

Surgical approach to malformation of maxillary central incisor following trauma to its predecessor. Two case reports

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Summary

In the case reports, two different approaches have been described to treat the developmental disturbances in the maxillary central incisors due to trauma to its predecessor.

The treatment plan was chosen according to the type and severity of the malformations, the exact location and the morphology of the involved teeth.

In the first case, the disimpaction of the maxillary right central incisor was achieved with the combined of surgical and orthodontic therapy, that was planned in two consecutive stages.

In the second case the severe root angulation and the failure of the previous orthodontic traction made impossible the repositioning of the upper right central incisor, which was surgical removed.

Key words: tooth injuries, deciduous tooth, permanent dentition, tooth abnormalities, tooth unerupted, tooth extraction.

Introduction

The prevalence of developmental disturbances in upper central incisors due to trauma in the primary den-

tition ranges from 12 to 74% (1-5).

The most common cause of trauma is falls, and the highest incidence of injuries occurs before the age of 2 years, as psychomotor development and poor motor skill predispose children to fall (5-8). At this age there are no significant differences in the prevalence among boys and girls (6, 8, 9). The injuries of primary dentition followed by a higher incidence of developmental anomalies in the permanent dentition are avulsion and intrusive luxation (3-5, 7, 10-12).

These types of injury are related to the high resilience and flexibility of the primary teeth supporting structures, the large volume of teeth in relation to the bone and the short roots (1, 6).

The sequelae on the permanent teeth depends on the direction of the traumatic force, the type and the severity of trauma, the degree of primary root resorption and the developmental stage of the permanent tooth at the time of the injury, and mainly to the child's age (Tab. 1) (1, 4, 13). The child's age was reported to have a statistically significant association with the severity of the developmental sequelae in the permanent maxillary central incisors: lower the age greater the severity (4, 12).

This may be explained as the germ of the permanent maxillary central incisor in the early stages of development is localized palatally and above the apex of the deciduous predecessor (14). Between 3-5 years of age this tooth change its eruption pathway proceeding forward and downward and its crown becoming closer to the resorbing primary root (14). Furthermore in this area the presence of the connective tissue, that is not permeable to the displacement of the primary teeth, infection or necrosis explains the risk of developing disturbances in the succeeding permanent teeth after injuries to their predecessors (1, 14).

The purpose of the present report is to describe two cases of malformation of maxillary central incisor following traumatic injury in its predecessor, in which different approaches were adopted.

Case reports

I Case

A 7-year-old boy was referred to the "Sapienza" Rome University, Department of Oral and Maxillofacial Sciences, Oral Surgery Unit by his parents. The chief complaint was the eruption delay of the permanent maxillary right central incisor.

The past medical history was negative, except for traumatic injury to the premaxilla at 3-year-old age.

