

# Impacted maxillary central incisor: Surgical exposure and orthodontic treatment

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This case report describes the treatment of a patient with a horizontally impacted maxillary central incisor, a canine in the same quadrant, and an inclusion tendency. Due to severe crowding in the maxilla and the Class II molar relationship on the impaction side, a 2-stage treatment plan was developed. In the first stage, the right first premolar and deciduous canine were extracted; this allowed enough space for the eruption of the maxillary right permanent canine. The second stage included surgical exposure and traction of the impacted central incisor with a fixed orthodontic appliance. An excisional uncovering technique was needed to expose the impacted incisor. After it erupted, an apically positioned partial-thickness flap was used to add keratinized attached gingiva in the area surrounding the crown, initially located in an area of unattached gingiva. The patient finished treatment with a normal and stable occlusion between the maxillary and mandibular arches and an adequate width of attached gingiva. (*Am J Orthod Dentofacial Orthop* 2011;140:256-65)

**I**mpaction of a permanent tooth is not common in the mixed dentition; however, an impacted central incisor is usually diagnosed when the tooth fails to erupt. Although the maxillary canine is the most frequently impacted anterior tooth, impaction of the maxillary central incisor poses a problem at an earlier age.<sup>1</sup> This tooth usually erupts several years before the canine, when the child is between 8 and 10 years of age, and its impaction is more conspicuous to the parents.<sup>2</sup>

The most common causes of canine impactions are a long path of eruption, tooth size-arch length discrepancies, abnormal position of the tooth bud, prolonged retention or early loss of the temporary canine, trauma, an alveolar cleft, ankylosis, cystic or neoplastic formation, dilaceration of the root, supernumerary teeth, and odontomas.<sup>3,4</sup> Although impaction of the maxillary central incisor is almost as prevalent as impaction of

the canines, its etiology is different. The principal factors involved are supernumerary teeth, odontomas, and trauma. Adjacent anomalous or missing maxillary lateral incisors have been implicated in the etiology of palatally displaced canines by not providing proper guidance to the canine during its eruption.<sup>3,5-9</sup>

Diagnosis of an impacted canine could occur before the age of 10 years if there is a family history or the maxillary lateral incisors are anomalous or missing, or after age 10 if there is asymmetry in palpation or a pronounced difference in the eruption of the canines between the left and right sides, or the canines cannot be palpated and occlusal development is advanced, or the lateral incisor is proclined and tipped distally, and, on a panoramic radiograph of the late mixed dentition, if the cusp tip of the canine overlaps the root of the lateral incisor.<sup>5</sup>

Treatment alternatives for an impacted central incisor include extraction and restoration with a bridge or an implant later when growth has ceased; extraction and closure of the space by substituting the lateral incisor for the central incisor with subsequent prosthetic restoration; and surgical exposure, orthodontic space opening, and traction of the impacted central incisor into its proper position.<sup>10,11</sup> Clinicians should consider treatment goals that minimize injuries to the dentition and the periodontium.<sup>12</sup>

Resorption of the permanent incisors is a rare complication caused by ectopic eruption of the maxillary canines; when it happens, orthodontic treatment might be required.<sup>13</sup> Sometimes, to reduce orthodontic

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**Fig 1.** Pretreatment photographs.

treatment time and prevent further resorption of the maxillary central incisor roots, the impacted maxillary canines and mandibular first premolars are extracted, because of the proximity of the maxillary canine and central incisor roots.<sup>14</sup>

