CASE REPORT

Multidisciplinary Treatment of an Avulsed Central Incisor

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This article shows a failed attempt at central incisor reimplantation after trauma-induced avulsion. The case emphasizes how the likelihood of successful recovery from dento-alveolar trauma can be reduced by inappropriate treatment decisions.

Diagnosis

A 16-year-old female presented with the chief concern of esthetic deficiency caused by a missing tooth (Fig. 1A). She had lost her maxillary right central incisor in a cycling accident nine years previously. The tooth, which had been avulsed during the accident, was reimplanted and subjected to endodontic therapy several days later, but was lost again in a second traumatic avulsion after a few months. The patient was not treated for trauma at that time and had not undergone further dental examination or treatment of the incisal area before initial consultation at our clinic.

Intraoral examination revealed, in addition to the absent tooth, a full Class II malocclusion on the right and partial Class II malocclusion on the left. Even light pressure on the apical zone at the site of the missing tooth caused severe pain. X-rays showed a well-delineated zone of radiopacity in this area, indicating the presence of a foreign body (Fig. 1B).

Treatment Plan

The treatment plan, formulated in cooperation with a periodontal specialist, involved initial orthodontic movement to achieve Class I canine and molar relationships and to open the space between the maxillary left central


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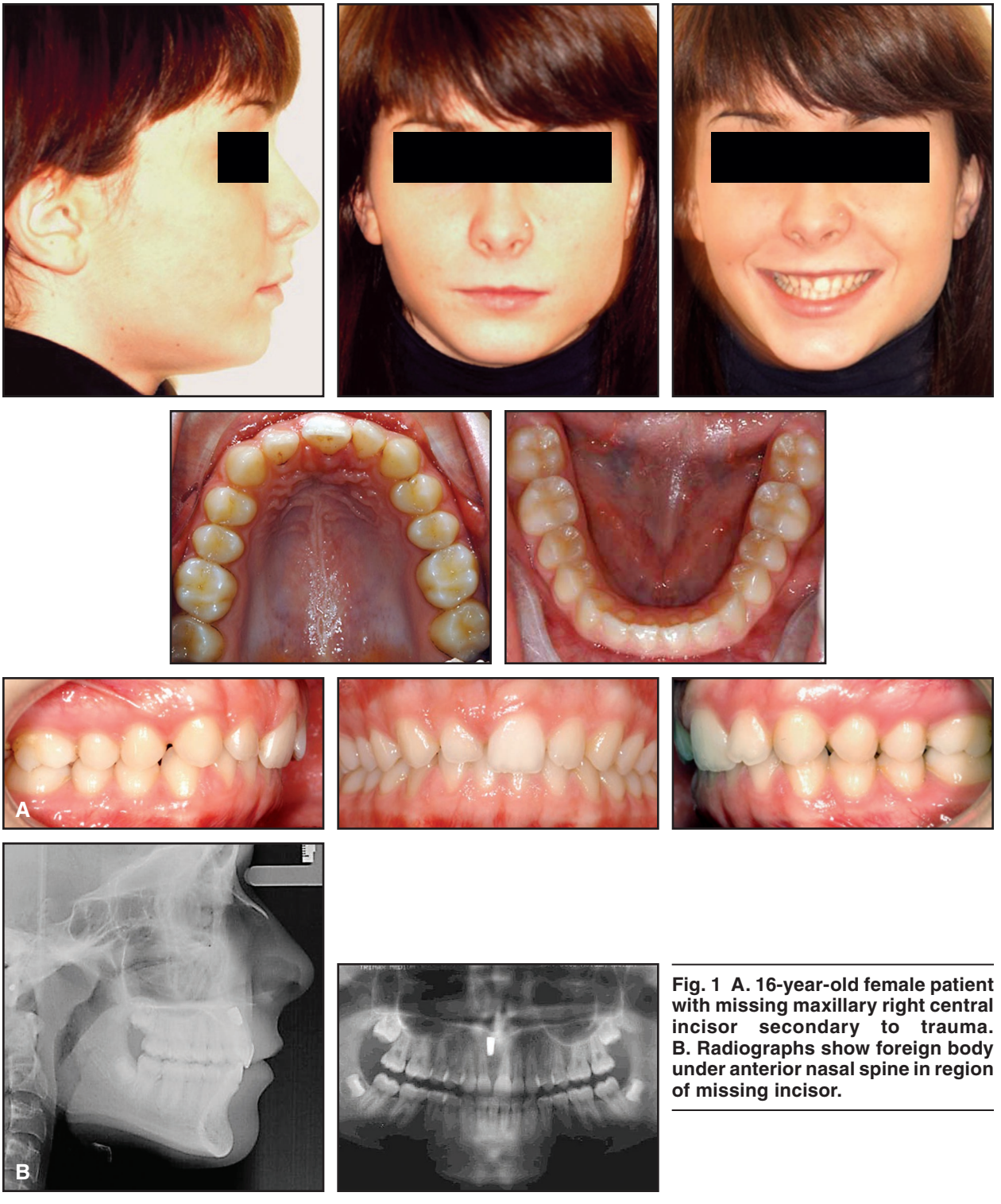


Fig. 1 A. 16-year-old female patient with missing maxillary right central incisor secondary to trauma. B. Radiographs show foreign body under anterior nasal spine in region of missing incisor.

