Autotransplantation as a Treatment Modality of Macrodontia: A Case Report

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Abstract

Tooth autotransplantation is a treatment modality involving replacing either developmentally absent teeth or teeth with poor prognosis by transplanting a tooth from another area. This is a case report of an auto transplantation in a 7-year-old female patient in the mixed dentition stage, presenting with a supernumerary lateral incisor erupted distal to the maxillary right lateral incisor and with a macrodont maxillary left lateral incisor. The treatment plan involved two phases. Phase one consisted of the extraction of the macrodont tooth and an auto transplantation of the supernumerary tooth into the position of the maxillary left lateral incisor. Phase two consisted of interceptive orthodontics, which involved expansion with a hyrax appliance to address the maxillary constriction, and an upper sectional fixed appliance for alignment purposes. A one-year follow up revealed a stable and a normally developed, auto transplanted supernumerary tooth.

Key Words: Autotransplantation, Macrodont Lateral Incisor, Supernumerary

Introduction

Tooth auto transplantation is a treatment modality in which an embedded, impacted or erupted tooth is transplanted into an extraction or a surgically prepared site [1]. The procedure was first introduced in relevant literature in the 1950s, initially by Apfel and then in 1956 by Miller, who presented case reports of an autogenous transplantation to replace an absent first molar [2,3]. This treatment modality is indicated to replace developmentally absent teeth or teeth with poor prognosis, such as for the replacement of a carious first molar with a third molar [1,4-6]. Another indication is the replacement of traumatized teeth, and it is particularly common in replacing traumatized incisors with premolar donor teeth [1,6,7]. Auto transplantation might be considered in the management of dental anomalies, like ectopic eruption and malformed teeth [8-10]. However, there are several complications to this treatment approach, including root resorption of the transplanted tooth, as well as mobility and eventual failure of the transplanted tooth as a result of the loss of periodontal attachment around the tooth. There are systemic factors, such as cardiac diseases, and local factors, such as poor oral hygiene, that increase the probability of procedural failure [9]. However, a patient's young age, optimum oral hygiene, and normal dental development with open apices of the transplanted teeth are favorable factors leading to successful auto transplantation [1,8,10].

Aim

The aim of this article is to present a case report of an interdisciplinary management involving the auto transplantation of a supernumerary tooth replacing a macrodont lateral incisor, an interceptive orthodontic treatment, and the records of a one-year follow-up.

Case Description

A healthy, 7-year-10-month-old Saudi female was referred from the pediatric dentist for an orthodontic consultation. Historically, the patient had undergone comprehensive pediatric dental care, which concluded with the placement of an upper left band and loop appliance that was cemented to the maxillary left, second primary molar (tooth #65) and a lower lingual holding arch for space maintenance purposes.

Upon examination, she presented with a supernumerary lateral incisor tooth that had erupted labially and distally to the maxillary right lateral incisor (tooth #12), and a macro-maxillary left lateral incisor (tooth #22). The maxillary arch was constricted (v-shaped), the overbite was shallow, and the upper midline was deviated to the right by 1.5 mm (*Figure 1*).

The orthopantomograph, upper standard occlusal and periapical radiographs confirmed the clinical findings (*Figures 2 and 3*). The radiographs showed the supernumerary tooth to be located between the maxillary left lateral incisor and the primary canine. The supernumerary tooth had normal root formation with an opened root apex (*Figure 3A*).