Table 1. Sequelae on the permanent teeth following trauma to primary teeth

Pathologic Alteration	Clinical Features	Age
<i>White or yellow-brown discoloration of enamel</i>	The affected enamel appears as a white or yellow-brown area, extent varying, sharply demarcated, without detectable defects in the enamel surface. The white colour was due to a lower mineral statement and the yellow-brown colour was due to a bleeding spread where the enamel is developing.	2-5 years
<i>White or yellow-brown discoloration of enamel with circular enamel hypoplasia</i>	Hypoplastic defects may be caused by a localized damage to the enamel matrix during the secretory phase of the ameloblasts, before the mineralization is completed. This malformation is characterized by a narrow horizontal groove around the crown in cervical position with respect to the areas with white or yellow-brown discoloration.	2 years
<i>Crown dilaceration</i>	Crown dilaceration is a deviation of the crown in relation to the long axis of the tooth as a consequence of the traumatic non-axial displacement between unmineralized and mineralized tissues of the developing tooth germ The curve can be located at the cervical portion, midway along the root or even just at the apex of the root. Half of these teeth become impacted, whereas the remaining half erupts normally either in facial or in lingual version.	1.5- 3.5 years
<i>Root duplication</i>	Root duplication is the result of a traumatic division of the cervical loop that develops two separate roots. Radiographically, it can be demonstrated a mesial and distal root, which extend from a partially formed crown. Histologically there is a calcium-traumatic line separating the hard tissue formed before the injury.	2-5 years
<i>Vestibular root angulation or dilaceration</i>	Vestibular root angulation is a marked curvature confined to the root, due to the gradual change in the direction of development. The malformed tooth is usually impacted and the crown palpable in the labial sulcus. This malformation is unique feature of the maxillary central incisors.	2-5 years
<i>Lateral root angulation or dilaceration</i>	Lateral root angulation or dilaceration are mesial or distal bending of the root of the tooth. The dilaceration is caused when the impact force is transferred along an imaginary oblique line that goes through the incisal edge of the permanent incisor and causes this crown to turn upwards into its tooth follicle. The permanent incisor root already formed wheels and it creates an unusual angle between the pre- and post-traumatic parts of the tooth.	2-5 years
<i>Partial or complete arrest of root formation</i>	Partial or complete arrest of root formation is a rare complication characterized by missing eruption or mobility, as a result from inadequate periodontal support. Normal root development can be compromised by direct injury to Hertwig's epithelial root sheath resulting in a calciotraumatic line separating the hard tissue deposited before and after the injury.	1-3 years
<i>Sequestration of permanent tooth germs</i>	This rare complication is characterized by swelling, suppuration and fistula formation. Radiographic examination discloses osteolytic changes around the tooth germ, including disappearance of the outline of the dental crypt and expanded cortical alveolar bone.	1-3 years
<i>Disturbance in eruption</i>	Disturbances in permanent tooth eruption include: impaction, ectopic eruption, delayed eruption, scar plate formation and ankylotic primary teeth. Impaction is very common in the cases in which there is crown or the root malformations. The ectopic eruption is related with the early loss of primary incisors due to lack of eruption guidance. The delayed eruption is related with the abnormal changes in the connective tissue after the early loss of primary incisors (avulsion or extraction).	1-3 years
<i>Odontoma-like malformation</i>	This malformation occurs during early stage of odontogenesis and affect the morphogenetic stages of ameloblastic development. The histologic analysis shows a conglomerate of hard tissue, having the morphology of a complex odontoma or separate tooth elements.	1-3 years

The panoramic radiograph showed in the right side of the maxillary jaw the presence of the deciduous incisors and the inclusion of the permanent central incisor with the crown underneath the anterior nasal spine and with its incisal edge upwards. In the left side the rotated permanent left central incisor and the lateral primary incisor were present (Fig. 1).

The computer tomography confirmed the position of the right central incisor across the premaxilla and showed its incomplete root formation, developing on the long axis of the crown (Fig. 2).

In agreement with the orthodontist, it was decided to try the surgical exposure and orthodontic traction of the affected tooth, before performing the orthodontic treatment for the correction of the malocclusion and the repositioning of the right central incisor into proper position.

In view of the incisor position, surgical exposure was planned in two stages.

In the first a full-thickness buccal flap was made under local anaesthesia to gain access to cortical plane of the maxilla, and the primary incisors were extracted (Fig. 3a). After bone removal, the crown was exposed and an orthodontic bracket with ligature wire was bonded onto the palatal surface of the maxillary right central incisor (Fig. 3b). The flap was repositioned and sutured. Two weeks later, orthodontic forces were applied to pull the crown in buccal and horizontal direction, in order to move away the incisor from the roots of the adjacent teeth.

The second surgical stage was performed when the crown was visible through the buccal mucosa (Fig. 4a). Using an apically repositioned flap, the crown was exposed and a bracket was bonded on its labial surface to change direction to orthodontic traction in order to straighten the tooth (Fig. 4b).

After 14 months the recovering of the maxillary right incisor was achieved and the orthodontic therapy was

started to correct the patient's malocclusion and to place the tooth into its proper position in the dental arch (Fig. 5).