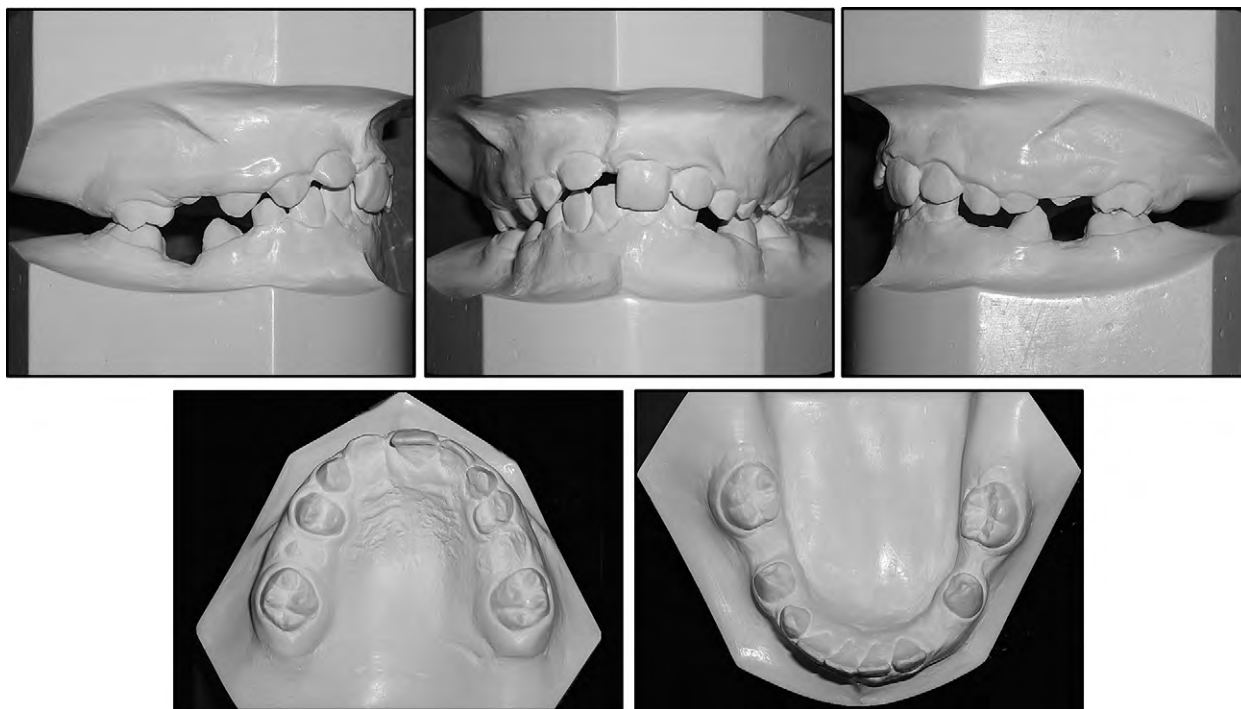
Several factors might affect the outcome of the orthodontic-surgical plan for the resolution of impacted central incisors but, particularly, the manner in which the impacted tooth is exposed. Impacted teeth can be exposed by removal or repositioning the soft tissue that envelopes them, leaving them in full view at the end of the surgical procedure. This has been termed “open-eruption” exposure. Removal of the oral mucosa overlying the unerupted teeth, although more direct, has the disadvantage that the finally erupted tooth will have a nonkeratinized labial gingival margin, whereas apical repositioning can be expected to provide adequate width of the attached gingiva. The teeth might then erupt spontaneously, or, with a bonded attachment, an extrusive force can

be applied to augment the diminished natural eruptive force.<sup>15-17</sup>

However, little research has been carried out in the context of impacted central incisors until recently, when a study was undertaken to investigate the long-term periodontal, pulpal, and esthetic outcomes for a group of impacted maxillary central incisors exposed with a closed-eruption surgical and orthodontic treatment technique.<sup>1</sup> Although the importance of a minimal zone of attached gingiva has been disputed, investigations have shown that an adequate zone of attached gingiva might prevent gingival recession.<sup>18-20</sup> If the attached gingiva is too narrow, inflammation leads to recession rather than pocketing.<sup>21,22</sup>

#### DIAGNOSIS AND ETIOLOGY

An 8-year-old girl in the early mixed dentition stage came with the appearance of her anterior teeth as her chief complaint (Figs 1 and 2). She had a balanced facial



**Fig 2.** Dental casts before treatment.

pattern but an asymmetric smile, with the occlusal plane and upper lip canted upward to the right side and more gum showing on the left side. The maxillary dental midline deviated about 2 mm to the right. The maxillary right central incisor was impacted, and the adjacent teeth had drifted into the unoccupied space. There was significant dental crowding in the maxillary right arch with a Class II right molar relationship. Overjet was 2 mm and overbite 4 mm.