***Figure 1**. Pre-treatment intra-oral views, demonstrating the maxillary left macrodont lateral incisor.*

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A joint appointment was arranged that included the pediatric dentist, the orthodontist, and the periodontist. Classically, there were multiple treatment options to deliver comprehensive dental care. One option was to maintain the macrodont lateral incisor and to extract the supernumerary tooth. However, this treatment option would require comprehensive endodontic and restorative treatments in order to reduce the mesiodistal width of the macrodont lateral incisor. This option was not an ideal approach due to the large pulp chamber of the macrodont maxillary left lateral incisor, which would lead to failure of any endodontic therapy, and the extremely wide root would not facilitate the construction of an esthetically acceptable prosthetic crown. An alternative option was to consider the extraction of the macrodont lateral incisor and utilize fixed orthodontic treatment to close the space. However, this option was discarded as it would require a comprehensive orthodontic treatment, which was not feasible at the current mixed dentition stage. Another option was to consider, at a later age, an implant restorative treatment to replace the macrodont maxillary left lateral incisor. Nonetheless, due to the young age of the patient and the aggressive nature of this approach, this option was excluded. Following a detailed discussion on the available treatment options with the patient and family, our preferred treatment plan became an auto transplantation of the maxillary right supernumerary tooth into the place of the macrodont maxillary left lateral incisor, followed by an early orthodontic treatment to address the constriction in the maxilla. Supporting signs to this preferred treatment option included the following: the patient's young age and healthy medical status, good oral hygiene, and the opened root apex of the supernumerary tooth.

The first phase of the treatment involved the extraction of the macrodont lateral incisor (*Figure 4A*), and the atraumatic extraction of the supernumerary tooth, which was immediately auto transplanted into the socket of the extracted maxillary, left lateral incisor (*Figure 4B*). Suturing of the gingival tissue on the mesial and distal aspects of the tooth was undertaken using a 4-0 silk suture (Ethicon, Inc., Somerville, New Jersey, USA) to facilitate the healing process. The auto transplanted tooth was subsequently stabilized with an orthodontic wire (0.016" X 0.022" Stainless Steel), which was bonded using an acid-etch composite resin to the maxillary left central incisor and to the maxillary primary left canine (*Figures 4C and 6B*). These procedures were performed by the periodontist with the patient under local anesthetic.

The patient was instructed to adhere to strict oral hygiene instructions and to use Listerine® (McNeil Consumer Healthcare, Fort Washington, Pennsylvania, USA) mouthwash twice daily for one week. In addition, she was prescribed 250 mg of amoxicillin three times a day for seven days in order to prevent any infection around the surgical site. She was also instructed that she could take 200 mg of the non-steroidal anti-inflammatory ibuprofen, as needed.

A month later, the labial orthodontic wire splint was removed. Clinical observation revealed a normal healing process. A periapical radiograph showed normal healing process in the periradicular area as well (*Figure 6C*).

The second phase of the treatment was comprised of an interceptive orthodontic care commenced one month after the auto transplantation procedure (*Figures 5A-C*). This was planned following a detailed assessment of the transplanted tooth, which had a normal gingival contour and normal mobility, and it responded to thermal and electrical pulp tests. The orthodontic plan involved using a fixed expansion appliance with a jackscrew and an upper sectional (2 X 4) fixed appliance. Primarily, the expansion appliance was cemented, and the parents were instructed to turn the screw once a day to correct the constricted maxilla.

Three months later, fixed orthodontic appliances (0.022"

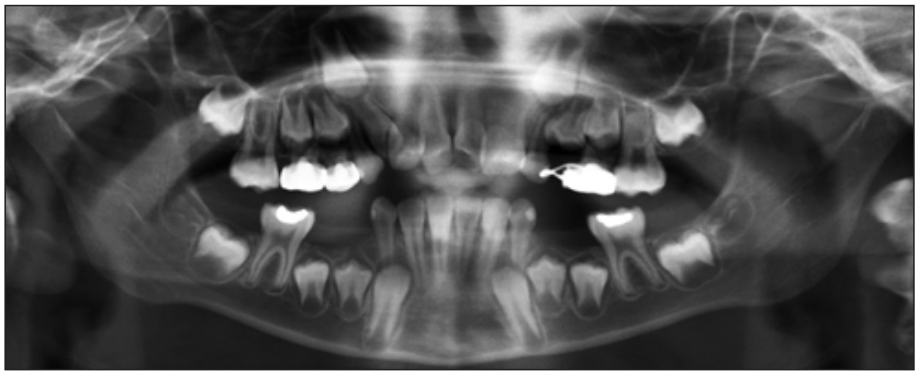

Figure 2. *Pre-treatment orthopantomograph, showing the maxillary left macrodont lateral incisor, and the right supernumerary tooth.*

