

Aesthetic replacement of a vertically fractured anterior tooth using the natural tooth as a pontic : a Case Report

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Abstract: Teeth with vertical root fractures (VRF) have complete or incomplete fractures that begin in the root and extend toward the occlusal surface. The most common causes of VRFs are trauma, inadequate endodontic treatment, iatrogenic causes, for e.g. excessive canal shaping, excessive restorative procedures, excessive forces of lateral condensation of obturation, etc. Diagnosis is difficult but invariably, treatment is extraction of the tooth/root. The sudden loss of an anterior tooth due to aforementioned reasons can be psychologically and socially damaging to the patient. This paper describes the immediate replacement of an endodontically treated vertically fractured left central incisor with the natural tooth crown as a pontic using composite resin. This technique allows the abutment teeth to be conserved with minimal or no preparation, and thus, keeps the technique reversible. Also, it can be completed chair-side, thereby avoiding laboratory costs. Hence, it can be used as an interim prosthesis to prevent psychological trauma to the patient.

Keywords: cone beam computed tomography, natural crown pontic, vertical root fracture, wire-composite splinting.

I. Introduction

According to the American Association of Endodontists, "A vertical root fracture (VRF) is a longitudinally oriented fracture of the root that originates from the apex and propagates to the coronal part [1]." Vertical root fractures represent about 2 to 5% of crown/root fractures, with the greatest incidence occurring in endodontically treated teeth [2]. Literature enumerates VRF as the third most common reason for extraction of an endodontically treated tooth [3]. The causes of VRFs are mainly trauma and iatrogenic factors. Trauma is the most common cause of VRFs in vital teeth, typically trauma, clenching or bruxism, or in teeth undergoing apexification. In endodontically treated teeth, the reasons for a VRF include excessive canal shaping, excessive restorative procedures, excessive forces of lateral condensation of obturation, etc. [4-6].

Vertical root fracture is an important threat to a tooth's prognosis during and after endodontic treatment. The diagnosis of VRF can be problematic, often requiring prediction rather than definitive visualisation. Diagnosis begins with a comprehensive dental history, listening patiently to the patient's complaints, asking relevant questions and encouraging the patient to recall when the symptoms first occurred. The clinical scenario resembles that of a failed root canal treatment or a periodontal disease. Therefore, it is imperative to differentially diagnose VRF from such similar clinical conditions. Radiographic diagnosis is also difficult, as not all the classical radiographic signs of VRF may be present in every case. The accuracy of radiographic diagnosis depends on the proper radiographic angulation, contrast and sensitivity of the clinician in interpreting the radiograph. A VRF will be visible on a radiograph only if the X rays pass along the fracture line, i.e. parallel to the fracture. Hence, there is a need for the development of a diagnostic strategy depending on the patient's dental history, clinical signs and radiographic observations. CBCT has been used in recent studies with a high accuracy and sensitivity in detecting vertical root fracture [7-12].

In most cases, tooth extraction is the only reasonable treatment when VRF is finally diagnosed [13]. Whenever an anterior tooth is lost due to such reasons, the clinician should provide with an immediate replacement to avoid aesthetic and phonetic problems and to prevent drifting of adjacent teeth into the extraction space. Conventional solutions to this problem have included the fabrication of a provisional prosthetic appliance using the adjacent teeth as abutments, removable temporary acrylic prostheses, natural/acrylic tooth pontic and resin-bonded bridges [14-16]. Each of these approaches has its own specific advantages and disadvantages in terms of usage, aesthetics, cost, ease of fabrication and compatibility. A natural tooth pontic offers several advantages over removable appliances, including enhanced aesthetics, ease of use, and avoidance for the of having to become accustomed to a removable prosthesis [17-20]. This approach permits the patient's natural crown to be used as a pontic for an immediate replacement, with little or no need for complicated laboratory procedures. The use of the extracted natural crown as a pontic provides the unparalleled aesthetic advantage of having the appropriate size, shape, texture, and colour. Moreover, the patient is psychologically comforted by the presence of his/her natural tooth. It provides additional advantages of abutment teeth conservation, cost effectiveness, and preservation of the lost tooth's gingival architecture.

This article describes the innovative technique of replacing an endodontically treated, vertically fractured extracted tooth with a natural tooth pontic..

II. Case Report

A 35 year old male patient, a lecturer by profession, reported to the Department of Conservative Dentistry and Endodontics, Government Dental College and Hospital, Ahmedabad with the complaint of pus discharge, mobility and occasional episodes of pain in his upper front tooth since one year. The medical history of the patient was non contributory to the dental treatment. He gave a history of root canal treatment in his upper left central (21) and lateral incisor (22) followed by a periapical surgery in relation to his upper left central incisor 10 years previously. On clinical examination, the maxillary right central incisor showed grade II mobility with a solitary pocket with a depth of 10 mm on the mesiopalatal aspect. There was moderate pain on palpation of the periapical region without any sinus. Adjacent teeth responded normally to pulp sensibility testing.