// Case

A 12-year-old boy was referred to the "Sapienza" Rome University, Department of Oral and Maxillofacial Sciences, Oral Surgery Unit by his parents, complaining of the failure of surgical-orthodontic repositioning of the maxillary right central incisor lasted three years. The child was healthy and his medical history did not reveal any important information. The parents reported that the patient at the age of 22 months underwent intrusion of central primary incisor, spontaneously re-erupted after 3 weeks.

The intraoral examination revealed the permanent right central incisor missing, the partial loss of its space due to the migration of the adjacent teeth and the crown of the maxillary right lateral incisor affected by white or yellow-brown discoloration of enamel and circular enamel hypoplasia (Fig. 6).

In periapical radiograph, the crown of the maxillary right central incisor appeared with its incisal edge upwards underneath the anterior nasal spine (Fig. 7).

The cross-sectional images of the computer tomography confirmed the buccal angulation with a severe curvature, already suspected in the conventional radiograph and provided valuable information about the morphology of the root (Fig. 8).

In this case the severe root angulation and the failure of the previous orthodontic traction made impossible the central incisor repositioning, therefore its surgical removal was preferred.

A full-thickness buccal flap was reflected, the osteotomy was carried out on the labial cortical plane to expose the crown completely, and the impacted tooth was easily removed (Fig. 9a, b). The debridement of the scars following to the previous intervention of the

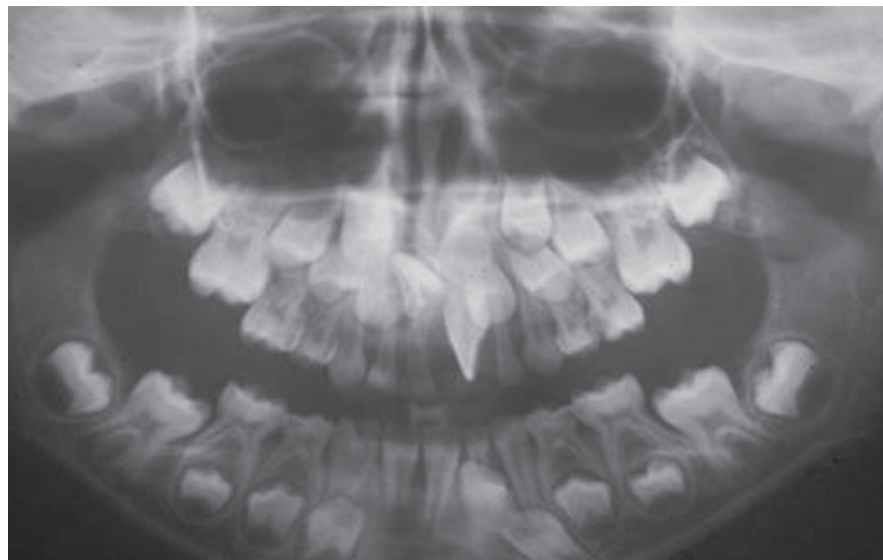


Figure 1. Panoramic radiograph showing in the right side of the maxilla the deciduous incisors and the inclusion of the permanent central incisor and in the left side the rotated permanent left central incisor and the lateral primary incisor.

