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Central incisor loss after delayed replantation following avulsion: a contemporary restorative and adjunctive orthodontic management approach

CASE REPORT

Andrea Savi[1], Oliviero Turillazzi[2], Renato Cocconi[3], Mauro Bonanini[4], Silvia Pizzi[4], Maddalena Manfredi[4]

[1]Dental Practitioner, Brescia and Parma; [2]Dental Technician, Brescia; [3]Orthodontist, Parma, Italy; [4]Sezione di Odontostomatologia, Università di Parma, Parma

Correspondence to: Maddalena Manfredi DDS, PhD, Sezione Odontostomatologia, Università di Parma, Via Gramsci 14, 43100 Parma, Italy
Tel.: +39 0521 986722
Fax: +39 0521 292955
e-mail: maddalena.manfredi@unipr.it

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Abstract – Delayed replantation of an avulsed tooth may result in rapid root resorption or, more frequently, dental ankylosis with subsequent bone substitution. If this process develop slowly, it is possible to observe that tooth loss is characterized by a well conserved alveolus with regard to bone preservation, particularly in vertical dimension. This clinical case reports a dental trauma of a central incisor in a young boy characterized by tooth avulsion and its delayed replantation. After 10 years, dental ankylosis of the incisor was recorded and the patient underwent a prosthetic-orthodontic rehabilitation using CAD-CAM technology and no-prep veneers.

Avulsions in the permanent dentition are relatively rare (0.5–3%) and deemed the most severe of all dental injuries. Surface resorption, ankylosis and/or inflammatory resorption are sequelae of replantation. The consequence of the tooth after incisor injuries to permanent teeth involving periodontal tissues are, therefore, dependant on the type of trauma, severity of the injury and patient age when the trauma occurs (1–3).

In particular, a delayed replacement of a tooth that has been avulsed from the alveolus may determine rapid root resorption or, more frequently, dental ankylosis with subsequent bone substitution. This abnormal calcification of the periodontal ligament causes the complete resorption of the re-implanted tooth and its consequent loss. If this process develop slowly, it is possible to observe that tooth loss is characterized by a well-conserved alveolus with regard to bone preservation, particularly in vertical dimension (4). In addition, if the replantation and ankylosis become evident before the end of jaw growth, the replaced tooth will appear infra-occluded. This effect is more evident the earlier during the growth phase that the replantation is carried out (5–7).

Once jaw growth is complete, the prosthetic rehabilitation should take into account the gingival margin height in relation to the contralateral tooth.

Case report

This clinical case reports a dental trauma of a central incisor (11) in a young boy (15 years old) characterized by tooth avulsion and its delayed replantation. The tooth was maintained in place until its complete radicular resorption which occurred after 10 years (Fig 1a,b).

At the time of crown extraction, the central incisor was characterized by several asymmetries in comparison with the contralateral tooth. In particular, a more apical position of gingival contour of the tooth was evident, as well as a more mesially inclined and buccal-positioned tooth.

As a result, the mesial-distal space of the central right incisor (11) was much larger than that of the left incisor (21) (Fig 2).

After the residual crown removal, which had almost completely resorbed, a curettage of the alveolus was performed to carefully eliminate all radicular remnants.

As a consequence of the bone resorption, the positioning of a dental implant, even if correctly performed, is necessarily more palatal in comparison with a natural dental root. For the same reason, even the creation of a prosthetic crown results in difficulties in the control of the overcontour (8, 9).