For radiographic evaluation, two intra oral peri-apical radiographs (IOPA) were taken (Fig. 1). The IOPA radiograph revealed a satisfactory obturation in 21 and 22 with an incomplete root resection on 21. However, a large J shaped periradicular radiolucency along with a double image of the obturation was noted with respect to 21 (Fig.1a). Gutta percha point tracing of the pocket in 21 showed the pocket to originate on the mesial aspect of the root (Fig. 1b). Left lateral incisor was root canal treated with normal periapical region. These findings were suggestive of a vertical root fracture in relation to 21 but the fracture per se could not be traced and thereby, a sectional cone beam computed tomography (CBCT) scan was advised.



Figure 1 : Preoperative IOPA radiographs showing; a) J shaped radiolucency in 21; b) gutta percha tracing of pocket in 21

On CBCT evaluation (CareStream CS9300, SNAAP Imaging Centre, Ahmedabad, India), the suspected vertical fracture could not be visualised but associated factors like a break in the continuity of enamel at the cemento-enamel junction (CEJ) level, a depression on the root dentin at the cervical, middle and apical one thirds of the root and a lateral radiolucency on the mesiopalatal aspect on 21 could be confirmed. Another finding was the absent labial cortical plate in relation to 21 and 22 (Fig. 2).

The tentative diagnosis provided was a vertical root fracture in relation 21 which would be further confirmed on surgical exposure.

A written informed consent was obtained and the patient was scheduled for treatment. On the day of the surgery, antiseptics were carried out using 0.2% chlorhexidine gluconate; left maxillary incisor was anesthetized using an infiltration and nasopalatine nerve block injection with 2% lignocaine with adrenaline at a ratio of 1:2,00,000 (Ligno-Aid, Vishal Dentocare Pvt. Ltd., Ahmedabad, India).

Palatal and labial full thickness muco-periosteal flaps were reflected using intrasulcular incisions with vertical releasing incisions extending beyond the mucogingival line. The papillae were dissected and reflected. Removal of granulation tissue revealed a VRF on the mesio-palatal aspect of 21 (Fig. 3). The fracture line propagated from the CEJ to the apex of the tooth. Removal of granulation tissue on the labial aspect revealed the absence of labial cortical plate upto the apical third of the roots of 21. This absence of the labial cortical plate along with a VRF convinced us to extract the tooth and treat the patient with an implant placement, but the extensive bone loss (poor implant recipient site) was the main limitation for the desired treatment plan. Hence, we planned a regenerative procedure with guided bone regeneration to preserve the ridge width for future implant placement, post extraction. Owing to the high aesthetic and phonetic demands of the patient's job, immediate bonding of the natural tooth pontic as a provisional restoration was performed which provided aesthetics and protected the extraction socket.

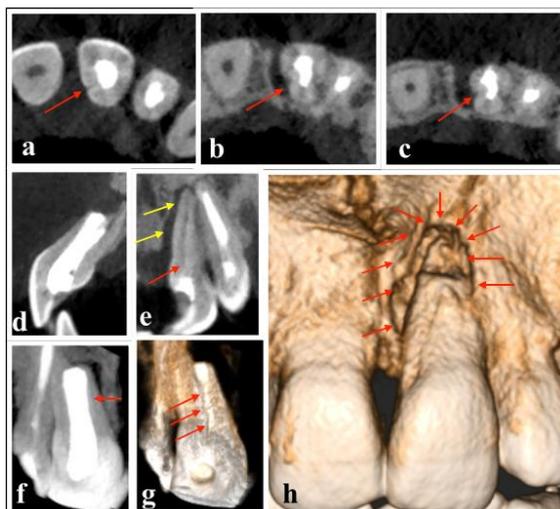


Figure 2 : CBCT scan - (a) Axial slice at CEJ level with fracture line on mesio-palatal aspect (red arrow); (b) Axial slice at mid-root level showing fracture line (red arrow); (c) Axial slice at apical third root level showing fracture line (red arrow); (d) Saggital slice showing incomplete root resection from previous apicoectomy; (e) Coronal slice showing VRF (red arrow) and periradicular radiolucency (yellow arrows); (f) 3D reconstruction with MPR view showing VRF (red arrow); (g) palatal view of 3D reconstruction showing VRF (red arrow); (h) labial view of 3D reconstruction showing periradicular radiolucency in 21 (red arrows)

Extraction was performed atraumatically to preserve adjacent bone and the socket was carefully curetted to remove granulation tissue. The extracted tooth was stored in saline. The blood-filled socket was grafted with a bone graft (PerioGlass®, Novabone) and carefully covered with aresorbable collagen membrane (Perioguide™). The flap was repositioned coronally using periosteal releasing incisions to achieve primary closure over the membrane and sutured with 4-0 Ethicon sutures (Johnson & Johnson, Himachal Pradesh, India).