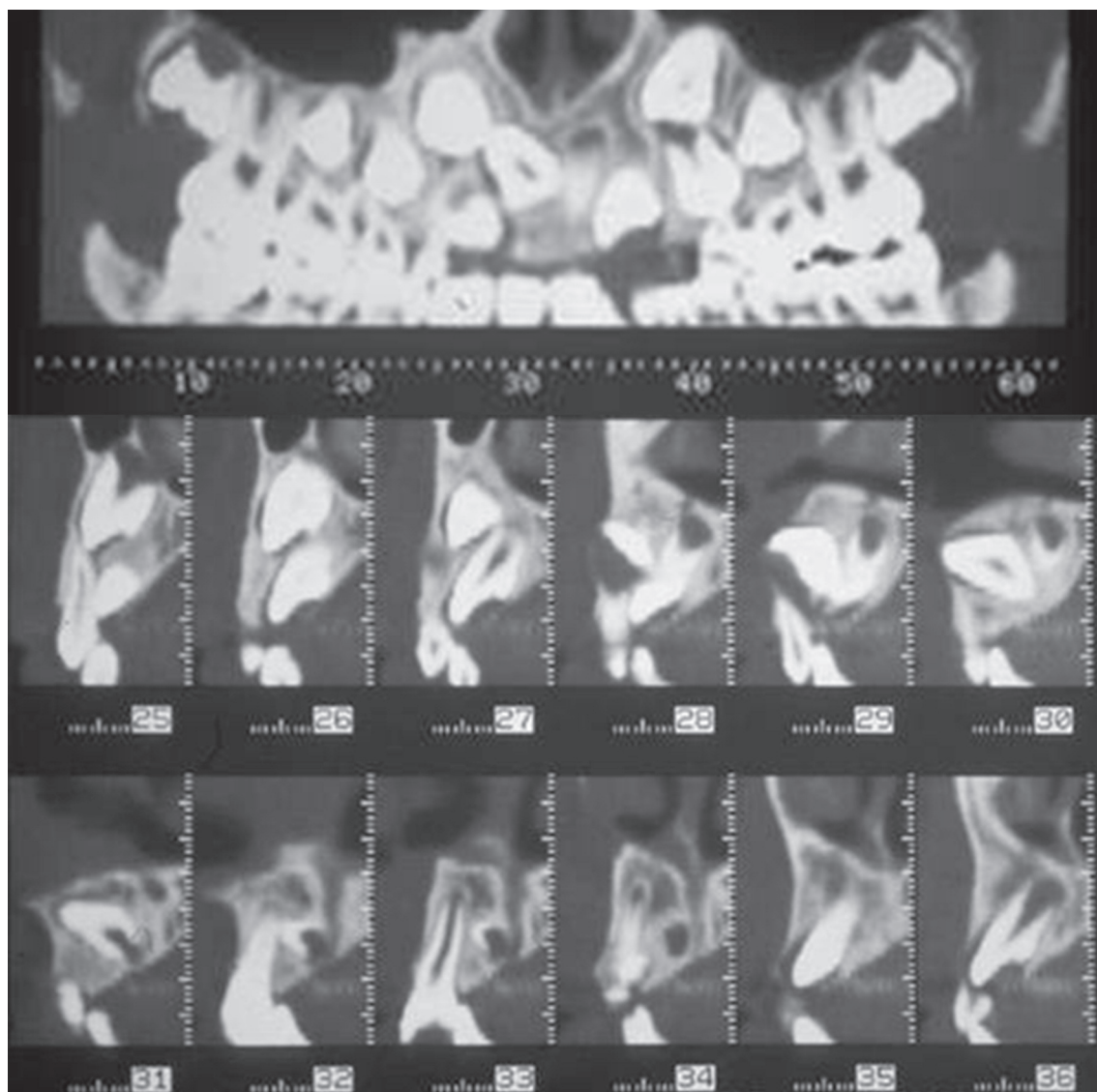


Figure 2. Computer tomography showing the position of the right central incisor across the premaxilla and its incomplete root formation.

