IMMEDIATE AUTOTRANSPLANTATION OF PREMOLAR AS A TREATMENT MODALITY TO REPLACE A SEVERELY TRAUMATIZED CENTRAL INCISOR

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ABSTRACT

Autotransplantation of teeth has been reported by many authors to replace missing teeth, either posterior or anterior, where it became a realistic treatment alternative and useful routine procedure for replacement of teeth in young adolescents where the implant option is relatively contraindicated, particularly to replace teeth lost due to trauma.

This paper presents fourteen years old boy, who was referred for the treatment of crown fracture of the maxillary central incisor. Decision was made to extract a mandibular premolar and to transplant it in the site of extracted incisor.

At the time of surgery, the central incisor was removed and the mandibular first premolar was transplanted in its socket and splinted with orthodontic multiflex wire for three weeks.

Endodontic treatment commenced after one week. The pulp was extirpated and non-setting calcium hydroxide was inserted in the canal and replaced every month for six months, the root was filled with gutta-percha filling material and the crown was reshaped to look like central incisor by composite resin restoration. The patient was then referred for orthodontic treatment.

Key Words: Autotransplantation, incisors trauma.

INTRODUCTION

Traumatic injuries to maxillary incisors are common in young children and in adolescence due to many reasons, like falling down, sports injuries and accidents. Shulman and Peterson reported that more than 23% of individuals studied, had evidenced trauma on at least one central incisor, with trauma four times more prevalent on maxillary (22%) than on mandibular incisors 5%.

Many restorative options have been advocated to treat or to restore lost tooth structure, ranging from the very conservative approach like enamel smoothening to root canal treatment and replacement with post and core in case a decision has been made to retain the traumatized tooth.

However, with the availability of more advanced replacement options, extraction of the offended tooth was no more an invalid option, particularly when an implant replacement is the restorative option due to the high success rate and its superior aesthetic properties.

Autotransplantation of teeth has been mentioned in many cases reported by many authors, where it became a realistic treatment alternative and useful routine procedure for replacement of teeth in young adolescents where the implant option is relatively contraindicated, particularly to replace teeth lost due to trauma. The success of which was entirely dependant on the proper selection of the transplanted tooth and to the aseptic procedure along with the meticulous attention to the fine details, from the early case preparation, the surgical procedure, non-setting calcium hydroxide therapy and root canal treatment. Nevertheless, complications of these procedures seem to be unavoidable due to root resorption, ankylosis or infection which will compromise the final outcome of the entire treatment.

Immediate autotransplantation of teeth at the time of extracting the offended tooth offers a less traumatic approach in term of decreasing or eliminating surgical manipulation of the extraction socket and therefore decrease post autotransplantation complications like resorption or ankylosis.

Proper judgment must be made prior to the procedure to verify its viability and validity and to take...
the required measurements and dimensions of the root and the transplanted socket to ensure a stress-free transplanted tooth.

In this paper immediate autotransplantation of mandibular premolar to maxillary central incisor socket as a treatment modality for replacement of severely traumatized central incisor that has been judged to be beyond restoration.

Clinical Features

A fourteen years old boy attended the Restorative Dentistry Department of Queen Alia Military Hospital (QAMH) in Amman-Jordan, referred from his general dental practitioner for treatment of fractured maxillary right central incisor which has been traumatized 24 hours ago due to falling down injury resulting in loss of the entire clinical crown (Fig 1).

Clinical examination showed that the patient had maxillary and mandibular moderate crowding with bilateral class I molar relationship with class II canine relationship. The patient had also congenitaly missing maxillary right lateral incisor (Fig 2, 3).

Upon orthodontic evaluation, the patient had been judged to be a candidate for orthodontic treatment to relieve maxillary and mandibular crowding and to close the remaining space at the site of the missing lateral by moving the canine into the site.

