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Autotransplantation of first premolar to replace a maxillary incisor – 3D-volume tomography for evaluation of the periodontal space

CASE REPORT

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Abstract – The anterior maxilla is the most traumatized region during childhood and tooth loss is frequently involved. Space closure with implants is contraindicated in growing patients and maintenance of space is necessary over a long period. Transplantation of premolars from the mandible with two-third to three-quarter root formation wide open foramen provides the best prognosis for permanent survival. *Case report:* This report describes the management of a 10 year old girl with autotransplantation to replace an upper incisor by a lower premolar under consideration of special care for the periodontal ligament during surgical procedure. A 3-D imaging with digital volume tomography (DVT) was used 20 months after transplantation to evaluate the periodontal morphology. *Discussion:* Autotransplantation of premolars with incomplete root formation to replace maxillary incisor is a treatment alternative after traumatic loss of teeth. There were no signs of pathosis like resorption or ankylosis and a normal periodontal space demonstrated with DVT. There is no need for endodontic treatment before transplantation. In this case of autotransplantation of a premolar, the DVT after 20 months gives evidence of a successful regeneration of the periodontal ligament.

During childhood, the anterior maxilla is the most traumatized region and tooth loss is frequently involved. Space closure with implants is contraindicated in growing patients and maintenance of space is needed over a long period until growth has ceased. Avulsed and lost anterior teeth are common in children. Using autotransplantation, it is possible to move problems in regions of the dental arch where they are easier to solve (1). Transplantation of premolars from the mandible with two-third to three-quarter root formation wide open foramen provides the best prognosis for permanent survival (2, 3). It is reported from the Scandinavian countries, that the periodontal, gingival and aesthetic conditions could be adapted to natural incisors (4). But one reason for the limited use of premolar autotransplantation in other European countries and North America may be the fact that a very careful surgical procedure is mandatory for a successful outcome. Failures to perform the procedure are often related to surgical complications because of the removal and difficulties in immediate implantation without injuries to the periodontal ligament (5). In many cases, pulp survival with more or less obliteration is not a problem, whereas the part of the root surface covered with the periodontal ligament is more crucial for a successful transplantation. According to Andreasen (6) the prerequisite for periodontal regeneration is the survival of the majority of cells from the periodontal ligament, which are in competition with osteoblasts and osteoclasts from the alveolar bone. If the latter are predominant, root resorption starts and there is a poor prognosis.

Using standardized two-dimensional radiography, it is difficult to diagnose a partial ankylosis and there are many cases where root resorption starts undetected. Recently, the digital volume tomography (DVT) has been introduced in Dentistry. The main advantage of this technique is 3-D imaging and remarkable reduction of radiation exposure in comparison with conventional computer tomography (CT). Clinical applications have been reported for implantology, for the TMJ, in orthodontics for impacted canines and recently for periodontology, too (7).

The case report is focused on the autotransplantation of a lower premolar to replace a maxillary incisor under consideration of a careful atraumatic surgical technique to preserve an intact periodontal ligament of the transplant. To monitor periodontal healing, 3-D imaging of the periodontal morphology was taken 20 months after transplantation.

Case report

This is a case report of a 10-year-old girl, presenting an avulsed upper right central incisor caused by an accident. Endodontic treatment of the incisor was carried out and the tooth was reimplanted within 6 h. Eight months after

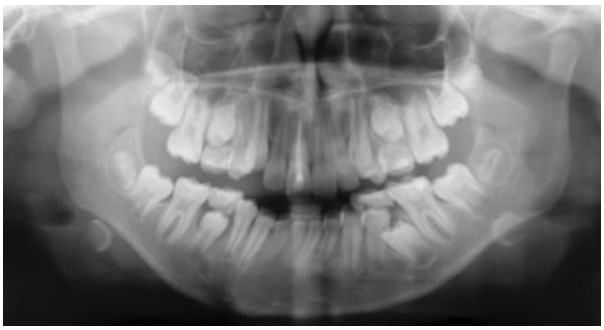

Fig. 1. Orthopantomogram from a 10-year-old girl with reimplantation of right central incisor after traumatic avulsion.

Fig. 2. Upper right central incisor with endodontic treatment and signs of root resorption after reimplantation.

Fig. 3. Ten-year-old girl with crowding and ectopic canines, discoloured tooth crown of the right upper central incisor after reimplantation.

