D. Celli, A. L. Greco, S. Sferra, R. Deli

Catholic University of Sacred Heart, Rome, Italy

e-mail: simonesferra@hotmail.it

Management of impacted dilacerated maxillary incisor with strategic positioning of a straightwire appliance

ABSTRACT

Aim *To describe the orthodontic management of root dilaceration of an impacted maxillary tooth following trauma to its deciduous predecessors, to show the clinical management of root dilaceration of a maxillary central incisor and describe how the dilacerated tooth was successfully moved into alignment in a young patient with a proper multidisciplinary approach, using the simple and effective straightwire technique.*

Case report *After surgical exposure and orthodontic traction, the impacted dilacerated tooth was brought to alignment in the arch. The patient's chewing and speech function, and aesthetics were restored. The radiograph shows that the root is finally straight and relatively well developed. This approach avoids extraction and prosthetic rehabilitation of the dilacerated tooth.*

Keywords *Dilacerated teeth; Straightwire appliance; Impacted maxillary central incisor.*

Introduction

Andreasen et al. [1971] defined dilaceration as the abrupt deviation of the long axis of the crown or root portion of the tooth, which is due to a traumatic non-axial displacement of already formed hard tissue in relation to the developing soft tissue [Andreasen et al., 1971].

The knowledge regarding how, where and when the traumatic injury has occurred is very important in order to make a precise diagnosis during the emergency visit, and to adopt the correct and most efficient clinical procedure [Ribeiro and Campos, 2009].

The aetiology of dilaceration is not fully understood. There are two main explanations of its causes: an acute mechanical injury to the primary predecessor tooth, which causes dilaceration of the underlying developing succedaneous permanent tooth; idiopathic developmental disturbances as the cause of dilacerations, mainly in cases where there is no clear sign or history of traumatic injury [Topouzelis et al., 2010; Smith and Winter, 1981; Jafarzadeb and Abbott, 2007; Stewart, 1978].

The treatment of a dilacerated anterior tooth includes surgical exposure followed by orthodontic traction; endodontic treatment or apicectomy may be associated [Lin, 1999]. Alternatively, treatment often involves surgical removal followed by orthodontic therapy to either close the space or keep it open until the patient reaches an age when implants or prosthetic treatment can be performed.

This article presents a patient with a dilacerated maxillary right central incisor managed with a multidisciplinary approach. The dilacerated tooth was disimpacted and aligned using a simple and effective method by strategic positioning of a straightwire appliance.

Case report

Diagnosis and treatment plan

A 9-year-old Caucasian girl was referred by her general dentist to our examination. The chief concern was the non-eruption of the maxillary right central incisor. His parents mentioned a traumatic injury affecting the frontal oral region when the child was 5 years old.

Clinical examination revealed that the patient had a symmetric face and brachyfacial type.

Intraoral examination showed an early mixed dentition and an Angle Class I molar and canine relationship. The impaction of the maxillary right central incisor had resulted in drifting of the adjacent teeth with a resultant midline deviation (Fig. 1). A metal chain showed through the gingival tissues of tooth 1.1 area because her general dentist had performed a surgical exposure and applied a traction chain. We performed an occlusal radiograph that showed a bracket bonded to the palatal surface of the impacted tooth (Fig. 2).

Palpation of the vestibular mucosa indicated a bulge in the upper anterior area where the dilacerated incisor was probably located. Cephalometric, panoramic and occlusal radiographs revealed that the permanent maxillary right central incisor was impacted and displayed root dilaceration. Its apical foramen appeared as a circular radiopaque area with a dark radiolucent spot in the center, known as the 'Bull's eye'. The tooth's morphology and position were clearly visible in the lateral cephalometric radiograph showing a horizontally displaced tooth, with its crown rotated more than 100° from normal, and its