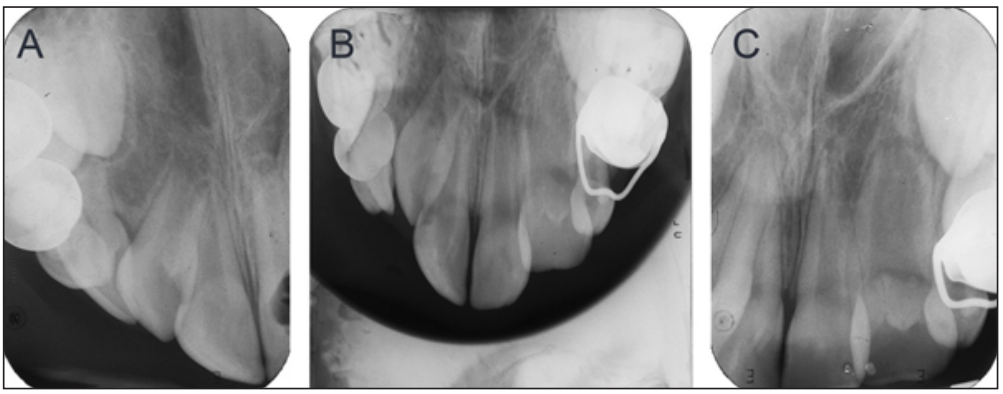

Figure 3. *Pre-treatment radiographs: A. Periapical radiograph of the maxillary right supplemental supernumerary tooth; B. Upper standard occlusal radiograph confirming the presence of the maxillary right supplemental supernumerary tooth and the maxillary left macrodont lateral incisor; and C. Periapical radiograph of the maxillary left macrodont lateral incisor.*

Roth Prescription, Victory series, 3M Unitek®) were bonded on the upper incisors, and the teeth were aligned initially using 0.016" NiTi followed by 0.016" X 0.022" NiTi. Following six months of orthodontic treatment, debonding was completed and an upper Hawley retainer was inserted (*Figures 5D-F*). The patient and her parents were instructed to use the retainer on a full-time basis for the first three months, followed by night-time wearing thereafter.

The one-year follow-up clinical examination following the auto transplantation revealed a stable tooth with normal gingival condition. Periapical radiographic assessment showed normal root apex closure with evidence of dilaceration (*Figure 6D*).

Discussion

Tooth auto transplantation is considered a useful treatment strategy with numerous advantages in the management of absent teeth or teeth with poor prognosis. One advantage is that a transplanted tooth maintains occlusal harmony with adjacent dentition, particularly if this procedure was undertaken before the patient's pubertal growth spurt is complete [11]. Another advantage is the acceleration of the healing and regeneration process of the pulpal tissue, in particular when the root apex is open and the Hertwig epithelial root sheath is maintained [9,11]. A valuable advantage of auto transplantation is the ability of the Periodontal Ligament (PDL) cells to facilitate bone regeneration, which resolves the discrepancy between

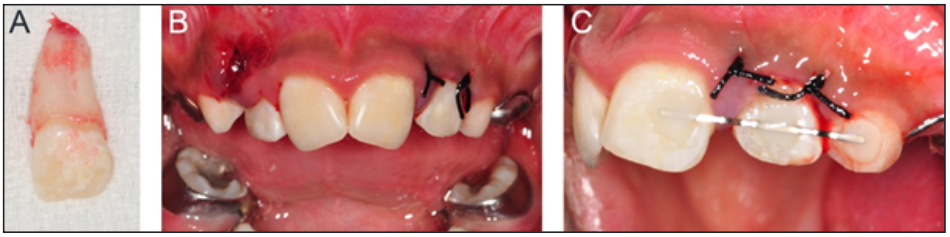

***Figure 4**. A. The extracted maxillary left macrodont lateral incisor; B. The autotransplanted maxillary right supernumerary tooth into the maxillary left lateral incisor position; and C. The autotransplanted tooth with the archwire splint.*