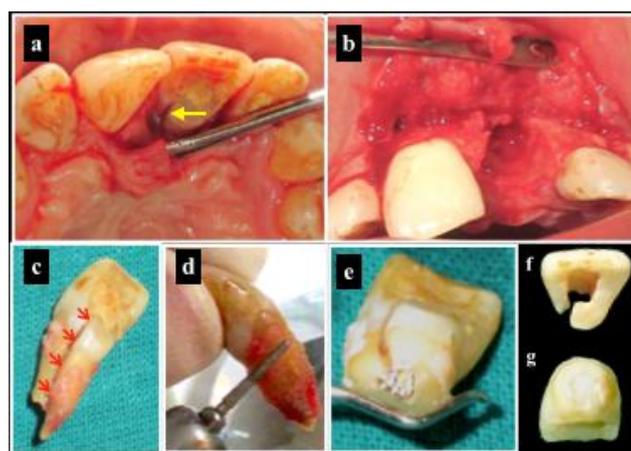


Figure 3: (a) Palatal flap reflection revealing VRF on mesio-palatal aspect of 21; (b) Extraction socket; (c) Extracted tooth showing VRF (red arrows); (d) Separation of the crown from the root; (e) Separated crown showing the communication of fracture line with the obtruded pulp space; (f) Cleaning of the crown portion; (g) Restoration of the crown with composite and shaping it to a ridge-lap pontic design.

For the preparation of the natural pontic, the crown was separated from the root by using a diamond bur . The apical opening of the pulp canal was cleaned by complete removal of gutta percha and restorative material. The access cavity and the apical opening in the crown were sealed with composite resin. The restored crown was shaped into a modified ridge-lap pontic to facilitate cleaning and to give an emergence profile to the natural tooth pontic (Fig. 3)

Following satisfactory try-in and occlusal adjustments, the abutment teeth and the pontic were cleaned and dried. A horizontal groove was prepared on the pontic on the mid-palatal aspect with a round bur. Abutment teeth and the pontic were etched with 37% phosphoric acid for 30seconds, washed and dried, and bonding agent applied and light cured. A thin layer of flowable composite resin was placed across the abutment teeth and into

the horizontal groove on the pontic. A pre-cut round 0.001” braided stainless steel wire was roughly contoured to the palatal aspect of the maxillary incisors and thoroughly wetted using the unfilled resin. It was embedded into the horizontal groove in the pontic onto the uncured composite and cured. A further layer of flowable composite was placed over the wire, ensuring that all of it was covered by composite, and light cured. Excess composite resin was removed and occlusal interferences were again checked in protrusion and lateral excursions. Finishing and polishing procedures were carried out using composite finishing discs and stones. The surgical site and the pontic were covered with coe-pack (GC america, IL, USA) (Fig. 4). Oral hygiene instructions with chlorhexidine mouthrinse were given to the patient. The patient was put on an antibiotic regime of Amoxicillin 500mg and Ibuprofen 400mg, tid for five days each. First recall appointment was made 5 days later.

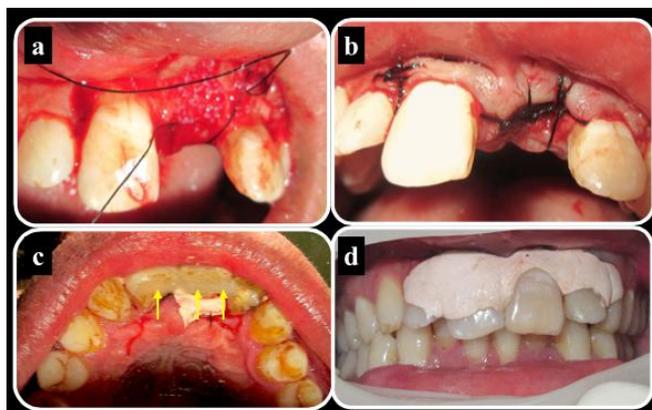


Figure 4 : (a) Bone graft in place in the extraction socket; (b) Sutures in place over the membrane; (c) Composite splinting of the natural tooth pontic over the coe-pack(palatal view); (d) Immediate post-op (buccal view)

On recall, coe-pack and sutures were removed and the irrigated with saline. Surgical site was healthy with primary closure. The patient was psychologically satisfied and highly motivated by the aesthetic result as well as improved ease of biting with no discomfort. Two months recall showed adequate bone fill (Fig. 5a), gingival healing with acceptable aesthetics of the natural tooth pontic (Fig. 5b).



