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Management of a 9-year-old boy experiencing severe dental injury – a 21-year follow-up of three autotransplants: a case report

CASE REPORT

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Abstract – The replacement of missing anterior teeth is a particular challenge in children and adolescents. This report describes the management of a 9-year-old boy suffering a severe dental injury. The treatment included three autotransplantations and orthodontic space closure to replace four maxillary teeth. A follow-up period of 21 years demonstrated a successful outcome. Autotransplantation of premolars in growing individuals is a predictable method for replacement of missing teeth and for re-establishment of the alveolar process after traumatic bone loss. This case report shows that a multidisciplinary approach is essential for the management and outcome of severe dental injuries in children.

Severe dental injuries may cause permanent loss of teeth. The most accident-prone time is between 8 and 12 years (1, 2), and the replacement of missing teeth is a challenge in growing individuals as implants are unsuitable in this age group (3). Orthodontic space closure and autotransplantation of teeth are valid treatment alternatives for replacing missing anterior teeth (4). In cases with bone loss, a transplant has the potential of bone induction and re-establishment of a normal alveolar process. Survival rates between 90% and 100% are reported (5–9), but only a few patients were followed more than 10 years. The transplant should have the potential for long-term, even lifelong survival, and in this perspective, only few studies (10) and case reports (11) are available.

This report describes the management of a 9-year-old boy suffering a severe dental injury. The treatment resulted in three autotransplantations and orthodontic space closure to replace four teeth in the maxilla. The follow-up period was 21 years.

Case report

A 9-year-old boy was brought to the hospital emergency department after a bicycle accident. Fractures of the mandible (body and both condyles) and avulsion of the maxillary right central and lateral incisors were diagnosed. The avulsed central incisor was not replanted, and the lateral incisor was lost at the site of accident.

Clinical and radiographic examination

Four weeks after the injury, the boy was examined by a pediatric dentist. Clinical examination revealed a frontal open bite and a lateral cross bite on the right side, a consequence of the mandible fractures. An atrophic alveolar process was seen where the two incisors were missing (Fig. 1). The intraoral examination also disclosed an untreated maxillary left central incisor, a complicated crown fracture with a periapical radiolucency.

Treatment progress

Endodontic treatment of the necrotic maxillary left central incisor was performed, and calcium hydroxide inserted. The boy was further referred to specialists in

Fig. 1. Clinical view showing the missing maxillary incisors, frontal open bite, cross bite and crowding in the mandibular arch.

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Fig. 2. The mandibular left second premolar is transplanted into the maxillary right central incisor region.

Fig. 3. A fistula is observed in the area between the maxillary right first premolar and the newly erupted canine.

orthodontics and oral surgery for interdisciplinary treatment planning. Transplantation of one premolar into the area of the missing central incisor and orthodontic space closure to replace the lateral incisor was

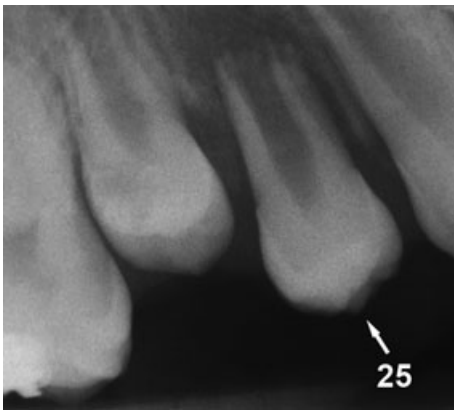

Fig. 4. The maxillary right first premolar was extracted because of pulp necrosis, and the maxillary left second premolar is transplanted into the area.

decided. Six months after the injury, the mandibular left second premolar was transplanted into the maxillary right central incisor region. The tooth was rotated 180° for an optimal placement in the atrophic alveolar process. The root development of the transplant was about one half of its potential length (Fig. 2). However, some unexpected complications occurred. Four weeks later, a fistula was observed in the area between the maxillary right first premolar and the newly erupted canine (Fig. 3). Pulp necrosis of the premolar was diagnosed, and the fistula healed after calcium hydroxide treatment. Because of incomplete root formation, the tooth was later extracted and the maxillary left second premolar transplanted into this area. The root development of the transplant was about one half of its potential length (Fig. 4). Replacement resorption of the maxillary left central incisor had for some time been suspected. On percussion, the sound was high, and ankylosis was verified by radiograph and no response to orthodontic forces. After removal of the ankylosed tooth, the mandibular right first premolar was transplanted into the area. The transplant had three quarters root development (Fig. 5a,b). The three transplantations were performed by the same oral surgeon, all within a year