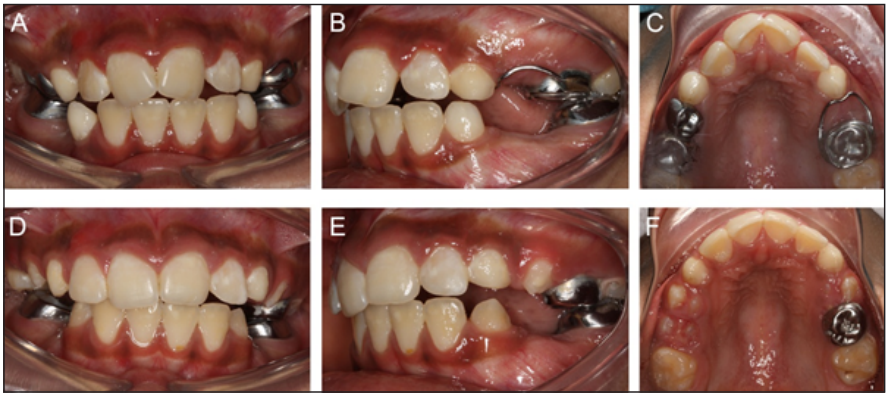

***Figure 5.** Pre-orthodontic treatment (A-C) showing maxillary constriction and malalignment, and post-treatment (D-F) intra-oral views demonstrating correction of the malocclusion including an aligned maxillary supplemental supernumerary tooth into the position of the maxillary left (extracted) macrodont lateral incisor.*

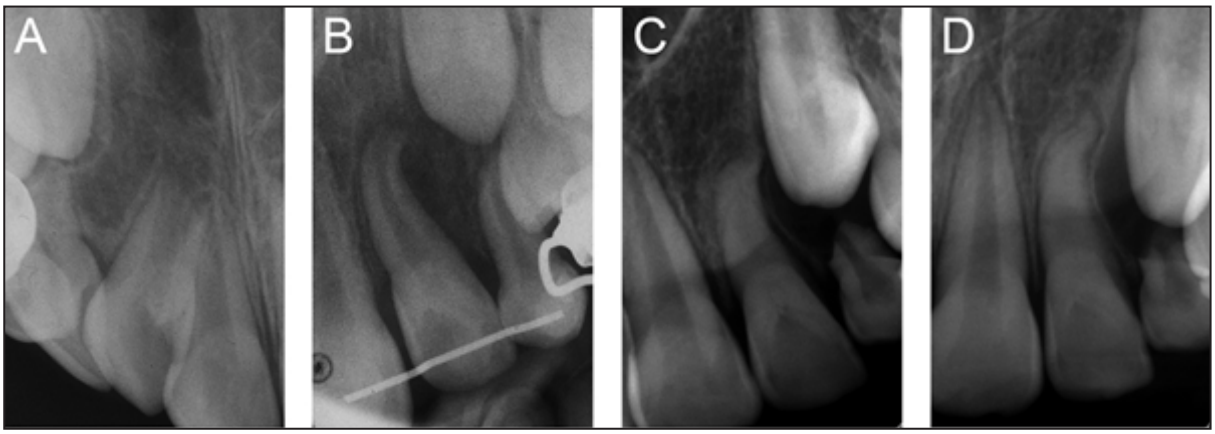

***Figure 6**. Periapical radiographs: A. Pre-treatment radiograph showing maxillary supplemental supernumerary tooth with incomplete root formation; B. Periapical radiograph immediately after the autotransplantation procedure showing the splinted autotransplanted supplemental supernumerary tooth; C. Periapical radiograph a month following the procedure demonstrating normal signs of healing around the transplanted supplemental supernumerary tooth; and D. Periapical radiograph at the one year follow-up confirming a normal bony development surrounding the transplanted supplemental supernumerary tooth.*

