Autotransplantation after primary bone repair of a recipient site with a large periradicular lesion. A case report

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Abstract

Aim This article describes a case of autotransplantation nine weeks after the extraction of a hopeless tooth with a large periradicular lesion, which enabled the healing of the recipient site.

Summary A 19-year-old male in generally good health was referred for evaluation of tooth 46. Clinically, there were class III mobility and sensitivity to percussion and palpation. There was a mesio-lingual swelling and a single narrow deep pocket of 15 mm at the disto-lingual aspect. CBCT imaging revealed a radiolucent area over 15 mm in diameter that extended from the mesial aspect of the mesial root of tooth 47 to the distal aspect of tooth 45. The radiolucent area was in proximity to the inferior alveolar canal and penetrated the buccal and the lingual cortical plates. The tooth was diagnosed with previously treated tooth, acute apical abscess and vertical root fracture. Tooth 46 was extracted and a delicate curettage and drainage were performed. Nine weeks afterward, a second surgery was performed: extraction of the impacted immature third (48). Immediately after the extraction, the tooth was replanted in the healing socket of tooth 46 and sufficient initial stability achieved. In a 1-year follow-up, the tooth had normal mobility, no sensitivity to palpation and percussion, and responded to thermal pulp testing. The soft tissue was normal, probing depths up to 3-mm, without swelling or sinus tract. Radiographically, periapical healing at the recipient site was observed. Compared to the post-operative periapical radiography immediately after the procedure, there was no change in the distal root dimensions. In the mesial root, development of the root length and a closed apex were demonstrated.

Key learning points:

- Postponed timing of autotransplantation is a viable option of an autotransplantation to a recipient site with inflammation and possible infection.
Introduction

Autotransplantation is transplantation of embedded, impacted or erupted teeth from one site to an extraction site or surgically prepared socket in the same individual (AAE 2015). It was first reported in the 1950s as an alternative to replacing a non-restorable tooth (Apfel 1950). Autotransplantation success rates range from 74% to 94% (Kristerson 1985, Tsukiboshi 2002). With appropriate case selection, careful surgical technique and minimal extra-oral time being necessary for a predictable outcome (Singh & Dudani 1970, Lundberg & Isaksson 1996, Czochrowska et al. 2002, Tsukiboshi 2002, Mejare et al. 2004, Keightley et al. 2010).

The autotransplantation procedure may include extraction of the tooth at the recipient site, preparation of the recipient socket if needed, atraumatic extraction of the donor tooth, minimal extra-oral time, positioning and splinting of the donor tooth and occlusal adjustment (Tsukiboshi 2002). In cases with a mature transplanted tooth, root canal treatment is performed extra-orally or at least 2 weeks after the tooth reposition (Tsukiboshi 2002). In immature teeth with open apices, revascularization is predictable (Andreasen et al. 1990). Today, technology enables prior planning of a computer-aided rapid prototyping (CARP) model for the osteotomy guide (Lee et al. 2001, Anderson et al. 2018).

There are various advantages to autotransplantation: cost-effectiveness, maintenance of proprioception, possible orthodontic movement, no potential interference with the growth of the alveolar process, creation of biological width with maintenance of the natural shape of the attached gingiva, and maintenance of the interdental papillae. Autotransplantation is not contraindicated in children or adolescents (Tsukiboshi 2002, Schwartz-Arad et al. 2005, Bae et al. 2010, Jang et al. 2013, Plakwicz et al. 2015, Jang et al. 2016).

Most of the previously reported protocols suggest that the extraction of the problematic tooth and the autotransplantation procedure will be performed in the same visit (Tsukiboshi 2002). This case report presents autotransplantation nine weeks after the extraction of a hopeless tooth with a large periradicular lesion, which enabled the initial healing of the recipient site. Postponed timing of the autotransplantation might be a viable option of an autotransplantation to an inflamed and possibly infected recipient site.
Case report

A 19-year-old male in generally good health was referred for evaluation of tooth 46. The dental history revealed a root canal treatment that had been performed five years ago due to symptomatic irreversible pulpitis. Two root canal retreatments were performed by endodontic specialists four and two years ago due to symptomatic apical periodontitis.

Clinical examination (Figure 1A) revealed a temporary fixed bridge, class III mobility (Miller 1950) and sensitivity to percussion and palpation. There was a mesio-lingual swelling and a single narrow deep pocket of 15 mm at the disto-lingual aspect.