Orthodontic treatment has been performed to obtain a correct redistribution of the mesio-distal spaces with

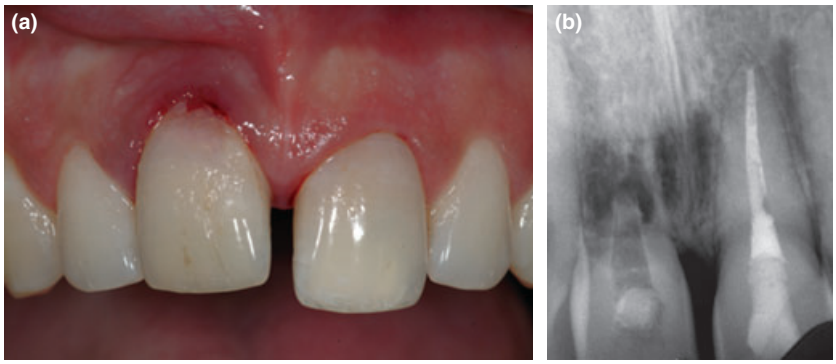

Fig. 1. (a, b) Complete root resorption of the central incisor (11): clinical and radiographic views.

Fig. 2. The mesial-distal space of the right central incisor is larger than that of the left central incisor.

regard to the median line and to reduce, as far as possible, the overjet to create the best conditions to achieve prosthetic rehabilitation (Fig. 3).

At the end of the orthodontic therapy, an implant (Prowital Dental Implants, Wiernsheim, Germany) was positioned in the area with a regenerative technique using Bio-Oss (Geistlich Biomaterials, Geistlich PharmaAG, Wolhusen, Germany), a collagen resorbable membrane (Bio-Guide, Geistlich Biomaterials) and a connective graft collected from the maxillary tuber (Fig. 4a,b) (10–12).

Fig. 3. Orthodontic movements used to reduce the overjet and create a symmetry of the mesial-distal space.

Six months after the implant positioning, during which the patient wore a removable provisional prosthesis, a second surgical operation was performed to place a healing abutment. Subsequently, soft tissues were conditioned with a provisional crown for 3 additional months.

The final impression was performed with the Aquasil Ultra Smart Wetting Impression Material (Dentsply International, York, PA, USA) and was converted into a digital image to create a zirconia veneer (Fig. 5a,b).

In line with the patient's request, the intercisal diastema was closed on the basis of a diagnostic wax-up of the mesial margin of the left central incisor (21).

A feldspathic ceramic veneer was realized without any dental preparation (Fig. 6a,b), as reported in literature (13, 14).

Once a rubber dam sheet had been positioned to isolate the tooth, the feldspathic ceramic veneer was cemented using a multistep conventional procedure with enamel etching using orthophosphoric acid gel at 37% (Caulk Tooth Conditioner Gel Syringe; Dentsply International) for 30 s, washing, air spray, subsequent bonding application (OptiBond FL, Kerr, Orange, CA, USA) and composite (Enamel Plus HRi; Micerium, Avegno-GE, Italy) with air block and final light polymerization for 3 min. The ceramic veneer was treated with 9.6% fluoridic acid (ENA ETCH, Micerium) for 3 min, washed using ultrasounds (1 min) and a final layer of silane (ENA ETCH porcelain primer; Micerium) was applied.

Once the ceramic veneer was cemented on the left incisor, the same procedure was repeated for the veneer cementation on the implant abutment (Fig. 7-a,b).

The advantage of a CAD-CAM ceramic veneer is a more successful management of the angle of the implant axis and the possibility to easily reproduce the ceramic product if necessary. In this case, for example, once the cementation was completed, it was evident that the incisal third was unsatisfactory (Fig. 8a,b).

The CAD-CAM virtual system memorizes the file to easily reproduce the abutment on which the new veneer can be created and then re-cemented (Fig. 9).

Long-term follow-up showed a good aesthetic result with respect to the soft tissues (Fig. 10).