In view of poor prognosis of the traumatized central incisor, a decision was made to extract it and to transplant the mandibular premolar into the extraction socket at the time of orthodontic extraction. This will also help to create space to relief mandibular crowding (Fig 4).

Periapical radiographic evaluation showed that the mandibular right and left first premolar root was very close to the size of the central incisor root, which will enable atraumatic stress-free seating of the premolar root in the central incisor socket without having the periodontal ligament compressed (Fig 5, 7).

The Operative Procedure

At the time of surgery, the patient was instructed to rinse his mouth with 0.02% chlorhexidine mouth wash, and an infiltration local anesthesia was achieved for the central incisor and the first premolar.

The attached gingiva around the lower first premolar was incised using scalpel blade number 15 to minimize the periodontal ligament tearing and damage. Owing to the conical shape configuration of both teeth, the elevator was excluded from the procedure and only extraction forceps were used to manipulate the teeth with simple and gentle rotational movement to minimize trauma which could result from the excessive compressive forces on the periodontal fibers (Fig 8).

The premolar was extracted first (Fig 9) without taking it out of the socket until the central incisor has been extracted, where a quick transplantation of the premolar was made in its position (Fig 10). The root apex was judged to be completely formed by direct observation at the time of extraction.

The premolar was passively fitted without any pressure on the periodontal ligament with the buccal surface forming the labial surface of the transplant and the small lingual cusp facing palatally behind the incisal tip of the mandibular central incisor. The socket was then compressed bucco-palatally with operator fingers for better adaptation to the new root.

The transplanted tooth was splinted with a non-rigid splint (orthodontic wire multiflex 0.175mm), and the tooth was verified to be out of occlusion (Fig 11).

A periapical radiograph was taken by paralex technique to verify the tooth position and to compare the subsequent follow up radiographs later on (Fig 12).

The patient was instructed not to bite on the tooth, and dismissed with amoxicillin 250mg tid, metronidazole 250mg tid and paracetamole 25mg prn. With 0.02% chlorhexidine mouth wash.

After one week the patient was recalled for follow up to observe vitality, healing and mobility and to commence root canal treatment.

The vitality testing was performed by electrical pulp testing and thermal testing using hot and cold applications and found to be non-responsive to both tests. The mobility was not recorded at this stage due to the presence of the splint. There were no signs of gingival inflammation or bleeding upon probing (Fig 13). Periapical radiographic investigation showed that the tooth has retained its original splinted position.

The tooth was accessed and pulp extirpated, the root canal was slightly enlarged to file number 25 to allow sufficient bulk of non-setting calcium hydroxide to be inserted in the canals and temporization with IRM (Fig 14). Afterward the patient was dismissed for another week while the tooth was still splinted.

The second follow up visit, the transplanted tooth was re-evaluated as mentioned in the first visit and a new non-setting calcium hydroxide was re-inserted and the patient was instructed to start passing some soft food on the tooth to bring it back to slight function gradually.

On the third visit after three weeks post-op, the splint was removed and the mobility rechecked and found to be similar to the adjacent teeth.

Non-setting calcium hydroxide paste was reinserted every month for 6 months before final root canal filling.

During the recall visits, periapical radiographs were taken each visit to evaluate the presence of any pulpal or periapical pathology such as, presence of periapical radiolucency, inflammatory root resorption or replacement resorption. Periapical radiograph taken at the forth week post-transplantation, showed slight haziness of the socket space around the tooth which indicated the beginning of the bone healing process.