Teeth 45 and 47 responded to thermal testing (EndoFrost, Roeko, Langenau, Germany), with no sensitivity to palpation and percussion, probing depths up to a 3mm, without swelling or sinus tract.

A periapical radiograph of tooth 46 (Figure 1B) revealed a core with radiopacity similar to amalgam, a previous root canal treatment with adequate density and and overextended root filling in the distal root. There was a 10 mm-diameter radiolucent area that was surrounding the distal and the mesial apices of tooth 46 and extended to the furcation area with a halo-like appearance. At the inferior aspect of the radiolucent area, a defined radiopaque area (2×4 mm) similar to gutta-percha was noticed.

The patient was referred for a small-field-of-view CBCT imaging (Carestream 9300; Carestream Health, Rochester, NY) (Fayad et al. 2015). CBCT imaging revealed a radiolucent area over 15 mm in diameter that extended from the mesial aspect of the mesial root of tooth 47 to the distal aspect of tooth 45 (Figure 1C). The radiolucent area penetrated the buccal and the lingual cortical plates (Figure 1D, 1E) and was in proximity to the inferior alveolar canal.

The diagnoses were previously treated tooth, acute apical abscess and suspected vertical root fracture.
The optional treatment plans were: intentional replantation (if a root fracture line would not be revealed in the extracted tooth) or autotransplantation of tooth 48 after primary bone repair at the extraction site of tooth 46.

Tooth 46 was extracted (Figure 2A), and a definitive diagnosis of VRF was made (Tsesis et al. 2010). Followed the extraction a delicate curettage and drainage were performed. The discarded tissues were sent for a histopathological evaluation.

To assure soft tissue healing and to increase the keratinized tissue width, Mucograft (Geistlich Biomaterials GmbH, BadenBaden, Germany) was placed and sutured with 6-0 nylon sutures (Figure 2B). The histopathological diagnosis was a radicular cyst with foreign material.

Nine weeks afterward, a second surgery was performed: extraction of the impacted immature third tooth (48). Initially, an incision in the soft tissue was made in the recipient site (Figure 3A). Then, at the donor site, a crestal incision was made, and a full thickness mucoperiosteal flap was raised (Figure 3B). Bone was removed using rotary burs and saline cooling, and the tooth was extracted using dental forceps with limited application to the crown (Figure 3C). Immediately after the extraction, the tooth was replanted in the healing socket of tooth 46 and an extra-oral time of several seconds was achieved. The bone at the recipient site was at the osteoid stage of healing, therefore fairly soft. Thus, no preparation of the recipient site was needed. The transplanted tooth was splinted for 2 weeks with a stainless steel wire (Twist Flex brand arch wire) in an infra-occlusion position to achieve sufficient initial stability (Figure 3D), and a periapical radiograph was taken to evaluate its position (Figure 3E).

Follow-ups were made 2 weeks, 1 month, 3 months and 1 year from the last procedure. In a 1-year follow-up, the tooth had normal mobility, no sensitivity to palpation and percussion, and responded to thermal testing (EndoFrost, Roeko). The soft tissue was normal, probing depths up to 3-mm, without swelling or sinus tract (Figure 4A, 4B). Radiographically, periapical healing at the recipient site was observed. 5mm from the mesial apex, a
radiopaque area was identified, which is similar to the pre-operative radiopaque object in proximity to the inferior alveolar canal (Figure 4C).

Compared to the post-operative periapical radiography immediately after the procedure, there was no change in the distal root dimensions. In the mesial root, development of the root length and a closed apex were demonstrated.

Discussion

A dental implant, a fixed bridge, or tooth autotransplantation are the current options for a single tooth replacement (Cross et al. 2013). Dental implants are not a superior alternative to a functioning natural dentition (Greenwell et al. 2018). High rates of peri-implantitis and low success rates of peri-implantitis treatments, constitutes a current and future challenge for patients and clinicians (Derks & Tomasi 2015, Derks et al. 2016). Dental implants are contraindicated in children and adolescents due to the continuous growth of the alveolar process which poses the risk of severe infraposition (Thilander et al. 2001), thus was not considered in the present case (19-year old patient).