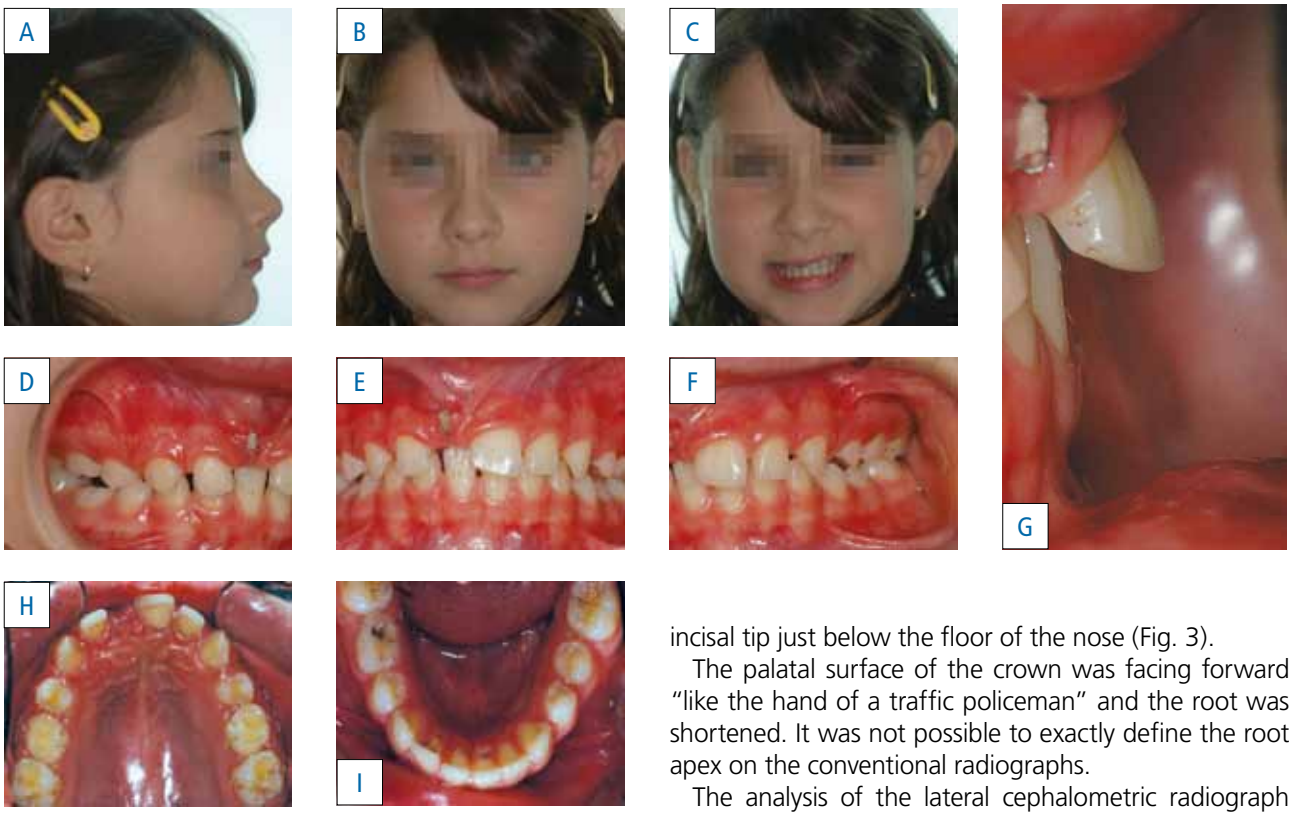


FIG. 1 (A-I) Pre-treatment extraoral and intraoral photographs.

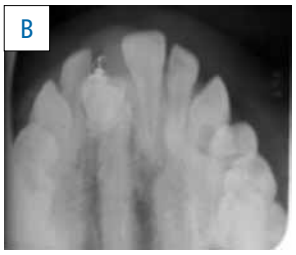
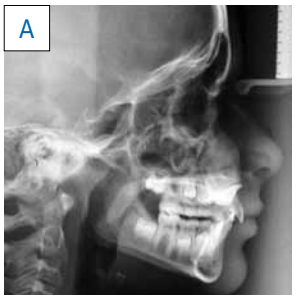


FIG. 2 (A-B) Pre-treatment panoramic and maxillary occlusal radiographs.



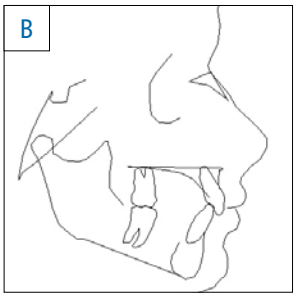


FIG. 3 A Pre-treatment cephalogram showing the dilacerated maxillary incisor; B cephalometric tracing.

incisal tip just below the floor of the nose (Fig. 3).