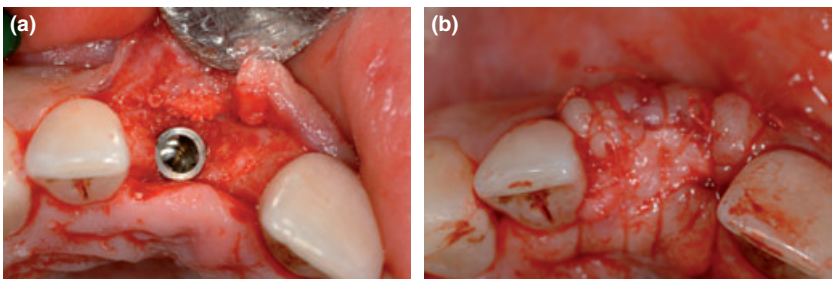

Fig. 4. (a, b) Dental implant with connective tissue graft.

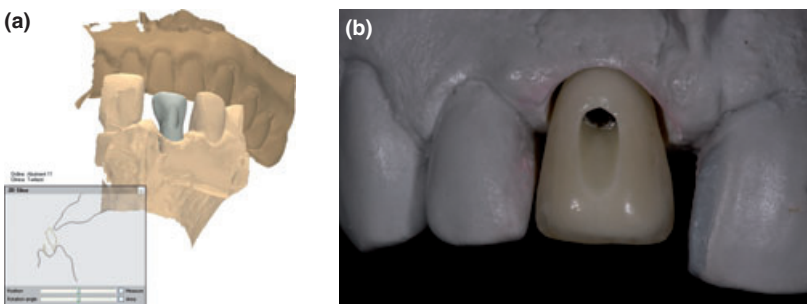

Fig. 5. (a, b) Virtual veneer and its realization.

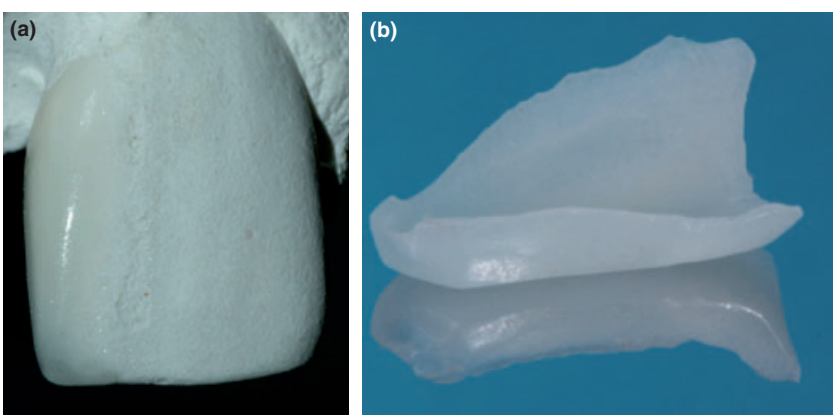

Fig. 6. (a, b) Feldspathic ceramic veneer.

Discussion

Avulsion is the most serious dental injury and may determine immediate or potential tooth loss as a consequence of root resorption. However, when possible, even a delayed replantation should be performed to maintain the crown of the traumatized tooth in place, thus preserving the space and partially the crest bone resorption (2, 3, 7, 15).

These recommendations are particularly important if the dental injury affects a young patient, where a definitive treatment should be delayed until after complete jaw growth.

As a consequence of childhood dental trauma, tooth infraclusion can also be observed. The younger the patient at the moment of the tooth replantation, the more evident this will be (4, 6).

Effective interdisciplinary teamwork is essential, especially in young patients with anterior tooth loss and incomplete jaw growth. Orthodontic treatment may be necessary to create the best conditions possible for a successful aesthetic result of the prosthetic rehabilitation. In addition, periodontic treatment may also be of great value if the orthodontic therapy has determined a reduction in the defect.

It is important to bear in mind that multidisciplinary and complex dental rehabilitation, as in the case described here, requires good patient compliance as well as access to the different phases of the treatment plan, which patients affected by dental injuries may not always have.