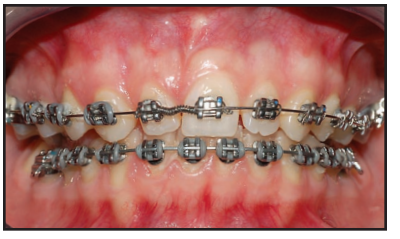
and right lateral incisors. Considering the reduced transverse diameter of the alveolar crest at the right central incisor site, we also planned to remove the foreign body and surgically reconstruct the alveolar crest to restore sufficient space for functional and esthetic prosthodontic rehabilitation of the maxillary right central incisor with an osseointegrated implant and ceramic crown.

Treatment Progress

Because the position and shape of the maxillary third molars were satisfactory, we decided to extract the maxillary second molars and distalize the maxillary first molars with a Distal Jet to achieve a Class I occlusion (Fig. 2). After 20 weeks of distalization, a Class I molar relationship had been obtained on both sides. We then placed a transpalatal bar to stabilize the molar positions and bonded MBT* preadjusted brackets in both arches to refine the molar and canine relationships (Fig. 3). Space for the prosthetic maxillary right central incisor was opened with an open-coil nickel titanium spring on a round stainless steel archwire for minimal friction. Another 32 weeks later, a space equivalent to the mesiodistal thickness of the existing left central incisor had been opened (Fig. 4).

Before surgical reconstruction of the alveolar crest, digital volume tomography** of the

Fig. 2 Distal Jet placed to achieve super-Class I molar occlusion.



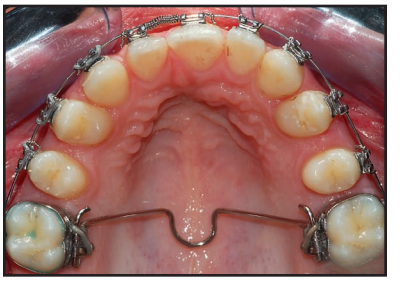


Fig. 3 After 20 weeks of distalization, transpalatal bar inserted and preadjusted appliance bonded, with coil spring used to open anterior space.

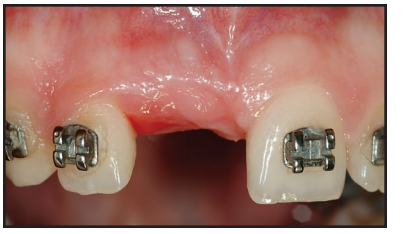
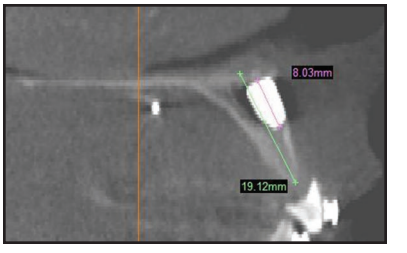


Fig. 4 Another 32 weeks later, adequate space opened to accommodate prosthetic right central incisor.



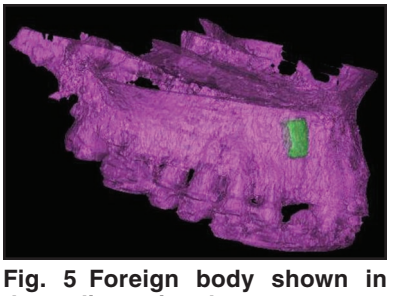


Fig. 5 Foreign body shown in three-dimensional computer rendering of maxilla.

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**NewTom 3G, QR S.r.l., Verona, Italy.

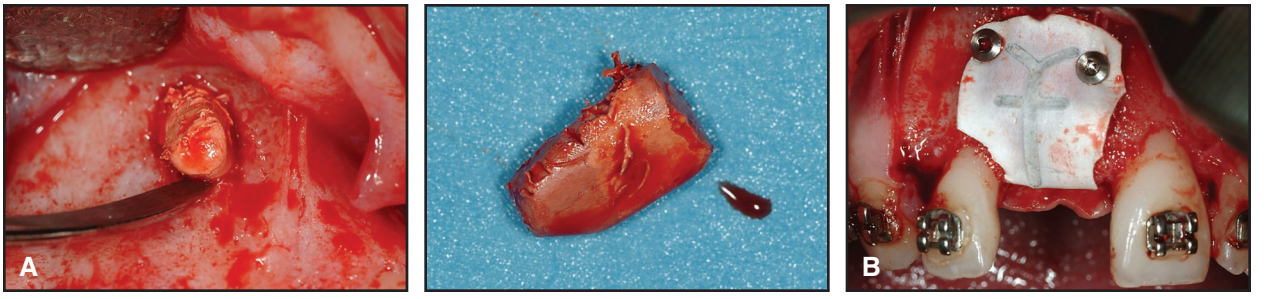

Fig. 6 A. Surgical removal of gutta-percha remnant. B. Titanium-reinforced nonresorbable membrane covering graft and fixed in place by titanium miniscrews.