The palatal surface of the crown was facing forward "like the hand of a traffic policeman" and the root was shortened. It was not possible to exactly define the root apex on the conventional radiographs.

The analysis of the lateral cephalometric radiograph disclosed a skeletal Class II occlusion with a balanced facial pattern (Table 1).

The aim of the treatment was to guide the impacted incisor into proper alignment with the adjacent incisor teeth and to re-create a complete anterior dentition. The treatment aimed at obtaining proper crown and root alignment without further root damage while maintaining the vitality and integrity of the root of the dilacerated tooth. The purpose of the treatment was, also, to extrude the tooth with all its supporting tissues (alveolar bone and attached gingiva) and to evaluate the long-term gingival and periodontal conditions.

	Pre-treatment	Post-treatment
SNA	81	82
SNB	76,5	78
ANB	5,5	4
Wits appraisal	2	0
SN/Go-Gn	34	37
FMA	26	28
SN /ANS-PNS	8	14
ANS-PNS / Go-Gn	22	23
+1 / ANS-PNS	112	118
IMPA	102	96
-1 / A-Pg	2	2
+1 / A-Pg	8	4
OVJ	5	2
OVB	4	2

TAB. 1 Cephalometric data.

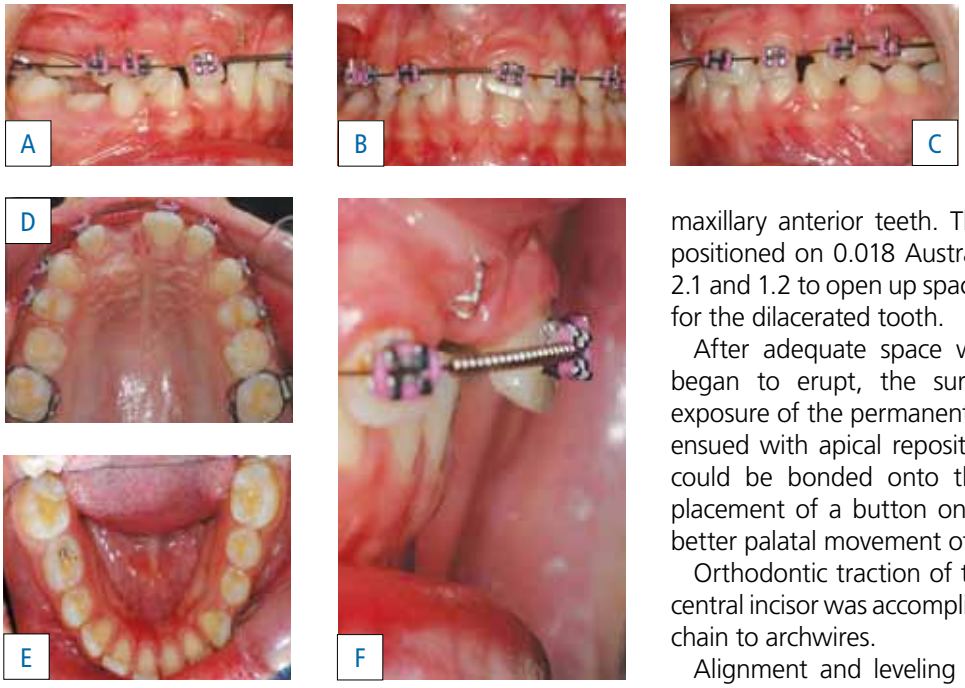


FIG. 4 (A-F) Intraoral view before surgery.

The approach was multidisciplinary involving a combined surgical/orthodontic treatment.

Treatment progress

A STEP (Leone®, Florence, Italy) straightwire appliance was placed on the maxillary permanent teeth to create space for the impacted central incisor (Fig. 4).

Prefabricated Ni-Ti, round section, 0.014 and 0.016-inch arch wires were used to align and to level the maxillary anterior teeth. Then an open-coil spring was positioned on 0.018 Australian archwire between teeth 2.1 and 1.2 to open up space in the arch to full availability for the dilacerated tooth.

After adequate space was obtained and the tooth began to erupt, the surgery was planned. Surgical exposure of the permanent maxillary right central incisor ensued with apical repositioning flap, so that a button could be bonded onto the labial tooth surface. The placement of a button on the labial surface allows for better palatal movement of the crown (Fig. 5).

Orthodontic traction of the permanent maxillary right central incisor was accomplished by attaching the traction chain to archwires.