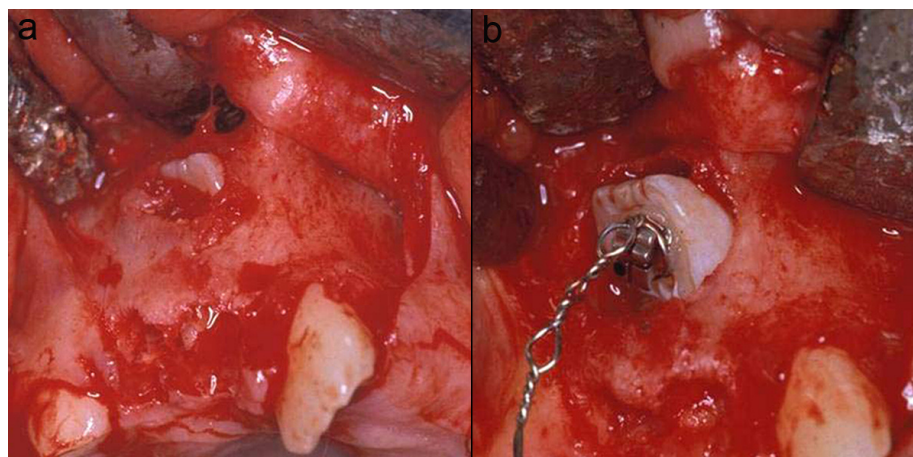


Figure 3a, b. The first stage of the surgical exposure of the maxillary right central incisor: a) a full-thickness buccal flap and the extraction of the primary incisors were carried-out; b) the crown was exposed and an orthodontic bracket was bonded onto its palatal surface.

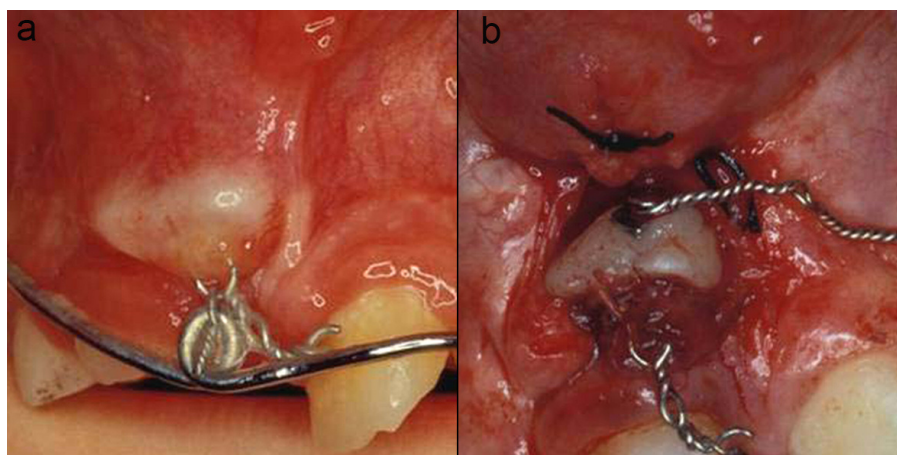


Figure 4a, b. The second surgical stage: a) the crown was visible through the buccal mucosa; b) the crown was exposed using an apically repositioned flap and a bracket was bonded on its labial surface.



Figure 5. The recovering of the maxillary right central incisor.

crown exposure was performed and the site, covered by periodontal dressing, was left healing by secondary intention (Fig. 9c, d).

Discussion

Developmental disturbances of permanent incisors following trauma to the primary dentition have a physical, aesthetic and psychological impact both for children and their parents.

In these cases, the choice of the appropriate treatment modalities is very important and depends on the type of lesion, the exact location and the morphology of the involved teeth.

Although panoramic or periapical radiographs are conventionally used for preoperative examination, more accurate information are achieved with computer tomography, because this method produces three-dimensional images without enlargement or superimposition of anatomical structures (13).

In fact to allow a correct diagnosis it is mandatory to determine the exact position of the involved teeth, their morphology and degree of root formation, the re-



Figure 6. The intraoral examination: the permanent right central incisor missing, the partial loss of its space due to the migration of the adjacent teeth and the crown of the maxillary right lateral incisor affected by white or yellow-brown discoloration of enamel and circular enamel hypoplasia.

lationship between deciduous teeth and the permanent successors.

The combined surgical and orthodontic therapy is the method of choice for many clinicians. The success rate of this treatment depends on the degree of malformation, position and root formation of the tooth. Studies have also shown that the bone loss after orthodontic treatment and the chance of injury to the tooth during traction is directly connected to the quantity of bone removed during surgical exposure. However with the combined surgical/orthodontic therapy, ankylosis, pulp necrosis, root resorption, gingival recession, delay in periodontal healing, bone loss and decrease in the width of keratinized gingiva may occur (14).



Figure 7. Periapical radiograph showing the crown of the maxillary right central incisor with its incisal edge upwards underneath the anterior nasal spine.