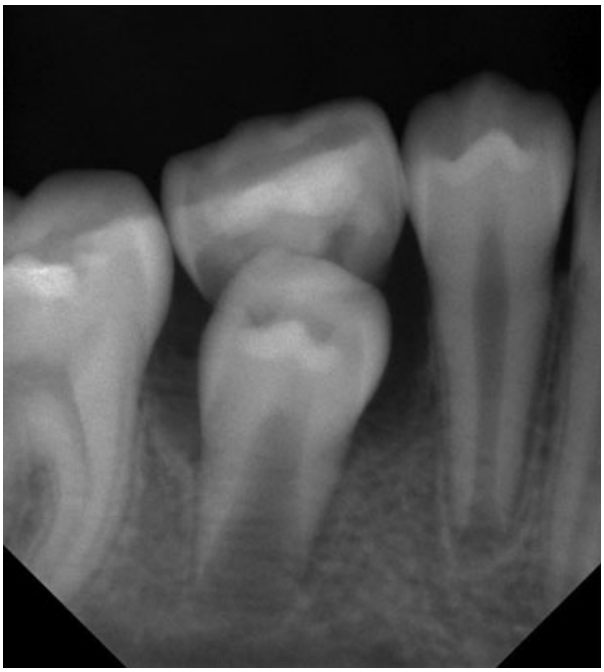

Fig. 4. Mixed dentition in a 10-year-old girl. Three-quarter root formation of the first left premolar in the mandible.

Fig. 5. Upper right central incisor with root resorption 8 months after reimplantation.

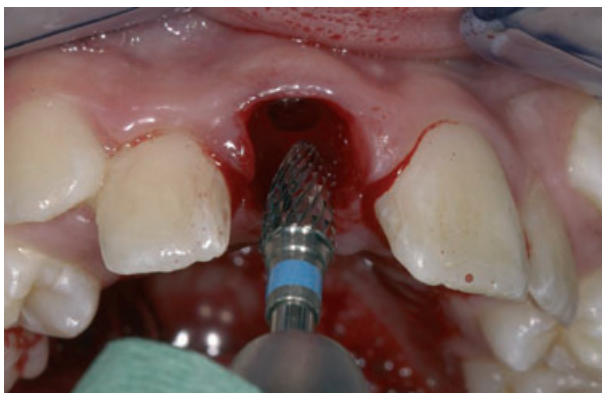

Fig. 6. Preparation of the socket for the autotransplantation replacing the maxillary incisor.

implantation, the radiographic check up showed severe root resorption (Figs 1 and 2) At the same time, a malocclusion with crowding in the upper and lower jaw was identified with an indication for extraction of four premolars. Because of the poor prognosis of the traumatized upper right incisor, we decided to replace the tooth by the left lower first premolar, which had to be removed in the framework of orthodontic treatment. The root formation of this premolar was three-quarter at this time (Figs 3 and 4).

To minimize the risk of root resorption of the transplant, the host socket was prepared with the aid of an acrylic tooth. To ensure a precise adjustment, the acrylic tooth had been shaped the same size as the donor tooth using an X-ray of the lower premolar before extraction.

Extraction of the two teeth and autotransplantation of the premolar took place as a one-stage procedure within 15 min: After local anaesthesia, the upper incisor was extracted and the recipient site was prepared using

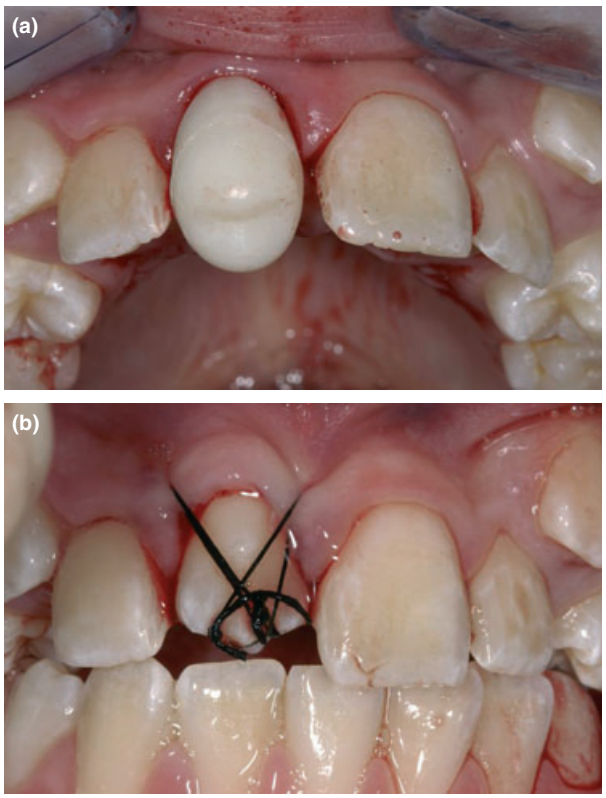

Fig. 8. Acrylic tooth to check the host socket (a), transplanted first premolar with fixation *in situ* (b).