The patient had a history of trauma at age 4, with the premature exfoliation of some deciduous teeth. Radiographs showed that the maxillary right central incisor was impacted in a horizontal position in the region of the nasal floor, and the right canine had an impaction tendency (the incisal tip overlapped the root of the lateral incisor<sup>5</sup>) (Fig 3).

### TREATMENT OBJECTIVES

The following treatment objectives were established: (1) recover space in the maxilla for the eruption of the right canine, (2) provide orthodontic traction for the impacted teeth, (3) create a stable functional occlusion, and (4) establish adequate attached gingiva and symmetric gingival margins for both maxillary central incisors.



**Fig 3.** Pretreatment panoramic x-ray.

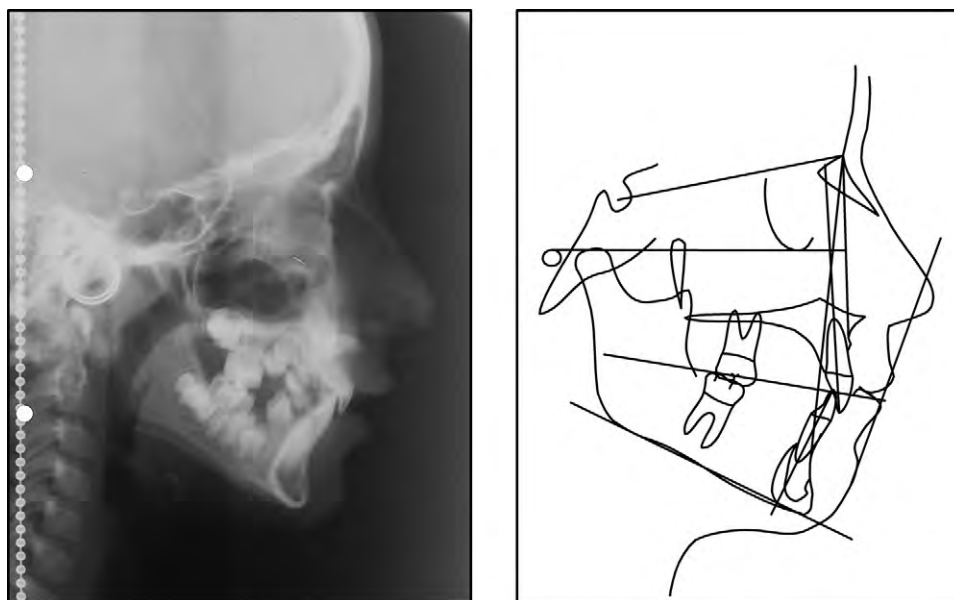
### TREATMENT ALTERNATIVES

1. Extraction of the impacted central incisor, orthodontic space opening, and future restoration with a bridge or an implant when growth had ceased.
2. Extraction of the impacted central incisor and closure of the space, bringing the lateral incisor into the place of the central incisor, and subsequent prosthetic restoration.
3. Orthodontic space opening, surgical exposure, and traction of the impacted dilacerated central incisor into its proper position.





**Fig 4.** Photographs after extraction of the maxillary right first premolar and deciduous canine.



**Fig 5.** Pretreatment cephalometric radiograph and tracing.

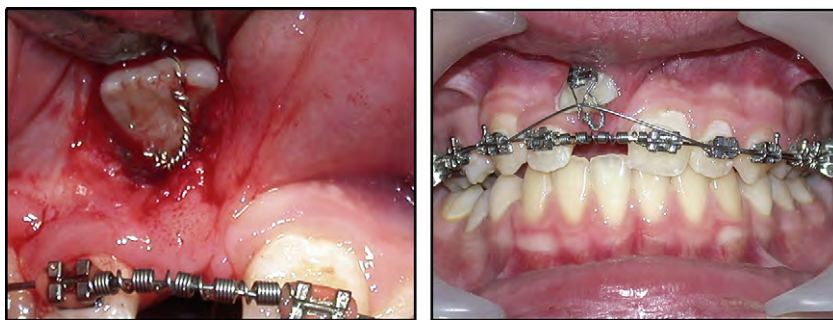
#### TREATMENT PLAN

After discussing the possible treatment alternatives, the parents and the clinicians chose to try to save the tooth and bring it into its proper position. Because of the maxillary right canine's impaction tendency, the treatment plan consisted of 2 stages. The first stage involved extraction of the right first premolar and the deciduous canine; the second stage consisted of fixed

