

Case Report

Surgical removal of impacted tooth that failed to extrude after orthodontic traction in the esthetic zone followed by immediate implant placement along with guided bone regeneration: a case report

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ABSTRACT

The prosthodontic management of impacted tooth that failed to extrude after orthodontic traction is a clinical challenge. There are many factors for orthodontic treatment failure like ankylosis and root exposure. Prosthodontic treatment options include surgical removal of failed tooth followed by implant placement either using staged approach or simultaneous approach. In this case report, the tooth that failed to erupt after orthodontic traction and tooth with root resorption in esthetic zone was managed successfully by immediate implant placement. Guided bone regeneration was performed along with implantation to compensate associated bone loss.

Keywords: Impacted tooth, Immediate implant, Orthodontic traction failure, Guided bone regeneration

INTRODUCTION

Successful management of impacted central incisor that failed to extrude after orthodontic retraction is really a clinical challenge for prosthodontist. The orthodontic treatment failure may be due to ankylosis, external root resorption, and root exposure.^{1,2} Root resorption is the most common sequelae of the orthodontic treatment. When the orthodontic force is applied, it results in ischemic necrosis localized in the periodontal ligament due to inflammatory process. Risk factors associated with orthodontic treatment that results in onset and progression of root resorption includes the duration of treatment, the magnitude of the force applied, the direction of the tooth movement and the method of force application (continuous versus intermittent). Patient-related risk factors are the individual susceptibility on a genetic basis, some systemic diseases, anomalies in root morphology, and dental trauma.³ Orthodontic traction failure can be managed by surgical removal of impacted tooth followed by implant placement. Following immediate implant placement, a gap can occur between the periphery of the

implant and the surrounding bone, is called the jumping distance.⁴ The gap consists of two dimensions: horizontal and vertical related to defect width and height. Bone fill in the gap between the implant and the peripheral bone is important. The buccal aspect of an implant is of great concern, especially in the aesthetic zone, because the buccal bony plate is usually thin and its resorption can result in soft tissue recession.^{4,5} Here, in this case report, Guided bone regeneration (GBR) (simultaneous approach) along with implant placement was performed after surgical removal of impacted right central incisor that was failed to erupt after orthodontic traction and left central incisor with external root resorption.

CASE REPORT

A 24 years old male patient undergoing orthodontic treatment reported to our department of Prosthodontics of Faculty of Dental Sciences with chief complaint of missing tooth in upper front region of the jaw. On clinical examination, missing 11 and 12 was found. Tooth 11 was impacted that was failed to extrude via orthodontic

treatment and 21 with external root resorption on radiographic assessment. (Figures 1 and 2).

Thereafter, treatment regarding removal of impacted 11 and 21 with external root resorption was planned followed by implant placement and explained to patient. Informed consent was taken for this. After that 64- slice 3-D dentascanner was done to know about available bone for implant placement in missing tooth region and planning regarding impacted tooth removal. Before undergoing surgical intervention, oral prophylaxis was done. After 1-week, surgical procedure was done under aseptic condition.

Local anesthesia (2% lidocaine with 1:80,000 adrenaline) was administered at the time of surgery. Surgery began with a mid-crestal incision in edentulous area along with vertical releasing incision, a full-thickness flap was elevated and the crestal ridge was exposed upto the inferior border of nasal floor.

After that impacted tooth and tooth with external root resorption were removed atraumatically. Osteotomy was prepared in 12 and 21 regions by engaging palatal bone. According to ADIN surgical guidelines, starting from pilot drill upto 3.65×13 mm diameter drill, implant of 3.75 mm diameter and 13 mm length was placed (Figure 3).

To cover the defect area and exposed implant thread, Geistlich Bio-oss® (bovine bone graft) was used in the form of sticky bone by mixing with I-PRF (Injectable-platelet rich fibrinogen) made at 700 rpm for 3 min in Choukroun PRF (DUO) system. Over the bone graft, A-PRF (Advanced or PRF enriched leukocytes) membrane was placed (prepared by centrifugation at 1300 rpm for 7 min in centrifuge system), above that resorbable barrier Periocol (synthetic collagen membrane) was placed and stabilised. The flap was replaced and sutured into place (Figure 4).

Post-operative and oral hygiene instructions were given to patient. Antibiotic regimes and anti-inflammatory analgesics were prescribed for 5 days. Patient was instructed to have a soft diet for atleast 3 months. Sutures were removed after 1 week and an IOPAR examination was done. Second stage surgery was performed after 6 month of implant placement and healing abutment was placed after an IOPAR examination that revealed bone formation. After 2 weeks an implant level open-tray impression was made using polyvinyl siloxane (addition silicone) and send to the lab for fabrication of the prosthesis (Figure 5).

Before prosthesis, implant stability was checked using RFA (Resonance frequency analyser: osstell mentor). ISQ (Implant stability quotient) measured was adequate for loading (ISQ-75 in 12 and 77 in 21 region). Cement retained metal ceramic crown with implant protected occlusion was given as definitive restoration. (Figures 6 and 7). Patient was instructed about soft diet for initial 3

months after loading and oral hygiene maintenance. At regular follow-up after loading for 1 year, the implant site was examined clinically and radiographically.

