teeth #12 and #22) received metal-free ceramic veneers (IPS e.max) to replace large composite resin facets that showed signs of failure. The ceramic veneers were luted using a light-curing resin cement (RelyX™ Veneer).

At the end of the clinical treatment, the patient received instructions about hygiene and the maintenance of each prosthetic unit. A follow-up program for visits every six months was defined so that the level of satisfaction achieved could be maintained for the longest possible time.

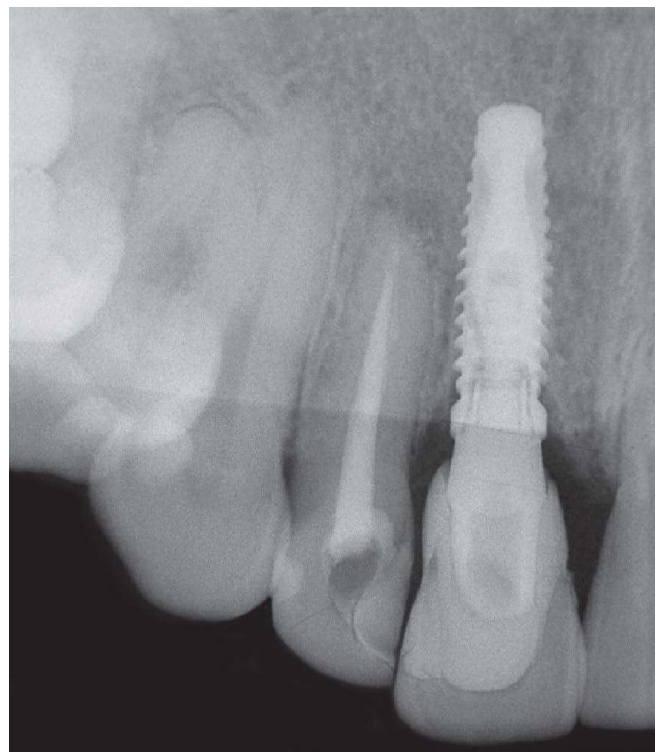


Figure 7 - Periapical control radiograph at 90 days after implant placement.



Figure 8 - Provisional prosthesis removal after osseointegration period (90 days). Provisional prosthesis preserved healthy gingiva and original soft tissue architecture.



Figure 9 - A, B) Buccal and palatal views of metal-free ceramic crown of tooth #11 (Cercon™).



Figure 10 - Patient smile at the end of treatment. Note the esthetic quality, gingival health, harmony of papillae crests and preservation of interproximal papillae.

Discussion

The prognosis of root fractures, such as those that affect the cervical and middle thirds of the root, depend not only on the length of the fracture line, but also on the condition of the pulp and occlusion, on the presence or absence of root fragment displacement, and on the general and oral health of the patient. At the same time, the prognosis should include an adequate treatment plan according to clinical and imaging findings.⁵ In the case reported here, the patient had no systemic disorders and, due to facial trauma, had a fracture in the middle third of the root of a maxillary central incisor (tooth #11) and injury to adjacent soft tissues.

The prognosis of cervical root fractures depends on the type and site of the fracture line. Their prognosis is better than that of fractures that follow the long axis of the root. At the same time, transverse cervical fractures have a worse prognosis than oblique fractures, probably because of the possible micro-movements that may occur after treatment and which may lead to further luxation. Such displacements may be caused even by minor impact generated by mastication or occlusion itself.^{20,21}

Statistically, maxillary central incisors are the teeth most often affected (75%) in cases of dental trauma, particularly due to their natural projection in the anterior maxilla, which makes them more susceptible to structural injury. Maxillary lateral incisors are also affected by a high percentage of trauma and account for 21% of the cases.⁶ Several techniques are available for the restoration of a lost tooth, such as the use of fixed or removable prosthesis and, currently, tooth replacement using osseointegrated implants.⁷

The use of the immediate loading technique may be indicated for all cases in which the immediate application of loads to an implant is possible. However, to increase chances of success and to allow the use of

immediate loading with a provisional, initial implant locking pressure should be high, about 40 Ncm². Therefore, the measurement of insertion torque at the time of implant placement should determine whether the prosthesis can be placed and the provisional crown fabricated immediately. Also, micro-movements generated by occlusion and mastication should be minimized to avoid intercuspation and eccentric contacts, and the provisional prosthesis should not be removed during the initial phases of peri-implant bone repair.^{9,22,23} The surgery protocol should include the evaluation of bone quality and quantity, as well as measures to ensure that the placement of the prosthesis and other components is adequate and to prevent parafunctional habits.²⁴⁻²⁷ In the case described here, in addition to an initial locking pressure greater than 40 Ncm², careful provisional fabrication and adjustment ensured that the esthetic result was good and avoided centric and eccentric contacts.

A critical factor in implant rehabilitation of teeth in the anterior maxilla is the three-dimensional positioning of implants. Implant insertion at a palatal position in relation to the alveolar ridge (palatal approach) preserves the buccal bone wall and provides better implant locking. Therefore, it reduces the incidence of future gingival recession and implant exposure. A cohort study found that the use of a palatal approach and bone autografts in the socket had successful results in 94% of the cases analyzed. In our case, the use of the palatal approach preserved the buccal wall of the socket, which was filled only with the clot, and kept in place by the edge of the provisional prosthesis itself.²⁸

One of the advantages of immediate loading is the restoration of function and esthetics immediately after surgery. Moreover, the adjacent gingival papillae are preserved and a second surgery is not necessary.⁹ Also, the use of a removable provisional prosthesis for a long time while

waiting for rehabilitation with a permanent prosthesis may be a problem, but not when the technique described here is used, because the provisional prosthesis is inserted and fixed immediately after surgery. In the clinical case described here, there was an important psychological gain as the use of a partial removable prosthesis was avoided (one of the patient's demands).

Screw-retained provisional crowns may be used in the anterior and posterior maxilla, but cemented crowns are preferred for the anterior maxilla due to the inclination of the premaxilla and the fact that the retention screw may transverse the buccal surface of the tooth. Therefore, we chose implant temporization using the crown of the

freshly extracted natural tooth cemented to a provisional abutment. There was an important esthetic gain because the natural gingival contour was preserved. Moreover, the provisional crown served as a model to fabricate the definitive crown after osseointegration was consolidated.

This clinical case showed that using the crown of a tooth with root fracture to fabricate its provisional prosthesis is one of the several possible alternatives for temporization. The preservation of esthetics, as well as of the characteristics of adjacent teeth and of gingival harmony, produced good results, facilitated fabrication of the definitive prosthesis and did not affect the individual characteristics of the patient's smile.

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