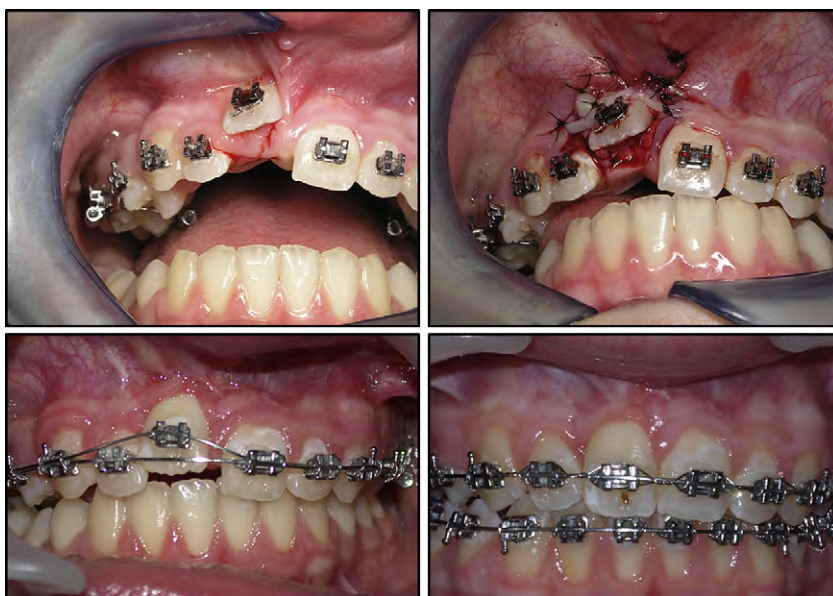
orthodontic treatment, surgical exposure, and traction of the impacted right central incisor from a horizontal to a vertical position and its alignment to obtain a normal occlusal relationship.

#### TREATMENT PROGRESS

The maxillary right first premolar and deciduous canine were extracted to relieve crowding and



**Fig 6.** Open exposure and traction of the central incisor.



**Fig 7.** Double papillar apically positioned partial-thickness flap and improvement of the gingival margin contour of the central incisor and adequate zone of attached gingiva.

facilitate canine eruption (Figs 4 and 5). After the eruption of all premolars and canines, bands or brackets were placed on all teeth. Once the maxillary arch was in a relatively rigid stabilizing wire (0.018  $\times$  0.025-in stainless steel in a 0.022-in slot), a coil spring was used to create adequate space for aligning the impacted incisor. Periodontal surgery was performed to expose the maxillary right central incisor (Fig 6).