On the final visit, there was no evidence of apical or periapical pathology. The soft tissues were normal in appearance with no sinus tract. Non-setting calcium hydroxide paste was removed and the canals washed out with 5.26% sodium hypochlorite solution, instrumented
Immediate Autotransplantation

Fig 1: Pre-operative presentation

Fig 2: Right side occlusal relationship

Fig 3: Left side occlusal relationship

Fig 4: Mandibular arch occlusal view

Fig 5: Periapical radiograph of both central incisors

Fig 6: Periapical radiograph of the left mandibular premolars

Fig 7: Periapical radiograph of the right mandibular premolars

Fig 8: Atraumatic extraction of the fractured central incisor

Fig 9: Atraumatic extraction of the mandibular premolar

Fig 10: Autotransplantation of the right premolar tooth in the socket of central incisor

Fig 11: Splinting with orthodontic multiflex wire

Fig 12: Periapical radiograph immediately after splinting of the transplanted premolar

Fig 13: One week follow up visit after transplantation

Fig 14: Calcium hydroxide treatment after pulp extirpation

Fig 15: Reshaping of the premolar using composite resin after root canal filling.
and filled with gutta-percha endodontic filling material. The access cavity was restored with resin-modified glass ionomer and composite. The tooth was reshaped by using composite resin to a central incisor by using cellulose crown form (Fig 15), after reducing the palatal cusp to the level of 2-3mm supragingivally, approximately close to the size of cingulum. The patient was referred to the orthodontist to commence orthodontic treatment in four months post-surgical procedure.

**DISCUSSION**

**Replacement modalities**

Loss of anterior tooth present a serious esthetic concern to the patients and to a lesser extent a functional problem by inability to incise food properly. The choice of replacement modality is usually depending on the position of the lost tooth, age of the patient, occlusal scheme and the stage of root development in case of considering autotransplantation.

Nevertheless, many treatment options are available to solve the problem of missing central incisor. First: orthodontic space closure by moving the lateral incisor in place and reshaping it to central incisor, which will not give the required esthetic cervical margin in the area of central incisor and in the area of canine, which in turn will take the place of the lateral incisor. Here in this case, the problem becomes more complicated due to congenital missing of the lateral incisor, which will present an additional complex esthetic and replacement problems if the canine moved into the lateral incisor position. Second: osseo-integrated implant, which is contraindicated in a growing child Third: fixed prosthetics, which is also contraindicated due to the large pulp horns in children and the instability of the growing dental arch and gingival margins level due to growth.

**Rationale for autotransplantation**

In this case autotransplantation was a suitable and viable treatment option due to two main reasons: 1. The sever traumatic injury to the maxillary right central incisor.

2. The healthy mandibular premolars were indicated for orthodontic extraction, where autotransplantation can preserve the alveolar bone by induction and reestablishment of normal alveolar process.

In this case, the traumatized central incisor had an extensive tooth structure loss which needed root canal treatment and crown lengthening procedure to expose root margins to enable the operator to restore it with cast post and core, where the aesthetic outcome of crown lengthening procedure will be less than satisfactory due to the disruption of the gingival margin level in comparison with the adjacent teeth. Fixed prosthodontic option was not suitable due to patient young age (14 years). So in the light of poor prognosis, a decision was made to extract the tooth and to transplant a mandibular premolar which already required extraction for orthodontic purposes. The patient, donor and recipient site had been selected carefully according to criteria believed to provide a favorable prognosis.

**Validity of Autotransplantation**

Despite the long history of tooth transplantation and autotransplantation, it was not included in the traditional treatment options of the lost maxillary incisors. However autotransplantation has been mentioned and recommended by many authors in literature as a successful and valid treatment modality for replacing missing teeth because of its many advantages which are: 1. It provides a natural replacement for the missing tooth; 2. Induction of bone formation 3. Induction of alveolar socket growth due to the presence stimulating cells in the periodontal ligament. Autotransplantation is said to have shown more than 90-98% survival rate in some studies, while another study has reported 100% survival rate regarding esthetic, function, clinical appearance, and radiographic evaluation. It is considered as a viable method of restoring edentulous areas for patients whose alveolar growth is not yet complete, where it provides a natural tooth replacement rather than osseointegrated implant.

Although autotransplantation of premolars with fully formed roots reduces the success rates and introduces an element of unpredictability regarding the long-term outcome, other studies consider it not compatible with outcome requirements for a method intended for routine use.