Autotransplantation refers to the repositioning of an autogenous tooth in another recipient site (AAE 2015). The autotransplantation procedure may include disinfection and anaesthesia of the surgical sites, extraction of the tooth at the recipient site; preparation of the recipient socket if needed, atraumatic extraction of the donor teeth (with minimal use of elevators); positioning and splinting of the donor tooth with nonabsorbable surgical sutures and a wire splint for 2 to 3 weeks, and occlusal adjustment (Tsukiboshi 2002). In cases with a mature transplanted tooth, root canal treatment should be performed extra-orally or within 2 weeks after tooth repositioning (Tsukiboshi 2002). Previous studies have investigated the influence of various factors on the success of this procedure: extra-oral time, transplanted tooth type, root development stage, and splinting (Kallu et al. 2005). Few studies have mentioned the possible influence of a periradicular lesion at the recipient site (Andreasen et al. 1990 Kallu et al. 2005).

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There are biological and mechanical differences between surgical preparations of different recipient sites: surgical formation without tooth extraction (congenitally missing tooth), and surgical preparation of an extraction site of a tooth with periradicular lesion or tooth without periradicular lesion. Periradicular lesion in close proximity to an anatomical structure such as the mandibular canal, the mental foramen or the maxillary sinus may limit the curettage procedure (Kim & Kratchman 2006), and residual inflamed tissue might damage the bone and soft tissue repair processes after autotransplantation. Furthermore, prominent bone resorption can create inadequate mechanical conditions for placement and retention of the replanted tooth.

In the present study, postponed autotransplantation was done due to a large periradicular lesion in close proximity to the mandibular canal with the buccal and lingual cortical plates destroyed.

The timing of 9 weeks after the extraction of tooth 46 was chosen due to the repair of soft tissue and the bone regeneration process. The bone regeneration process includes two phases as can be extrapolated from Evian et al. (1982), who examined the process in healthy extraction sites. The first phase, 4 to 8 weeks after the extraction, is the progressive osteogenic phase. There is a proliferation of osteogenic cells and immature bone formation. In the second stage, 8 to 12 weeks after the extraction, the osteogenesis slows down, and new trabeculae undergo maturation and increase in volume (Evian et al. 1982). Thus, 8 to 12 weeks after the extraction the recipient site contain a combination of both types of those bones.

Similarly to delayed immediate implants (Chen et al. 2004), postponing the second step of the autotransplantation procedure by 8 to 12 weeks will probably result in an inflammation-free site and convenient manipulation of the recipient site due to the immature osteogenic bone.

In the present case, no osteotomy was needed to prepare the recipient site and to fit the transplanted tooth.
Immature teeth, with wider apical foramina, have a significant potential for pulp revascularization (Lee et al. 2012, Jang et al. 2013), which takes place due to an invasion of blood capillaries through the wide apical foramen. If the Hertwig epithelial root sheath is preserved, differentiation into pulpal cells is predictable (Jang et al. 2013).

The favorable revascularization in the present study might be attributed to both the immature apex, and the postponed autotransplantation which gained a highly vascularized, non-inflamed and non-infected recipient site.

Based on one-year follow-up observation of the present case, postponed autotransplantation with an immature tooth resulted in a favorable prognosis. Although long-term follow-up is preferred, the current status of the tooth – the elongation of the root and the closure of the apex at the mesial root, together with the positive response to cold testing, and the healing of the surrounding bone suggest a positive outcome.

**Conclusion**

Postponed autotransplantation may be one of the treatment planning options in cases of autotransplantation to an extraction site with a large peri-radicular lesion penetrating the cortical plates and in proximity to an anatomical structure. Further case series and randomized controlled trials are needed to determine the exact influence of the postponed procedure on the autotransplantation outcome.

**Conflict of Interest statement**

The authors have stated explicitly that there are no conflicts of interest in connection with this article.
References


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Figure legends

Figure 1 Pre-operative clinical and radiographic evaluation: A- Lingual swelling adjacent to the fixed partial denture of tooth 46; B- Preoperative periapical radiograph. C- CBCT coronal image; D,E- CBCT axial images.

Figure 2 A- the extraction site of tooth 46 immediate after the extraction; B- the extraction site of tooth 46 after placing of muco-seal graft and 6-0 nylon sutures.

Figure 3 A- an incision in the soft tissue at the recipient site; B- crestal incision and a full thickness mucoperiosteal flap at the donor site; C- the extracted donor tooth (#48); D- Tooth 48 at the recipient site after suturing and splinting; E- Post-operative periapical radiographic imaging.

Figure 4 A,B- one-year clinical follow-up; C- one-year radiographically follow-up.