the acrylic tooth. After perfect fit of the acrylic tooth into the new socket, the tooth was removed and the new alveolus was rinsed once (Figs 5 and 6). The premolar was then carefully dissected with interproximal cuts of the gingival and immediately fitted into the new socket. The transplanted tooth was placed out of occlusion and

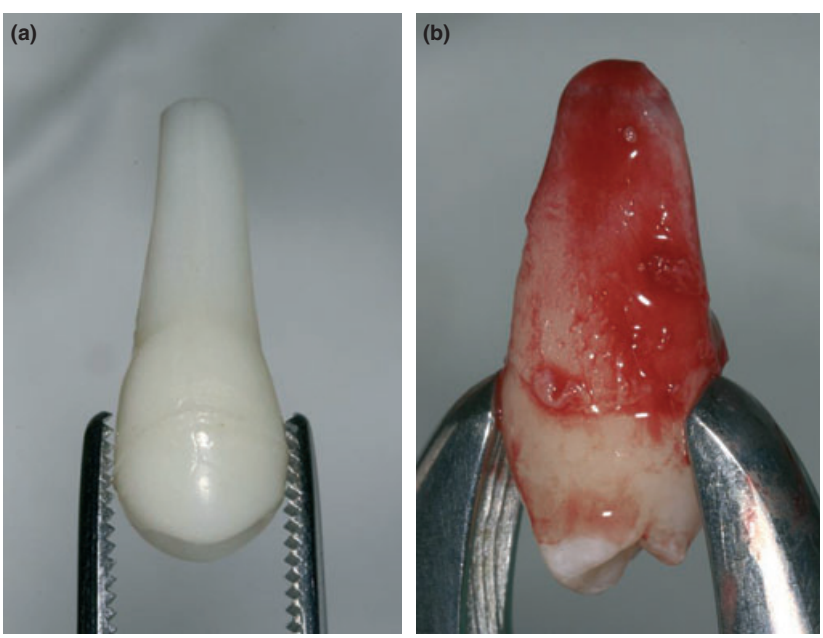

Fig. 7. Acrylic tooth for preparation of the host socket for transplantation (a), first left premolar from the mandible for transplantation (b).

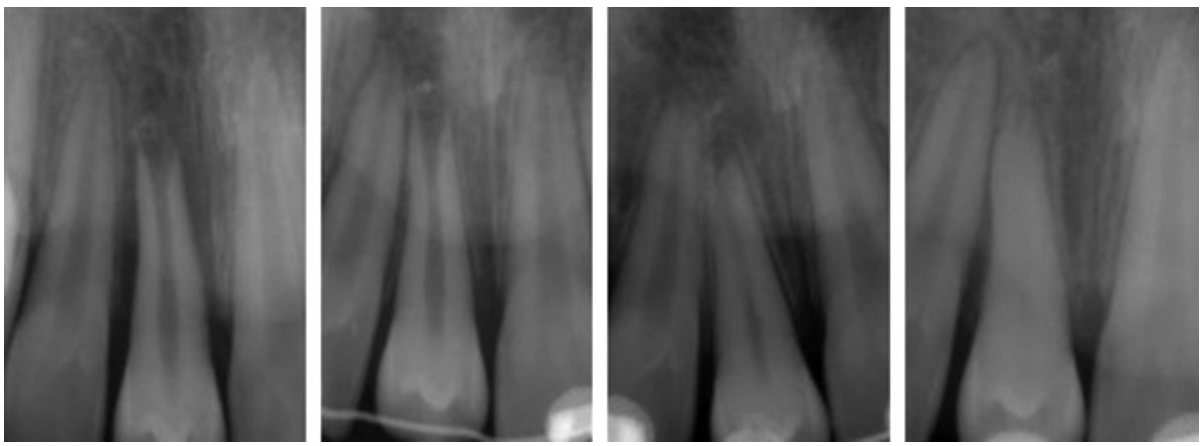

Fig. 9. Radiographs: day of transplantation, 3, 8 and 18 months after transplantation (from left to right), increasing obliteration of the pulp.