the donor tooth and the recipient socket [1,9,11]. In the present case report, the labially erupted supernumerary lateral incisor was transplanted to replace a malformed macrodont lateral incisor. The macrodont lateral incisor may have resulted from a fusion with a supernumerary tooth. This phenomenon was reported in previous investigations [12,13].

In a recent systematic review, it was reported that the survival rate for auto transplant was 98% after one year and 90% after five-year follow ups [14]. The success of auto transplantation procedures depends on a number of factors, including involving a healthy individual with meticulous oral hygiene [1,8-10]. A healthy periapical area with no signs of

inflammatory responses or root resorption affecting the donor tooth is a crucial factor to success [15]. Another factor is the preservation of intact periodontal ligament tissues around the transplanted tooth [6,9,16,17]. This latter factor is ensured through careful handling and through reducing the extra-oral time during the procedure [8]. In addition, the supernumerary donor tooth had an incomplete root formation in the present case, which is known to help in the success of the surgical procedure [18,19]. Loss of vitality and root resorption are major potential complications of the procedure. However, in 95% of transplantation procedures involving donor teeth with incomplete root formation, re-vascularization of the pulpal tissues will occur, which is required for the vitality of the pulpal tissues and the normality of root development [20]. This re-vascularization will eliminate the need for any endodontic treatment [17,20]. All of these criteria were met in the current case report, which led to an eventual successful treatment outcome.

In the present case, a one stage surgical technique was chosen to produce the auto transplantation. This is the preferred surgical technique to ensure an atraumatic surgical procedure [16,17]. Any trauma to the root during the surgical procedure could damage the epithelial root sheath of Hertwig, which is a fundamental source of normal root development [21]. Damage to the root, including resorption, is minimal if there is no contact between the root and the periosteum at the new site of placement [22].

Splinting of the transplanted tooth is required to aid in the stability of the donor tooth in the new position [1,8-10]. This is achieved in several ways; however, rigid fixation is known to lead to adverse effects on the healing process [23]. The latest meta-analysis showed that wire splinting increased the likelihood of survival rates more than did suture splinting [14]. Due to the extremely large socket of the macrodont maxillary left lateral incisor, the periodontist in the present case planned a flexible splinting of the transplanted tooth for a month instead of the 7- to 10-day period advocated in several reports [9,18,24]. Suturing of the gingival tissues of the transplanted tooth is usually recommended to enhance stability [25,26]. It is inevitable in cases of trauma and some donor premolars [9]. The periodontist, in this case, sutured the gingival tissue around the transplanted tooth, which means unveiled a subsequent stable result.

Orthodontic treatment may be carried out following auto transplantation and it is recommended to allow approximately a 3-month interval between the auto transplantation and subjecting the transplanted tooth to orthodontic forces, thus providing a sufficient period for periodontal regeneration [9,27-29]. We commenced the expansion one month following the surgery, to correct a posterior cross bite. However, orthodontic treatment with a fixed appliance was applied three months following the surgery.

Conclusion

Tooth autotransplantation is an atraumatic and non-invasive treatment alternative for dental replacement in clinical scenarios with malformed teeth. In the current case report, a proper case selection (good oral hygiene and an incomplete root development of the donor tooth) helped in the successful outcome. One stage, the careful surgical procedure and initial splinting, was undertaken to ensure effective surgical execution. An interceptive orthodontic treatment was carried out a month later to correct occlusal disharmony. The successful outcome is proved with a stable auto transplantation following a one year post-treatment.

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