Alignment and leveling was then continued using a 0.020 Australian archwire with a vertical occlusal step with an eyelet on extrusion axis. Traction was activated changing the elastic cotton thread every 2 weeks until the crown of the permanent maxillary right central incisor appeared properly oriented in the oral cavity. The traction force was about 40 g. This treatment stage lasted 6 months (Fig. 6).

Next, the button was removed from the labial surface of the permanent maxillary right central incisor and a bracket was bonded. Prefabricated round section Ni–Ti archwires with 0.014 and 0.016 inches were used again, in sequence, on the upper teeth.

In the same time a straightwire appliance was placed on the mandibular permanent teeth.

After that, Australian 0.018 and 0.020 inch archwire were used for the total alignment of the permanent maxillary right central incisor.

The right central incisor was brought closer to alignment, so an orthodontic bracket was bonded upside down on the labial surface to initiate labial root torque using a 0.019 x 0.025 Ni-Ti archwire. The strategic

FIG. 5 (A-B) Surgical exposure of the impacted tooth.

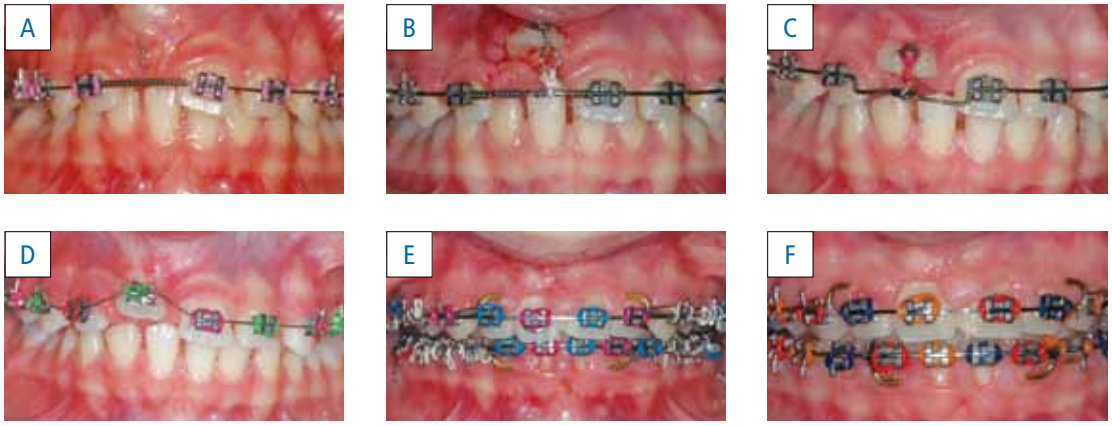


FIG. 6 (A-F) Progress of the orthodontic traction.

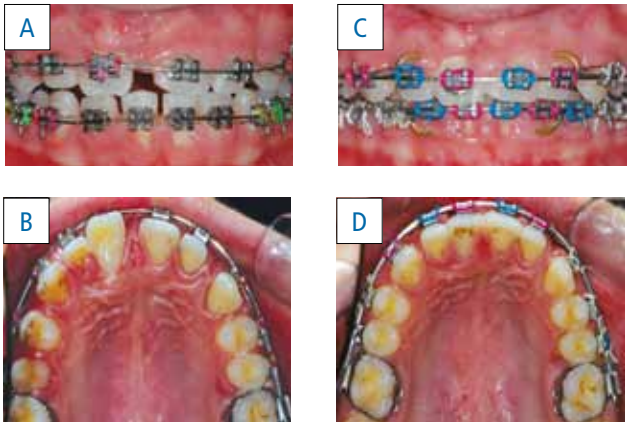


FIG. 7 (A-D) Strategic positioning of the bracket bonded upside down.

positioning of the bracket allowed a better position of the tooth root and harmonic gingival margin of the two central incisors (Fig. 7).

Treatment continued with a 0.019 x 0.025-inch SS wire with tie-back. After about 3 months the bracket on the 1.1 was repositioned normally. The finishing stage was performed by 0.018 Australian archwire.