**Modification of the recipient socket**

Manipulation of the socket and/or the tooth surface were known to have many disadvantages, and involving many complications such as infection of the socket, resorption of the transplanted tooth or ankylosis.

The incisor socket was kept without modification because the size of the selected premolar was smaller than the socket size, and therefore could easily fit in without any modification. Unlike a case report by Watwehouse et al where they modified the incisor socket to accommodate the transplanted premolar. Paulsen 2001 advised that the socket must be cut 1 to 2 mm larger and deeper than the donor root measurements to preserve the periodontal ligaments. In our case the selected donor root was slightly smaller that the recipient socket, therefore no intra-alveolar cutting or modification was needed to accommodate the transplanted tooth.

**Mature or immature root formation**

While it has been advocated that the transplanted tooth should have preferably an incompletely formed root to optimize the success and survival rate, transplantation of teeth with completely formed root has been reported for patients in the age of 24 years and 13 years old, which is similar to the age of our patient. However, the incidence of pulp necrosis in teeth with closed apices is higher than in teeth with immature root, so pulp extirpation should be undertaken within 7-10 days post transplantation.
Pulpal condition and root canal therapy

The frequency of pulpal healing appears to be closely related to stage of root development at the time of transplantation.\textsuperscript{9} It has been reported that transplanted teeth with immature root formation present a favorable condition to recover revascularization and regaining vitality after transplantation procedure. However these teeth have tendency for an increasing degree of pulp obliteration.\textsuperscript{6} Many transplanted teeth with immature root formation needed root canal treatment at various times due to the development of periapical radiolucency.\textsuperscript{6,9} And since the chance of retaining the pulp vitality and healing of apical vascular bundle is very low in mature roots (like in our case), the decision was made from the beginning of treatment to do pulp extirpation at the second week post transplantation to minimize the possibility of canal obliteration.

Rational for functional splinting

Stabilization of the transplanted tooth was carried out using non-rigid fixation or functional splint for 7-10 days to decrease possible complications of rigid fixation such as ankylosis\textsuperscript{2} and resorption\textsuperscript{13}, where many authors used non-rigid fixation of transplanted teeth for a longer period to ensure periodontal healing\textsuperscript{6} other considered that one week is sufficient.\textsuperscript{13}

Choice of the final reshaping restoration

Restoring the transplanted premolar to esthetic function and function was carried out using composite resin, which gives an immediate cost effective treatment modality. Czochrowska et al restored 41 teeth out of 44 with composite restoration, and reported that the esthetic outcome, the gingival morphology and condition were satisfactory.\textsuperscript{3} Díaz et al restored ten teeth with composite resin and considered the esthetic outcome satisfactory.\textsuperscript{6}

Until patient referred for orthodontic treatment, follow-up visits showed that the tooth was in occlusion and has restored both esthetic and function, with no patient complaint.

It is generally agreed that missing teeth replaced by a natural tooth will move the orthodontic situation to an easier and favorable treatment options\textsuperscript{13} where an effective method for the reconstruction and stability of occlusion is achieved\textsuperscript{16} with a long term outcome comparable to the fixed bridgwork treatment modality.\textsuperscript{7}

It has been mentioned that early application of orthodontic forces to the transplanted tooth may enhance periodontal healing and decrease the possibility of ankylosis or resorption.\textsuperscript{16} Suzuki et al\textsuperscript{2} reported that pre-application of orthodontic forces to the donor tooth will ease the extraction and therefore decrease the trauma to the periodontal ligament, hence decrease ankylosis after transplantation.

CONCLUSION

Many factors influence the success of the auto-transplanted tooth in the anterior maxillary zone namely recipient site, space condition, morphology of the donor tooth and final position of the transplant. Therefore a clear transplantation policy for these cases should be set to maximize the success rate, which should include proper initial assessment, radiographic evaluation of the donor and recipient site and meticulous atraumatic clinical procedure.

REFERENCES