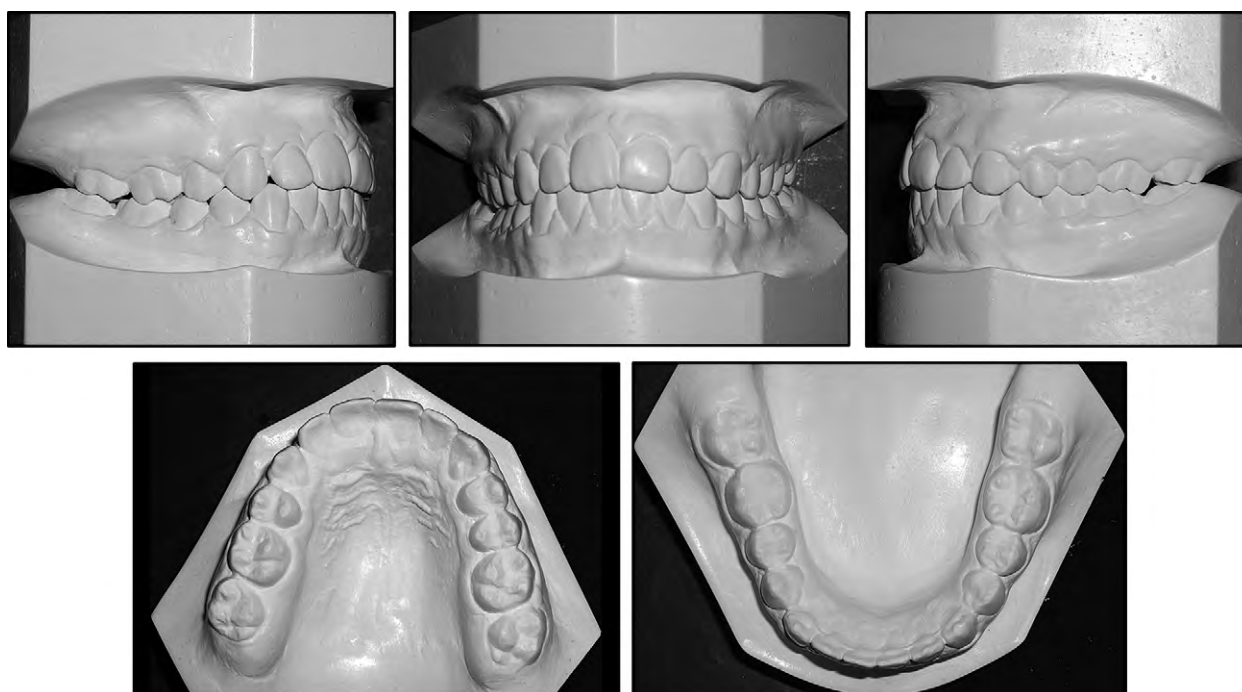
An access flap was elevated to expose the tooth, and it was necessary to make a small hole in the incisal edge of the incisor to tie it to a 0.010-in ligature wire and bond it to an elastic module for applying force in the apical direction. Once the impacted tooth had erupted, a double papillar apically positioned partial-thickness

flap was used to augment the keratinized attached gingiva labial to the crown (Fig 7). A bracket was bonded to the crown and tied to a double archwire (0.014-in nickel-titanium). In the mandibular arch, alignment and leveling were achieved with a sequence of 0.014- and 0.018-in nickel-titanium archwires, later replaced by rectangular nickel-titanium archwires (0.016  $\times$  0.022 and 0.019  $\times$  0.025 in).

Active treatment took 30 months. Photographs, dental casts, and panoramic and cephalometric radiographs were taken at the end of the treatment (Figs 8-10). Impressions were taken to create a maxillary circumferential retainer, and a 0.0175-in braided wire was bonded to the lingual surfaces of the mandibular incisors and canines.



**Fig 8.** Posttreatment photographs.



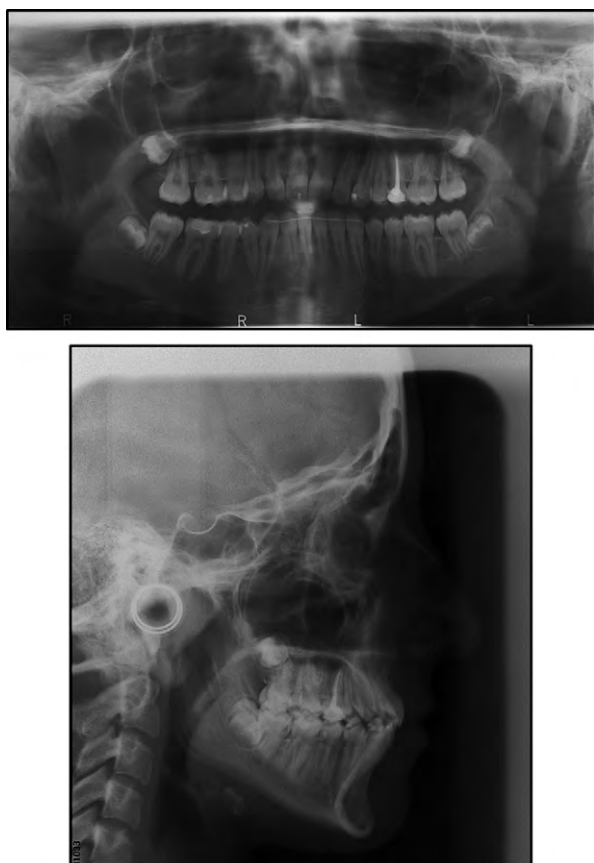
**Fig 9.** Posttreatment dental casts.