Treatment results

After 26 months of treatment the brackets were removed and permanent retention was bonded to the lingual surface of the lower anterior teeth. At the end of the treatment, the free and attached gingiva of the dilacerated tooth appeared acceptable (Fig. 8). The dilacerated impacted teeth was properly aligned in the dental arch restoring the masticatory, phonatory functions and patient's aesthetics. The root appears radiographically aligned and not severely compromised (Fig. 9-11). The patient was referred to the conservative dentist for restoration of the incisal margin. The one-year follow-up showed a good maintenance of the result. Aesthetic periodontal surgery and a prosthetic treatment might be recommended in adulthood (Fig. 12).

Discussion

Most studies of dilaceration have concerned the

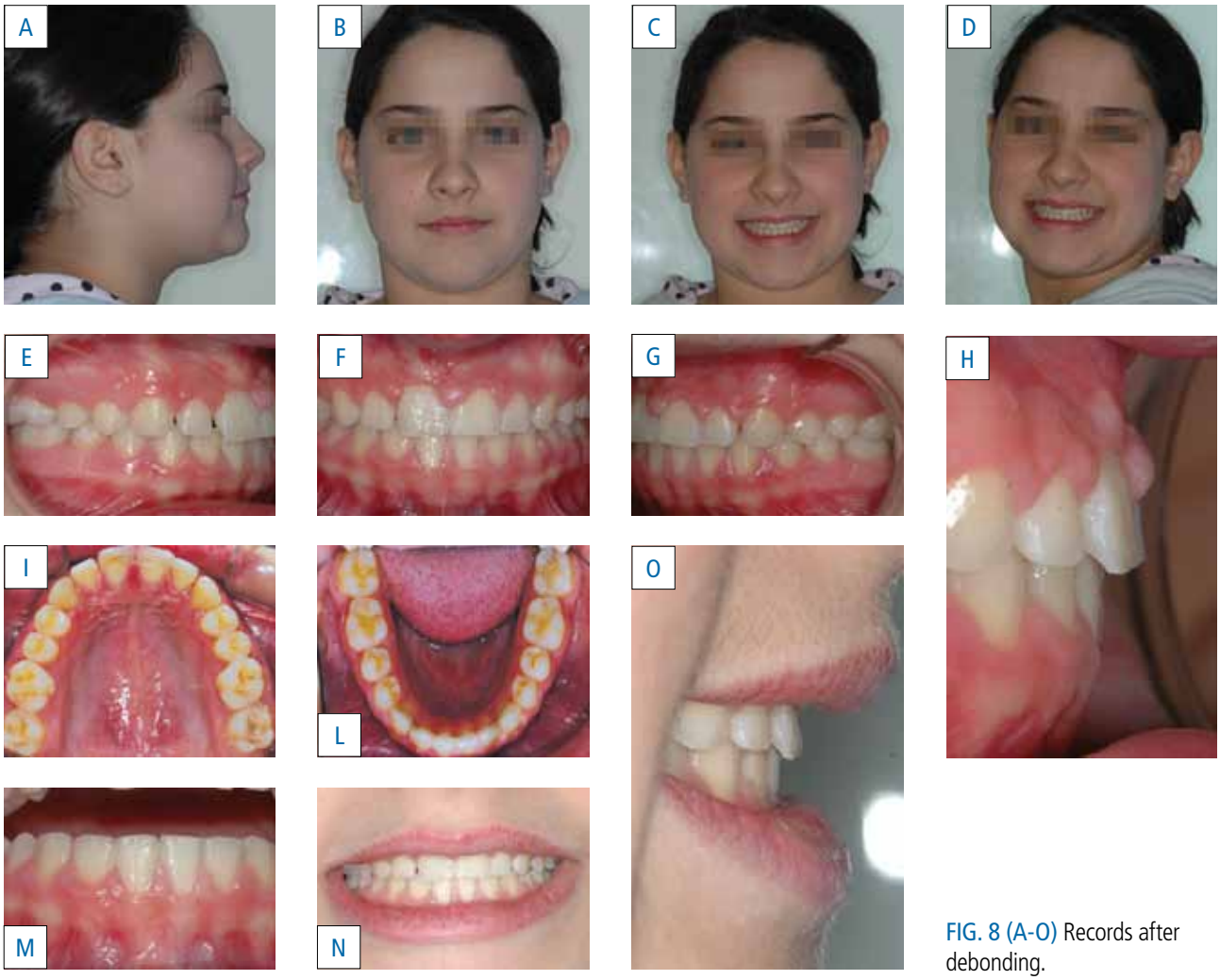


FIG. 8 (A-O) Records after debonding.