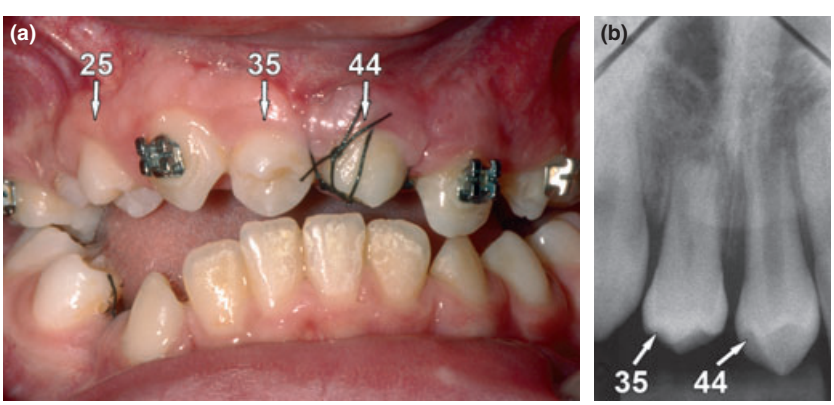

Fig. 5. (a) The mandibular right first premolar is transplanted into the area of the ankylosed and removed central incisor. (b) The earlier transplanted mandibular left second premolar shows pulp canal obliteration.

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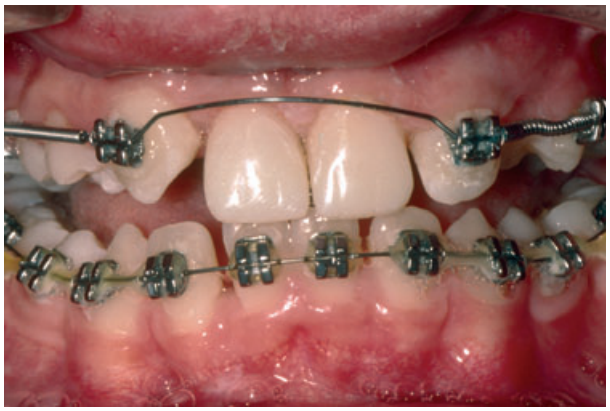

Fig. 6. Four months after the final transplantation, composite buildups were performed to resemble upper central incisors. The maxillary right canine was moved to the area of the missing lateral incisor, and tooth positions in both jaws were corrected.

with 4- and 5-month intervals. Four months after the final transplantation, composite buildups were performed to resemble upper central incisors. The maxillary right canine was moved to the area of the missing lateral incisor, and tooth positions in both jaws were corrected (Fig. 6).

Treatment result

At the age of 12, the orthodontic treatment was completed. Both the upper and lower jaws had twelve teeth, and all spaces were closed. The frontal view showed satisfactory growth of the alveolar process (Fig. 7a–c). Radiographs showed completed root formation, periodontal healing, and pulp canal obliteration of the three transplanted premolars. Positive sensibility responses confirmed pulp revascularization.

The patient met to a follow-up at the age of 31, 21 years after the first transplantation. Radiographs of the transplanted premolars showed no pathological changes (Fig. 8a,b). On percussion, the sound was normal, indicating no replacement resorption. The clinical examination revealed normal height of the upper anterior alveolar process. The composite buildups had been replaced by full crowns at the age of 20 (Fig. 9). The overall esthetic result was not optimal, but the patient had a low smile line and was very pleased with the outcome of the treatment.