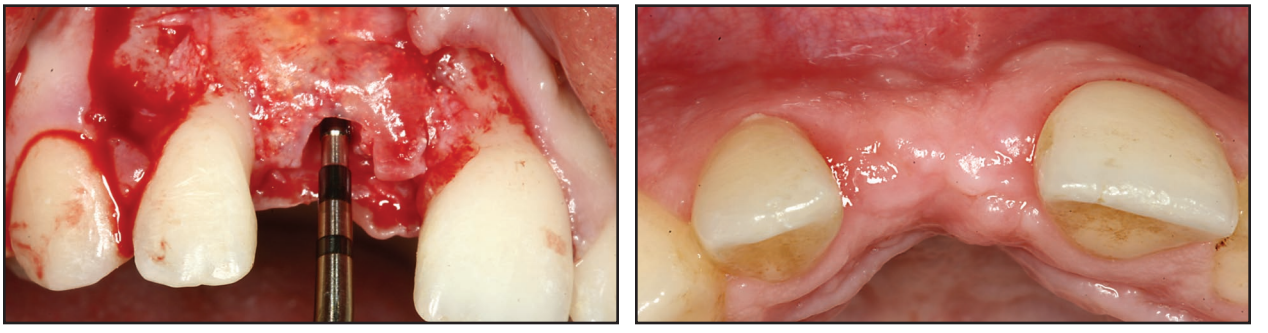

Fig. 7 Six months after surgery, regenerative intervention had failed to produce desired results, with no volumetric improvement in bone crest.

upper arch was performed. The scan revealed a radiopaque area 4.67mm wide and 8.03mm high, shaped like a truncated cone with its base oriented toward the nasal floor (Fig. 5). The well-defined shape and dimensions of the foreign body led us to conclude that it was a mass of gutta-percha that had been used to seal the endodontium of the traumatized incisor after the initial accident. Around this radiopaque zone was an area of radiotransparency, indicating cortical bone resorption on both the buccal and palatal sides.

The gutta-percha residue was surgically removed by lifting a total-thickness, trapezoidal access flap on the buccal side, without osteotomy (Fig. 6A). During the same procedure, the bed for osseous reconstructive surgery was prepared by opening the endosteal cavities. To increase the transverse diameter of the alveolar crest, we used a bone scraper*** to position an autologous intraoral cortical bone graft acquired from the left external oblique line, incorporating a hydroxyapatite biomaterial.† We used a titanium-reinforced nonresorbable membrane‡ to cover the graft and fixed it in place with titanium miniscrews (Fig. 6B). The flap was closed with internal mattress sutures and simple sutures of a delayed-resorption material.††† No local complications or adverse effects occurred during healing.

Six months later, examination showed that the transverse diameters of the bone crest were only 4mm at the coronal third and 5mm at the medial third (Fig. 7).

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Fig. 8 Patient after placement of Maryland bridge.

This narrow transverse crestal diameter, along with the proximity of the nasopalatine canal to the potential implant site, precluded the placement of an osseointegrated implant. The maxillary right central incisor was therefore rehabilitated by means of a Maryland bridge, with auxiliary retention on the maxillary left central and right lateral incisors. The volume of soft tissues at this site, together with the graft, ensured the esthetic success of the prosthesis (Fig. 8).

Discussion

When a totally avulsed tooth is repositioned in its alveolus, there are three possible reactions of the periodontal ligament: healing and restoration, healing with progressive or temporary ankylosis, or inflammatory resorption.[1] The success of the repositioning is generally determined by the elapsed time and how the tooth is conserved before reimplantation.[2-4]

In the patient shown here, the presence of the gutta-percha mass at the incisor site and subsequent root resorption impeded bone replacement; in fact, we discovered a severe osseous deficiency upon surgical removal of the mass. To further complicate the situation, the inflammation provoked by the gutta-percha had caused a loss of surrounding buccal bone. Because the bone thickness was entirely inadequate to provide primary stability for an osseointegrated implant, the implantation surgery had to be delayed until after total osseous coverage could be obtained.[5] Initial radiographic examination of the edentulous site had revealed a collapse of the alveolar crest on the palatal side due to prior trauma. Considering the proximity of the nasopalatine canal, the buccal aspect was selected, rather than the palatal, for osseous reconstructive surgery. We performed a combined reconstructive technique using a nonresorbable titanium-reinforced membrane with hydroxyapatite-based bone substitute.[6-8]

Six months after surgery, radiographic examination showed the buccolingual dimension of the bone crest to be only 5mm. The limited bone gain likely reflects the genetically determined bone contours of the buccal alveolar crest, since the buccal cortical plates of the two maxillary central incisors were actually aligned on the sagittal plane at this visit. The bone volume at the site should have allowed placement of a 3.5mm-wide implant. Since partial resorption of newly formed bone has been reported after ridge augmentation,[6] however, even minimal resorption of the alveolar crest would have exposed the implant fixture and compromised the esthetic result. We therefore believed a Maryland bridge to be the best option to replace the avulsed central incisor.

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