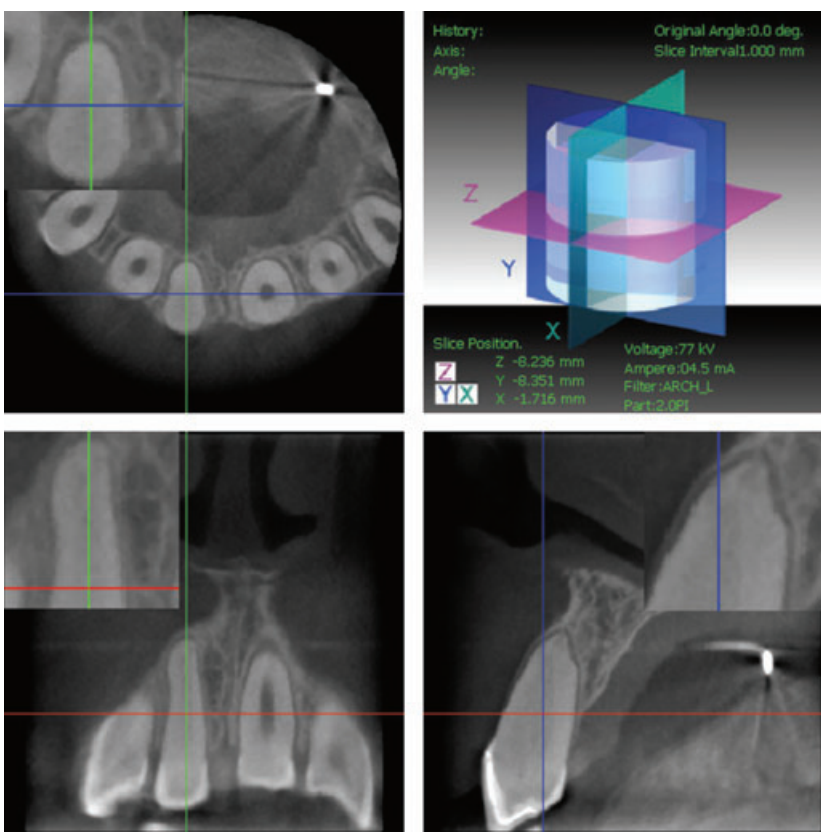

Fig. 10. 3-D digital volume tomography of the transplanted premolar 20 months after autotransplantation.

fixed with crossed threads (Figs 7 and 8). After 8 days, the fixation was removed and after 20 days, the tooth received a bracket within a fixed orthodontic appliance to move it in the right position. Radiographs for follow up were taken 3, 8 and 18 months after transplantation. A 3-D DVT was carried out 20 months after transplantation (Figs 9 and 10).

There was no inflammatory reaction of the gingiva or complaining of the patient after transplantation. The tooth showed stability after 6 weeks plus a positive response to sensitivity testing (temperature). An increasing obliteration of the pulp and periodontal ligament healing were monitored by radiographic examination. The DVT 20 weeks after transplantation confirmed the formation of the periodontal ligament. Later on, the transplant was prepared for a porcelain veneer (Fig. 11).

Discussion

In the Scandinavian countries, autotransplantation of premolars and replacing of incisors or missing teeth is a well introduced and well tested method with survival

Fig. 11. Transplanted tooth in region 11 reshaped with a veneer.

rates of more than 40 years. As mentioned before, the reason for tentative application in other countries is the lack of routine in the surgical procedure (3).

In this presentation, the tooth has been transplanted lately with three-fourth quarter of root formation. The advantage of a late transplantation is the long root with sufficient anchorage. The disadvantage is the obliteration of the pulp. Jacobson and Kerekes (8) showed that the teeth with partial pulp obliteration have a good prognosis. Obliteration is more or less a normal reaction after transplantation (4). There was no sign of pathosis like resorption or ankylosis. In this case, the DVT after 20 months gives more evidence for a successful regeneration of the periodontal ligament. The preparation of the socket is an important precondition to retain the layer from periodontal cell at the root surface. It is important to implant the tooth immediately after extraction to prevent any kind of drying out (9). After healing and alveolar bone formation, there was the same pocket depth like in the neighbour teeth. The orthodontic movement for the positioning before reshaping with a veneer stimulates the regeneration of the alveolar bone and the periodontal ligament. In comparison with natural teeth, the transplant could be adapted in the shape and colour with a veneer (Fig. 11) and the red aesthetic by orthodontic vertical movement. Autotransplantation of premolars with incomplete root formation to replace maxillary incisor is a treatment alternative after traumatic loss of teeth. The DVT could be used as an important tool for 3-D imaging of the periodontal conditions in the frame of healing and regeneration.

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