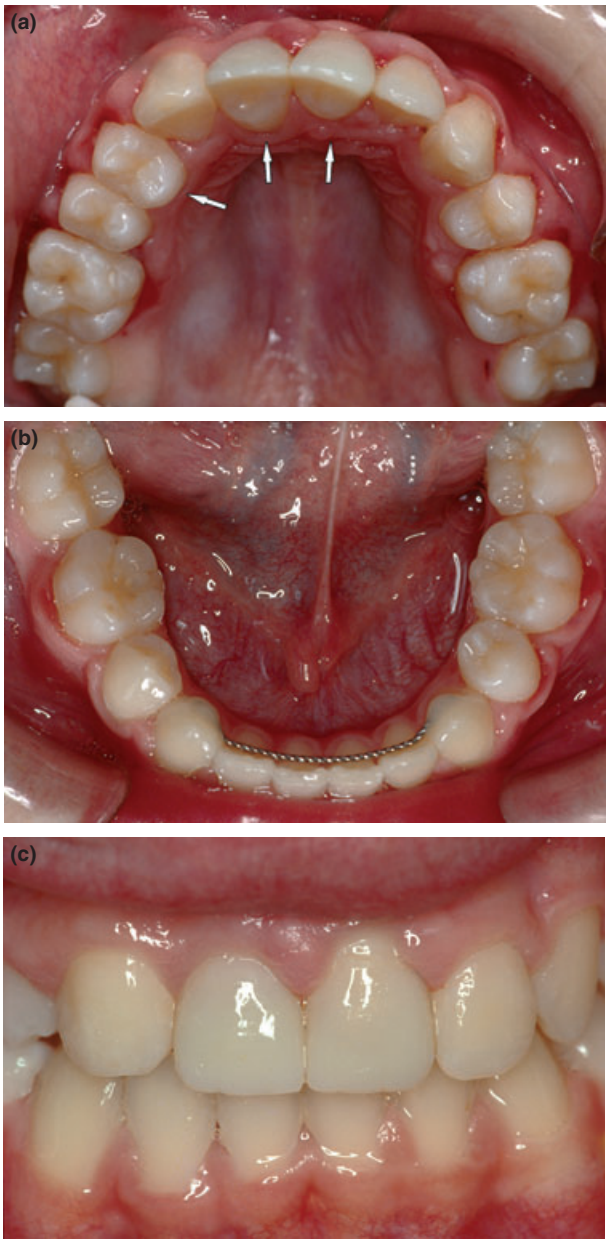

Fig. 7. (a, b) When the orthodontic treatment was completed at the age of 12, all spaces were closed and both jaws had twelve teeth. The arrows mark the transplanted premolars. (c) Frontal view showing satisfactory growth of the alveolar process.

Discussion

In case of avulsion of permanent anterior teeth, replantation of the avulsed tooth is the treatment of choice (12). In this case, however, priority was given to the multiple mandible fractures, and the upper right central and lateral incisors were not replanted at the hospital emergency department. The exact trauma diagnoses of the neighboring teeth were unknown at the first dental visit 4 weeks after the injury. Signs of replacement resorption in the upper left central incisor indicated a luxation injury, as well as the diagnosed complicated crown fracture. Most dental injuries affect the anterior teeth (1, 2), and an injury to the upper right first premolar was overlooked until the fistula was observed. Because of the unexpected complications, the treatment plan was revised during the treatment, leading to three transplantations.

Autotransplantation of developing premolars is a well-established procedure in the Scandinavian countries. A high potential for success has been reported for premolars transplanted when their root development has reached ½ to ¾ of the final length (5, 13). A careful atraumatic surgical procedure is mandatory to preserve an intact periodontal ligament of the transplant (14). In this case, the three transplantations were performed by

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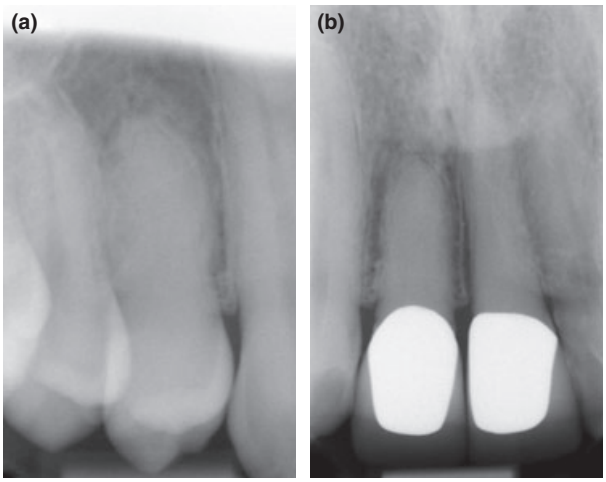

Fig. 8. (a, b) At the 21-year follow up, radiographs of the transplanted premolars showed no pathological changes.

Fig 9. The clinical examination, at the age of 31, revealed normal height of the upper anterior alveolar process. The composite buildups had been replaced by full crowns.

the same experienced oral surgeon, and the root development of the transplants was from ½ to ¾ of the potential length. Commonly used success criteria are the following: the absence of progressive tooth resorption, normal hard and soft periodontal tissues adjacent to the transplanted tooth, and a crown-to-root ratio < 1 (10). All the three transplanted teeth fulfilled these criteria. Obliteration is considered a normal reaction when pulp revascularization occurs.

The composite buildups had been replaced by full crowns at the age of 20. From a biological and esthetic point of view, porcelain laminates veneers had been preferable, but the patient was happy with the outcome. In a study from 2002, the majority of patients were satisfied with the appearance of reshaped transplants (15, 16), but to optimize the final esthetic outcome porcelain laminates veneers are now recommended (17).

Although there are recent publications from countries in northern Europe (9, 11, 18), autotransplantation is still an underused method for replacing missing teeth. Single tooth implants are becoming more common. However, recent studies indicate that the esthetic result for implants in the anterior region sometimes is suboptimal (19). Implants are not recommended to be installed until the alveolar growth is completed and thus contraindicated in children and adolescents (20).

In this case, a normal alveolar process was re-established by early intervention and transplantations, resulting in an optimal biological and a satisfactory esthetic result. The present case was ideal as there was crowding and need for extractions with subsequent orthodontic treatment. Thus, the end result was the same number of teeth as if there had been no traumatic injury.

Conclusions

1 In growing individuals, autotransplantation of premolars is a predictable method of replacing missing teeth and of re-establishing a normal alveolar process after traumatic loss of bone.

2 This case report shows that a multidisciplinary approach is essential for the management and outcome of severe dental injuries in children.

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