### TREATMENT RESULTS

The impacted maxillary right central incisor was brought into proper alignment with the adjacent teeth and produced a nice smile (Fig 8). Accessory periodontal

treatment with an apically positioned flap was indicated during the traction of the central incisor to provide an adequate width of attached gingiva and ensure alignment of the gingival margin of the positioned tooth





**Fig 10.** Posttreatment panoramic x-ray and cephalometric radiograph.

with the contralateral incisor. Bilateral Class I canine relationships and ideal overjet and overbite were achieved. The final radiographs indicated intact roots, proper root alignment, and no root disease (Fig 10).

The cephalometric analysis at the end of the treatment showed that the skeletal relationship improved because of the anterior growth of the mandible (Fig 11, Table).

Eighteen months after the orthodontic treatment, the affected central incisor remained asymptomatic (Fig 12). There was a significant discrepancy in ramal lengths between the right and left sides (Figs 3 and 10). The smile was improved but remained asymmetric because of the canted occlusal plane.

## DISCUSSION

An impacted maxillary central incisor in a child poses a disturbing esthetic dilemma because of its prominent location. Neither orthodontists nor parents want to wait for complete eruption of the permanent dentition before starting comprehensive orthodontic treatment,

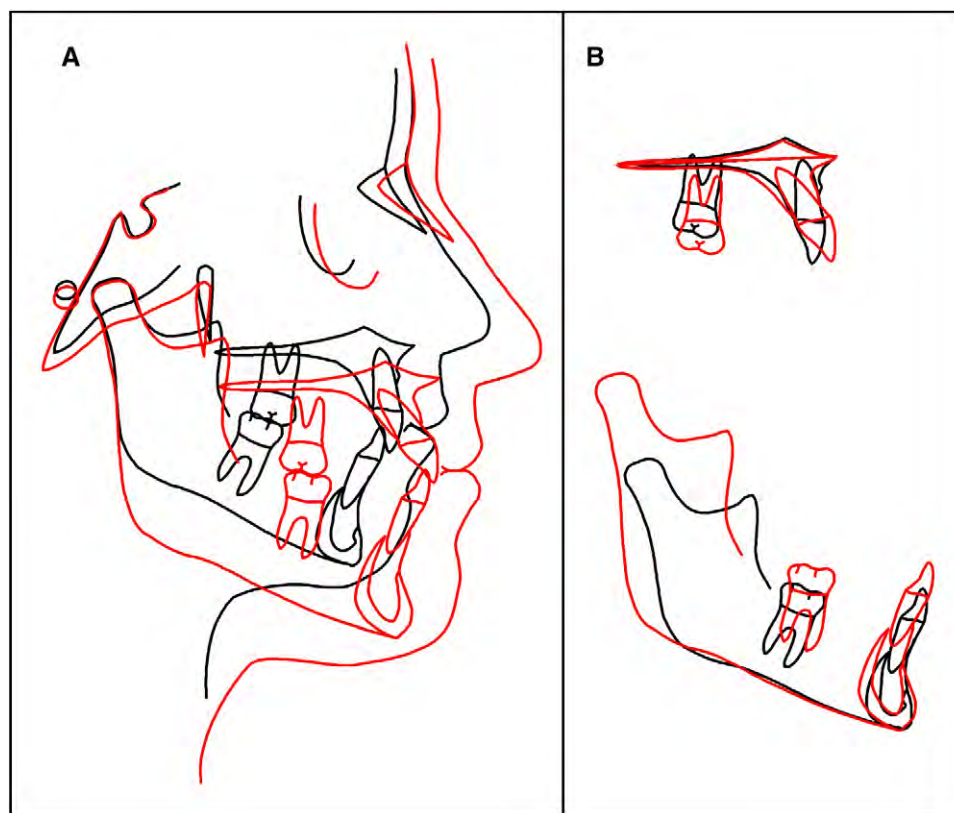
especially when the problem can be treated in the early mixed dentition stage.<sup>2</sup> However, it is important to properly inform the patient and the parents of the possibility of failure before extensive measures are undertaken to save a severely impacted tooth.<sup>23</sup>

Although the panoramic radiograph cannot be used as the sole radiograph to locate impacted maxillary canines, in this patient, we diagnosed a maxillary right canine impaction tendency because the tip of its crown overlapped the root of the lateral incisor.<sup>24</sup>