When surgical exposure and orthodontic traction fail or they are undesirable or impossible, such as in the case of odontoma like-malformation, the only option is the surgical tooth extraction as soon as possible. However, if the location is deep in the maxillary bone, without any eruption disturbance of the adjacent teeth, it is possible to decide to not remove the malformed tooth, but clinical follow-ups and periodic radiographs to rule out any pathologic development are necessary (15). This kind of non-treatment has the advantage of not exposing the patient to extensive surgery under general anesthesia, but it requires recall examinations over time and annual repetitive radiation exposure (15).

Conclusion

Determining prognosis and treatment planning for a retained tooth are often difficult tasks. Two different treatments approaches to manage a traumatized permanent tooth need to be considered: surgical exposure with orthodontic traction vs extraction and prosthetic replacement with fixed bridge or implant placement later when growth had ceased.

An appropriate diagnosis with both clinical and radiographic examination is needed for the choice and the success of the treatment plan.

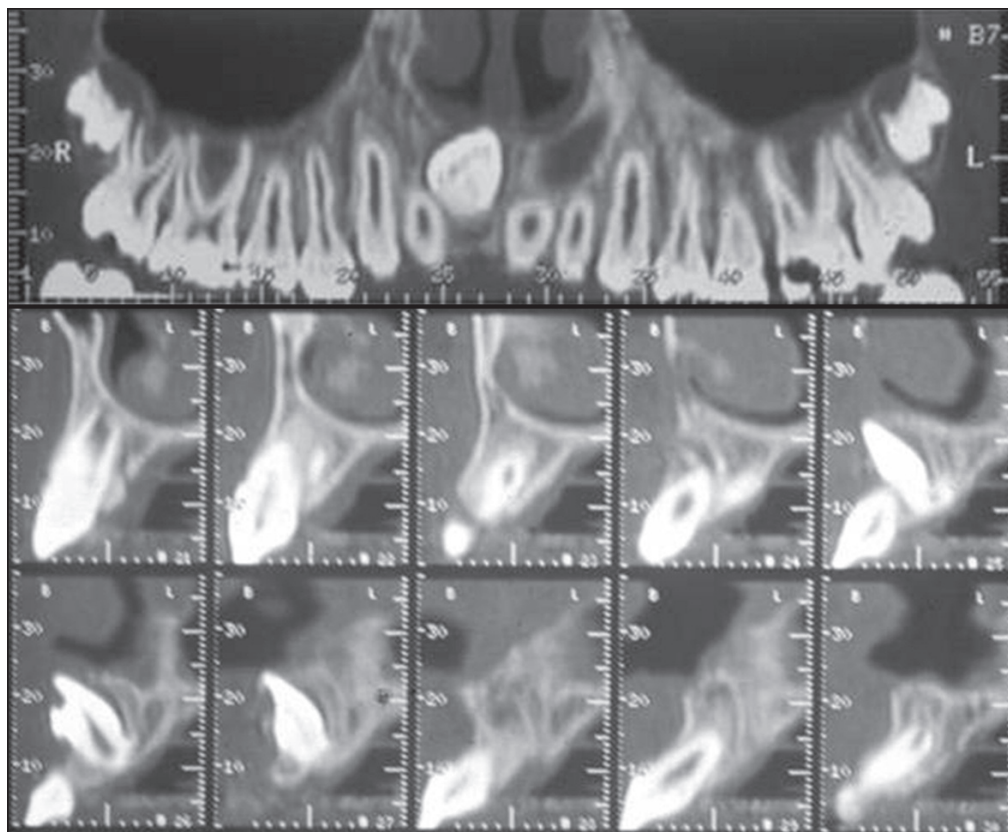


Figure 8. Computer tomography showing the permanent right central incisor with a marked buccal curvature of its root.