The implant was fully osseointegrated, presenting satisfactory functional and esthetic outcome.

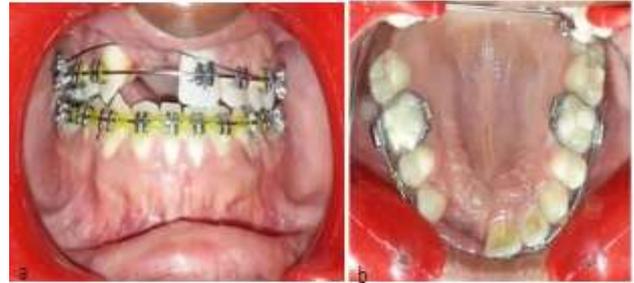


Figure 1: Clinical examination showing missing 11 and 12 in upper arch (a) intra-oral view; and (b) occlusal view.



Figure 2: Radiographic examination showing missing 12, impacted 11 and 21 with root resorption (a) IOPAR view; and (b) OPG view.



Figure 3: Surgical procedure (a) mucoperiosteal flap raised showing impacted 11; (b and c) surgical extraction of 11 and 21 done; and (d) Adin Implant placement in 12 and 21 regions (3.75D×13L mm).



Figure 4: Bone grafting procedure (a and b) formation of sticky bone graft (Bio-oss, Geistlich with I-PRF) and bone grafting in implant site; (c and d) A-PRF membrane and biologic resorbable collagen membrane placed (pericol), flap approximated and sutured; and (e) IOPAR examination.



Figure 5: Impression making (a) second stage surgery done after 6 months of implant placement; (b) open tray impression coping placed, splinted using pattern resin; and (c) implant level open tray impression making using polyvinyl siloxane.



Figure 6: Implant loading (a) implant stability checked using resonance frequency analyser (Osstell mentor); (b) keratinized gingival collar around implant; (c) abutment placed, screw secured using teflon tape; and (d and e) cement retained metal ceramic prosthesis.



Figure 7: (a and b) Post-op view; and (c) post-op IOPAR.

DISCUSSION

The impaction of maxillary permanent central incisors occurs in 0.2-1% of the population result from a number of local and systemic factors. Local factors include over-retained deciduous teeth, supernumerary teeth, or ectopic eruption and crowding.⁶ In this case report, the impacted tooth that failed to erupt after orthodontic traction and tooth with resorbed root were removed atraumatically and replaced immediately with implant placement. Immediate implant placement in the esthetic zone is a technique-sensitive procedure with little room for error. A slight mistake in the positioning of the implant or in the soft or hard tissue management can lead to esthetic failure and patient dissatisfaction.^{7,8} Here, in this case failed tooth were removed atraumatically to prevent any damage to the labial hard and soft tissue.⁹

Grunder et al suggested that the presence of a 2 mm labial bone plate is essential to avoid soft tissue recession, and an inter-implant distance of 3 mm should always be present to allow papilla formation.¹⁰ Furthermore, palatally placed implants offer more space to allow for the growth of horizontal soft tissue that can later be manipulated to produce a more adequate soft tissue profile. There are many techniques for bone augmentation including distraction osteogenesis, guided bone regeneration, and onlay bone grafting to assist implant placement if adequate bone is not present. Here, GBR using bovine bone graft with simultaneous approach was performed. Implant loading was done after 6 months. Simultaneous implant placement with bone grafting procedures shortens the treatment time without increasing complications or reducing the success rate.¹¹ Bone augmentation is required or not in case of immediate implant placement depends upon the peri-implant space. Many studies have shown that no bone augmentation is needed if the peri-implant space is 2 mm or less because impulsive bone fill and osseointegration will take place when using a rough surface implant.

However, bone resorption occurs and its magnitude is related to buccal plate thickness, implant positioning, and whether a flap is elevated or not. Some authors suggest that by adding bone graft material, horizontal bone resorption can be compensated. Beside this it has been seen that a

certain amount of crestal bone loss also occurs after an extraction due to loss of blood supply when the periodontal ligament is eliminated.^{11,12} Sites with more than 2 mm peri-implant horizontal defect require bone grafting to achieve bone fill and to increase the percentage of bone-to-implant contact.¹³ Marginal bone loss of 1 mm in the 1st year following the abutment connection, followed by 0.2 mm per year, was among the criteria for implant success.¹⁴ The immediate implant success rate was 95.8% following replacement of extracted teeth.¹⁵ As the adequate labial or buccal bone is required after extraction for implant placement, apical bone above the extraction socket is equally important. The teeth in the site of immediate implant placement should have 3-5 mm of bone beyond the apex for obtaining initial stability.^{16,17} In this case, 1 year follow-up was done after loading. No problem was found clinically as well as radiographically.

CONCLUSION

The tooth that failed to manage orthodontically can be successfully managed by prosthodontic intervention. Due to many factors like type of orthodontic force applied or tooth ankylosis, there may be treatment failure related to tooth root resorption or failure of impacted tooth extrusion. These situations can be managed by surgical removal of failed tooth followed by immediate implant placement along with guided bone regeneration. This is the good treatment option in replacing missing tooth in the esthetic zone but the long-term follow-up required for evaluating the success of the implant.

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