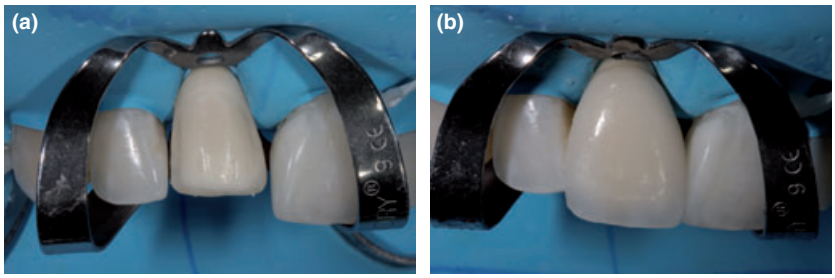

Fig. 7. (a, b) Isolation of the tooth with a rubber dam sheet and feldspathic ceramic veneer cementation on zirconia abutment.

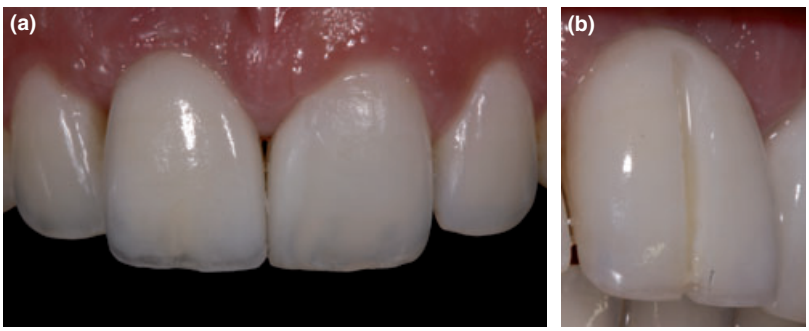

Fig. 8. (a, b) Incisal margin transparency of the restoration which appeared inadequate. The veneer was cut and removed.

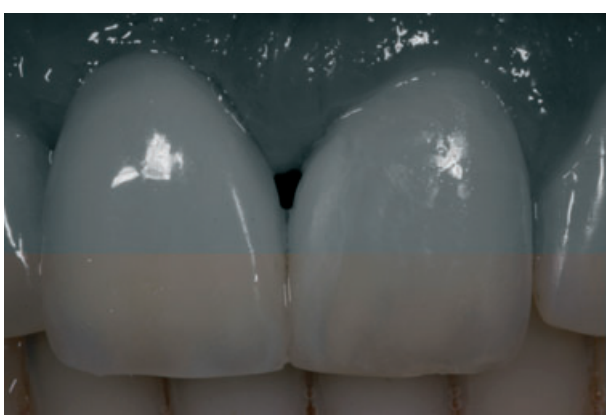

Fig. 9. The new ceramic veneer after cementation: note the successful chromatic integration of the incisal third.

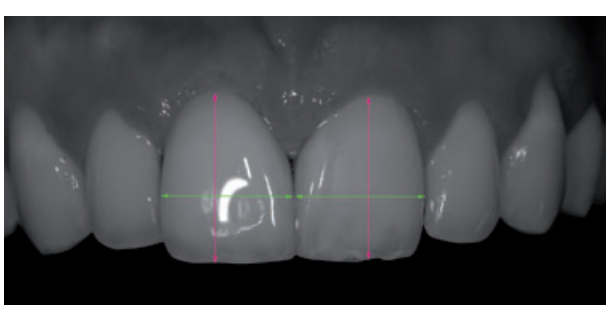

Fig. 10. Long-term follow-up: note the aesthetic result with respect to the tooth shape.

Finally, close collaboration with the dental technician ensures planning for the best prosthetic rehabilitation with particular regard to dental tissues, selecting, when possible, prosthetic treatment without teeth preparation.

The CAD-CAM technique represents a simplification of traditional procedures even if the ability of the dental technician remains fundamental for reproducing the chromatic characteristics of each prosthetic element. In particular, the rehabilitation of a single central incisor, perfectly harmonized with the other teeth and soft tissues, is still a real challenge for the entire dental team.

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