FIG. 9 Post-treatment panoramic radiograph showing no signs of root resorption of the aligned left central incisor.

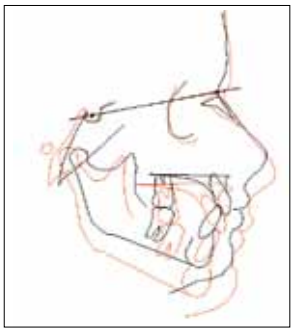


FIG. 11 Superimpositions of the lateral cephalograms showing the dental and skeletal changes during orthodontic treatment: superimposition on the anterior cranial base (S-N).

maxillary central incisors, as was the case in the present study. McNamara et al. [1998] successfully aligned dilacerated maxillary central incisors planning a therapy that encompassed endodontic treatment and apicoectomy.

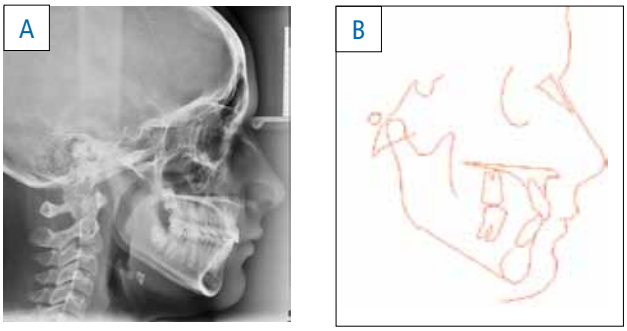


FIG. 10 A Post-treatment cephalogram proving that penetration of the cortical bone from the dilacerated root apex was avoided; B cephalometric tracing.

Dilacerated impacted teeth can be properly aligned in the dental arch by appropriate treatment, which frequently requires cooperation among orthodontists, periodontists, paedodontists, endodontists, and/or prosthodontists. In the present study, no endodontic treatment or apicoectomy was needed during or after treatment, as has sometimes been required in similar cases.

A dilacerated tooth is said to be more resistant to extrusion than a tooth with a normal root, making the apical area more prone to resorption. However, in our patient, no severe root resorption could be detected, suggesting that, in the case of dilaceration, root resorption can hardly be predicted. Radiographic checkups during orthodontic traction are advisable [Cozza et al., 2005].