We first determined whether the impacted tooth could be successfully aligned in its proper position on the basis of its position and orientation, the amount of root formation, and the degree of root dilaceration.<sup>11</sup> It is important to plan when and how the impacted tooth will be moved to its proper position, as well as the positions of adjacent teeth and the intermaxillary relationships. In this patient, there was insufficient space for the maxillary right canine; the lateral incisors had drifted into the unoccupied space, and the right molar had moved mesially. Extraction of the first premolar and the deciduous canine made the orthodontic correction easier by eliminating the possibility of other complications. This is in accordance with the studies of Jacobs<sup>5</sup> and Stivaros and Mandall,<sup>25</sup> who showed that preventing or intercepting a palatally displaced canine by extracting the deciduous canine is best carried out as early as the displacement is detected, typically around 10 years of age. Usually, prevention or interception will prevent the impaction of a palatally displaced canine and might help to prevent resorption of the adjacent incisor root.

Movement of an impacted central incisor could be impossible because of ankylosis and external root resorption.<sup>23,26</sup> Furthermore, even successfully treated patients can have irregular root formation<sup>11</sup> or an unesthetic gingival margin after alignment.<sup>27</sup> However, these complications did not occur in this patient.

Although the closed-eruption technique usually provides the most esthetically pleasing result, we did not use this surgical technique.<sup>28,29</sup> The horizontal position of the impacted maxillary central incisor meant that direct removal of the oral mucosa was the only way to expose the tooth and attach the wire. This procedure, although more direct, has the disadvantage of producing a nonkeratinized vestibular gingival margin.<sup>27</sup> This was corrected with an apically positioned flap during the traction to provide adequate width of the attached gingiva and result in a more esthetic gingival margin. Because of the relatively high prevalence of gingival defects in some studies, adjunctive postorthodontic periodontal surgery might be required in many patients treated with this method to achieve an esthetic gingival margin contour over the



**Fig 11.** **A**, Cephalometric superimposition before and after orthodontic treatment (Bjork method); **B**, maxillary and mandibular superimpositions.

central incisors and provide the teeth with an adequate zone of attached gingiva.<sup>1,27</sup>

According to previous studies, the masticatory axis is strongly correlated with the occlusal plane, thus implying a close relationship between stomatognathic function and morphogenesis.<sup>30,31</sup> There is a significant association between the severity of the Class II buccal-segment relationship and the extent of left-right asymmetries.<sup>32</sup> The relationship of the maxilla to the mandible and the mechanics of the stomatognathic system must be considered as a whole when studying the occlusion.<sup>33</sup> In this patient, we think that, apart from the maxillary right central incisor impaction and the canine impaction tendency, the occlusal plane and the upper lip cant might be related to underdevelopment on the maxillary right side. These findings could be a natural compensation and mask an underlying skeletal problem.<sup>34</sup> In this patient, we also found a significant discrepancy in the ramal lengths between the right and left sides; this could also be a natural compensation.

Although it is not yet well proven, a correlation between dysfunction of the craniomandibular system and malocclusion should be considered in diagnosis and

**Table.** Cephalometric analysis (Merrifield-Tweed) before and after treatment and at retention

Cephalometric analysis	Norm	Before treatment	After treatment
FMIA (°)	67 ± 3	63.7	62.4
FMA (°)	25 ± 3	25.9	23.3
IMPA (°)	88 ± 3	90.3	94.3
SNA (°)	82 ± 2	80.6	79
SNB (°)	80 ± 2	72.8	76.8
ANB (°)	1-5	7.8	2.2
Occlusal plane angle (°)	8-12	9.2	3.5
Z-angle (°)	75 ± 5	70.1	79.1
Posterior facial height (mm)	45	41.9	55.4
Anterior facial height (mm)	65	59.2	71
Index post ant	0.69	0.7	0.8

treatment planning. Malocclusion is thought to be an important predisposing factor in the dysfunction of the craniomandibular system because an occlusal balance allows the system to bear the action of a number of pathogenic





**Fig 12.** Intraoral photos 18 months after orthodontic treatment.

noxae.<sup>35</sup> This seems also true when analyzing the intraoral and extraoral diagnostic elements of this patient.

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