Figure 5 : 2 months post op (a) IOPA; (b) Photograph

III. Discussion

A vertical root fracture presents as a line of complete or incomplete fracture extending obliquely or longitudinally along the toothroot. Due to a poor prognosis, presence of VRF usually results in extraction of the affected tooth, making it a complex problem in clinical practice. If the tooth involved is an anterior tooth, such an unscheduled extraction can cause aesthetic, phonetic and psychological problems. Generally, extraction of such teeth should be followed by an implant placement which can be considered only after complete healing of the extraction socket that requires a waiting period of about 6 months; therefore, the overall treatment period is long. Immediate implant placement in fresh extraction sockets has been reported but many authors do not indicate this in the presence of infection or an inadequate bone support, as there is a potential for contamination during osseointegration. In the presence of such limiting factors, a decision must be made quickly, or the strategy of immediate implant placement should be aborted.

Post extraction, the remaining bone structure should be evaluated. If there is an inappropriate bone support, the use of regenerative bone grafting procedures and membranes are recommended to maintain the dimensions of the alveolar ridge, which will facilitate the future placement of the implant, providing a more favourable prognosis in relation to the final outcome of the prosthesis on implant.

Immediate replacement of such lost anterior teeth prevents psychological and social trauma to the patient. Removable appliances or prostheses are suitable immediate treatment options, but patient compliance is a problem [17-19]. Alternatively, resin composite may be used to splint the extracted tooth's modified crown portion as a pontic to sound neighbouring teeth as a provisional restoration until the final prosthesis is fabricated [21]. Replacement of missing anterior tooth using a natural tooth pontic technique is an temporary restoration and should not be used as permanent restoration. This technique cannot be used for every patient and several factors should be considered such as patient's bite, interfering para-functional habits, inadequate occlusal clearance and difficulty in maintaining isolation during bonding procedures. Several advantages of retaining the patient's natural crown over removable appliances include better ability to tolerate the effect of tooth loss, enhanced aesthetics, ease of use and avoidance of becoming accustomed to a removable prosthesis [15]. Moreover, it provides the optimal pontic in terms of shape, colour, size and alignment.

In the present case, the patient wanted immediate aesthetic replacement following extraction of the fractured tooth. Since the decision to extract was made during the surgery, very limited options remained for esthetic replacement. Hence, we decided to modify the extracted natural tooth as a pontic and splint it to the adjacent teeth, to preserve the gingival architecture of the extraction socket and to fulfil the aesthetic requirements of the patient. This approach permits utilisation of a patient's natural crown as a pontic, with little or no need to perform complicated laboratory procedures. Besides the use of resin composite to splint the pontic to neighbouring sound teeth, orthodontic wire and fibre splint are also used.

In this case, shape of natural tooth pontic was given as modified ridge lap pontic with a well-polished and smooth, convex surface that results in pressure-free contact with the alveolar ridge over a very small area for a better preservation of the soft tissue health [22]. This particular shape of pontic also helps to give the illusion that the replaced tooth emerges from the gingiva like a natural tooth. Although the technique is technically demanding, requiring increased chair-side time, the key advantages are excellent aesthetics, preservation of natural crown structure, immediate replacement, no laboratory work required, low cost, reduced psychological impact on the patient and reduced post-extraction ridge resorption [23]. Also, this technique is reversible and allows other restorative options to be evaluated. This immediate provisional restoration allows for exact repositioning of the coronal part of the extracted tooth in its original intra-oral three-dimensional position and thus relieves the apprehension of the patient caused by the sudden loss of an anterior tooth. Thus this procedure to a great extent helps in regaining esthetics and providing patient satisfaction [24-26].

IV. Conclusion

Management of vertical root fracture can be challenging as the treatment is immediate extraction of the fractured tooth. Natural tooth crown pontic can be used as an temporary prosthetic restoration until the extraction site heals; to be later replaced by a conventional bridge or an implant. In this case, the technique used offers a simple, less time consuming and cost-effective treatment option for the replacement of a fractured tooth, using its own natural coronal portion. It can be considered a hygienic, esthetic and non-invasive provisional treatment without bearing any risk, while providing superior aesthetics, phonetics and function. However, this procedure is highly operator-dependent and demands appropriate case selection and precise technique.

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