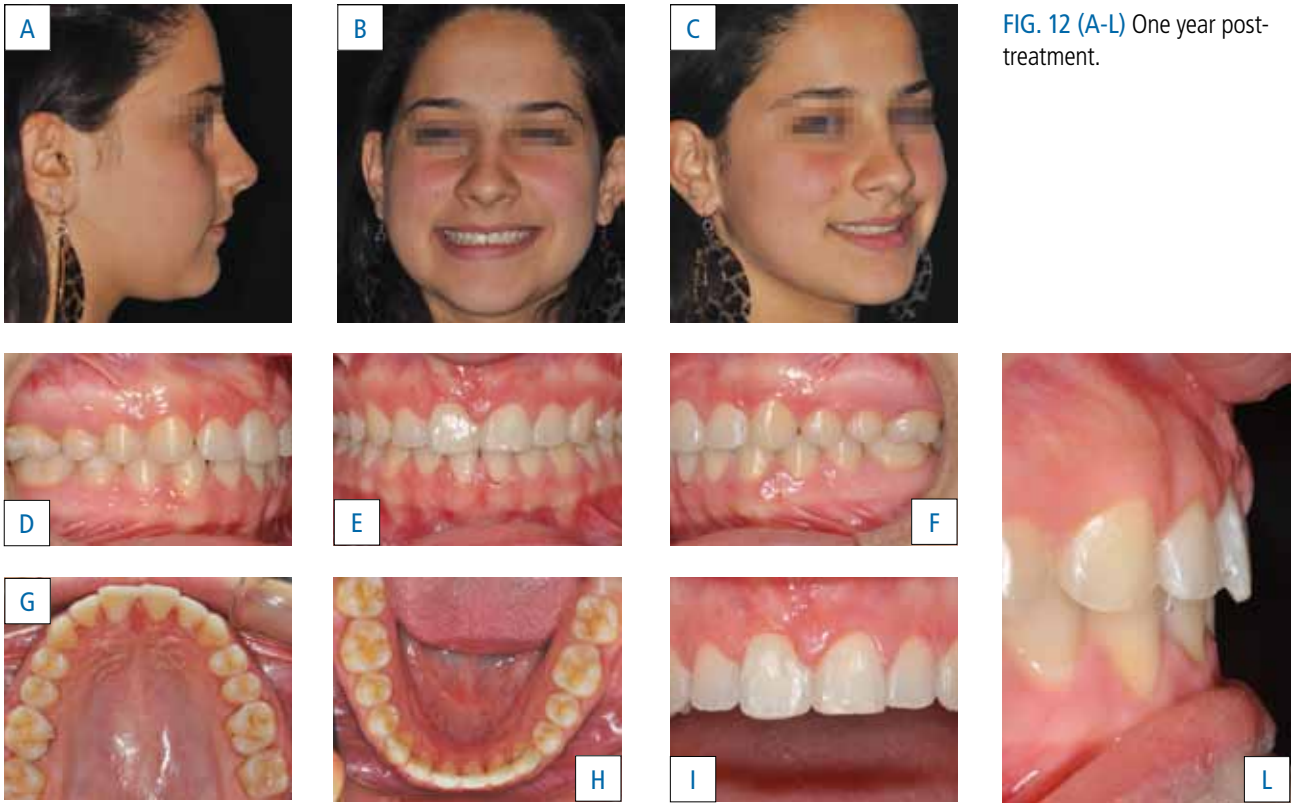


FIG. 12 (A-L) One year post-treatment.

The success rate of an impacted dilacerated tooth alignment mainly depends on the following factors:
- position and direction of the impacted tooth;
- degree of root formation;
- degree of dilaceration;
- availability of space for the impacted tooth.

Machtei et al. [1990] also include the condition of the periodontium. McNamara et al. [1998] underline the decisive significance of the post-traumatic condition of the Hertwig's epithelial root sheath for a successful therapeutic outcome, since normal root development depends on its integrity. A dilacerated tooth with an obtuse inclination angle, a lower position in relation to the alveolar crest combined with an incomplete root formation has a better prognosis for orthodontic traction.

Conclusion

The factors that determined a positive outcome are the following.
- The strategic placement of the straightwire appliance allows correct positioning of the tooth root and harmonic gingival margin of the two central incisors.
- The placement of buttons on the labial surface allows the palatal movement of the crown.
- The use of light and constant orthodontic forces (40 g) exerted by means of traction chain and elastic cotton thread before and NiTi superelastic wires.

References

› Andreasen JO, Sndström B, Ravn JJ. The effect of traumatic injuries to primary teeth on their permanent successors. A clinical and histologic study of 117 injured permanent teeth. Scand J Dent Res 1971 ; 79:219–83.
› Cozza P, Marino A, Condo, R. Orthodontic treatment of an impacted dilacerated maxillary incisor: a case report. J Clin Pediatr Dent Winter 2005 ; 30(2):93-7, .
› Jafarzadeb H, Abbott P. Dilaceration: review of an endodontic challenge. J Endod 2007 ; 33:1025–30.
› Lin YTJ. Treatment of an impacted dilacerated maxillary central incisor. Am J Orthod Dentofacial Orthop 1999 ; 115:406–9.
› Machtei EE, Zyskind K, Ben-Yehouda A. Periodontal considerations in the treatment of dilacerated maxillary incisors. Quintessence Int 1990; May 21(5):357-60.
› McNamara T, Woolfe SN, McNamara CM. Orthodontic management of a dilacerated maxillary central incisor with an unusual sequel. J Clin Orthod 1998; 32:293–7.
› Ribeiro D, Campos V. Prevalence of sequelae in the permanent anterior teeth after trauma in their predecessors: a longitudinal study of 8 years. Dental Traumatology 2009 ; 25:300–304.
› Stewart DJ. Dilacerate unerupted maxillary central incisors. Br Dent J 1978 145: 229–33.
› Smith DMH, Winter GB. Root dilaceration of maxillary incisors. Br Dent J 1981; 150:125–7.
› Topouzelis N, Tsaousoglou P, Pisoka V, Zouloumis L. Dilaceration of maxillary central incisor: a literature review. Dental Traumatology 2010; 26:427–433.
› White SC, Pharoah MJ, Oral radiology: principles and interpretation. 4th ed., St Louis: Mosby; 2000.