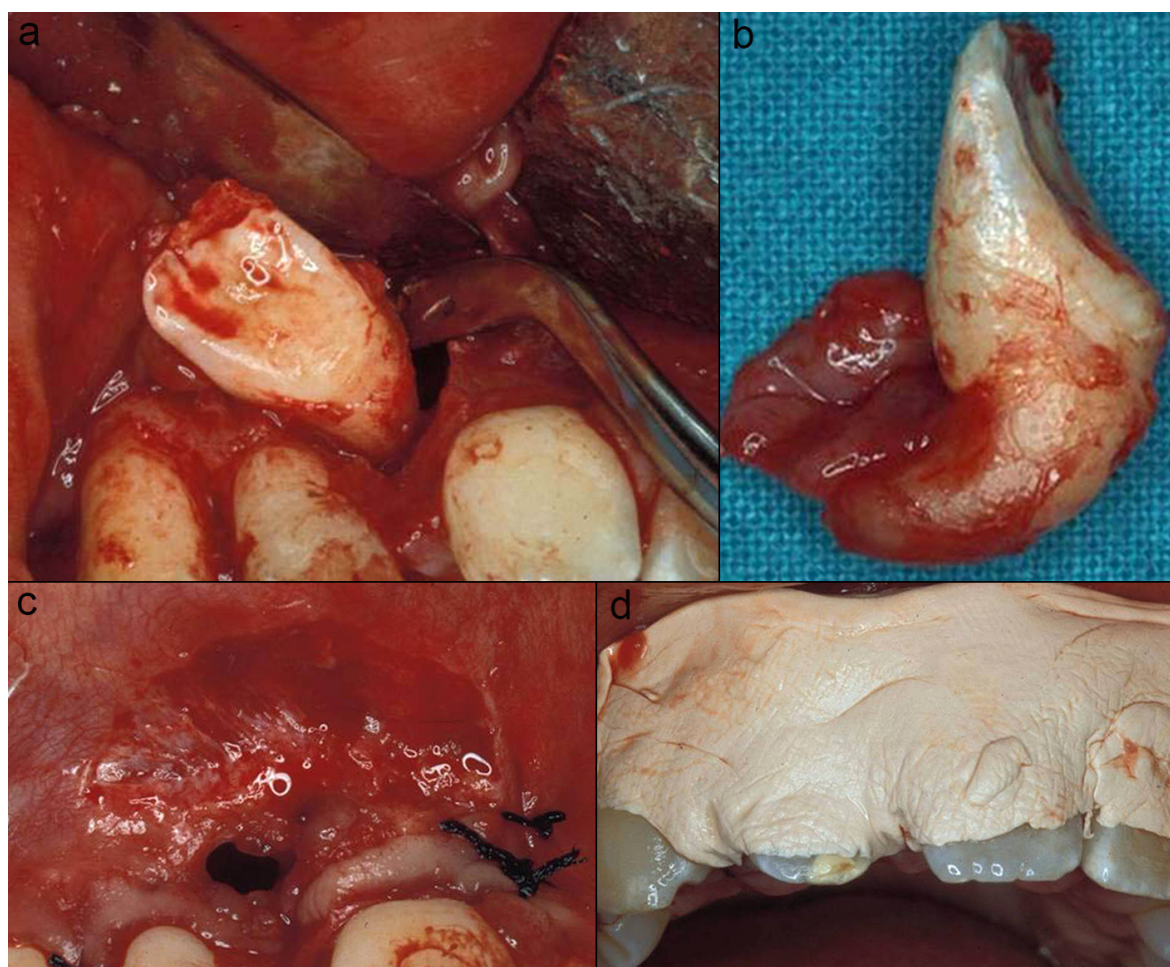


Figure 9a-d. Surgical intervention: a) extraction of the maxillary right central incisor; b) clinical view of the extracted tooth; c) debridement of the scars following to the previous intervention of the crown exposure; d) periodontal dressing.

The sequelae to the permanent dentition after trauma to the primary dentition may require a multidisciplinary approach involving Pediatric Dentist, Orthodontist, Periodontist, Oral Surgeon and Prosthodontist.

Conflict of interest and source of funding statement

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

Authors declarations

All Authors gave final approval and agree to be accountable for all aspects of the work.

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