

# Early treatment of an ectopic premolar to prevent molar-premolar transposition

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Orthodontic treatment is planned on an individual, case-by-case basis after thoroughly considering the patient's overall facial and dental characteristics, the expected duration of treatment, costs, patient preferences, and the orthodontist's experience. This article reports the treatment of a patient with a maxillary premolar-molar transposition in the permanent dentition that was successfully managed with orthodontic treatment. A girl, aged 10 years 2 months, came for treatment with an ectopic maxillary left premolar. Radiographic analysis indicated a developing complete transposition of the maxillary left premolar. The patient was treated with extraction of the deciduous molar and surgical exposure and ligation of the premolar. Eruption was properly guided, and the correct order of the 2 teeth was restored in the arch. This challenging treatment approach is described in detail, including the mechanics used to align the ectopic premolar. Early treatment can, in many cases, prevent a molar-premolar transposition. (*Am J Orthod Dentofacial Orthop* 2013;143:559-69)

**T**ooth transposition is defined as a type of ectopic eruption with a permanent tooth developing and erupting in the position normally occupied by another permanent tooth. A distinction is made between complete transposition (where the crown and entire root of the involved teeth exchange places in the dental arch and are fully parallel) and incomplete transposition (where the crowns are transposed, although the root apices remain in their relatively normal positions).<sup>1</sup>

The etiology of tooth transposition has been the subject of much controversy and is still not completely understood. Several theories have been proposed to explain the phenomenon. Multifactorial genetic factors, such as an interchange in the position of the developing dental laminae of the involved teeth, have been suggested as a cause for the transposition of teeth.<sup>1-3</sup> Environmental factors such as deciduous tooth trauma

or even retained deciduous teeth might also contribute, and familial occurrence has been observed.<sup>4</sup>

When transposition occurs, the involved teeth show a characteristic malposition and appearance. Moreover, other congenital dental anomalies such as hypodontia, peg-shaped or small maxillary lateral incisors, retained deciduous teeth, severe rotations, malpositions, dilacerations, or malformations of the adjacent teeth are often observed. Unilateral transposition has been reported more often than bilateral transposition, with the left side somewhat more frequently involved than the right. Transpositions can, according to some authors,<sup>5,6</sup> affect both sexes equally, whereas others report that transpositions are more frequent in female patients<sup>3,7-10</sup> or male patients.<sup>11,12</sup>

Although transpositions can appear in both the maxilla and the mandible, the maxillary canine is the most frequently involved tooth, followed by the first premolar, and less often by the lateral incisor. Transposition of teeth without involvement of the maxillary canine is extremely rare.<sup>4,9,13</sup>

In this article, we describe a particular clinical situation where an ectopic premolar was diagnosed early and treated. This probably prevented a complete maxillary left premolar-molar transposition, and the involved teeth were repositioned to their normal anatomic positions in the dental arch.

## DIAGNOSIS AND ETIOLOGY

The physical examination of a 10-year-old girl showed a Class I dental relationship in the early mixed dentition: the maxillary arch was slightly constricted

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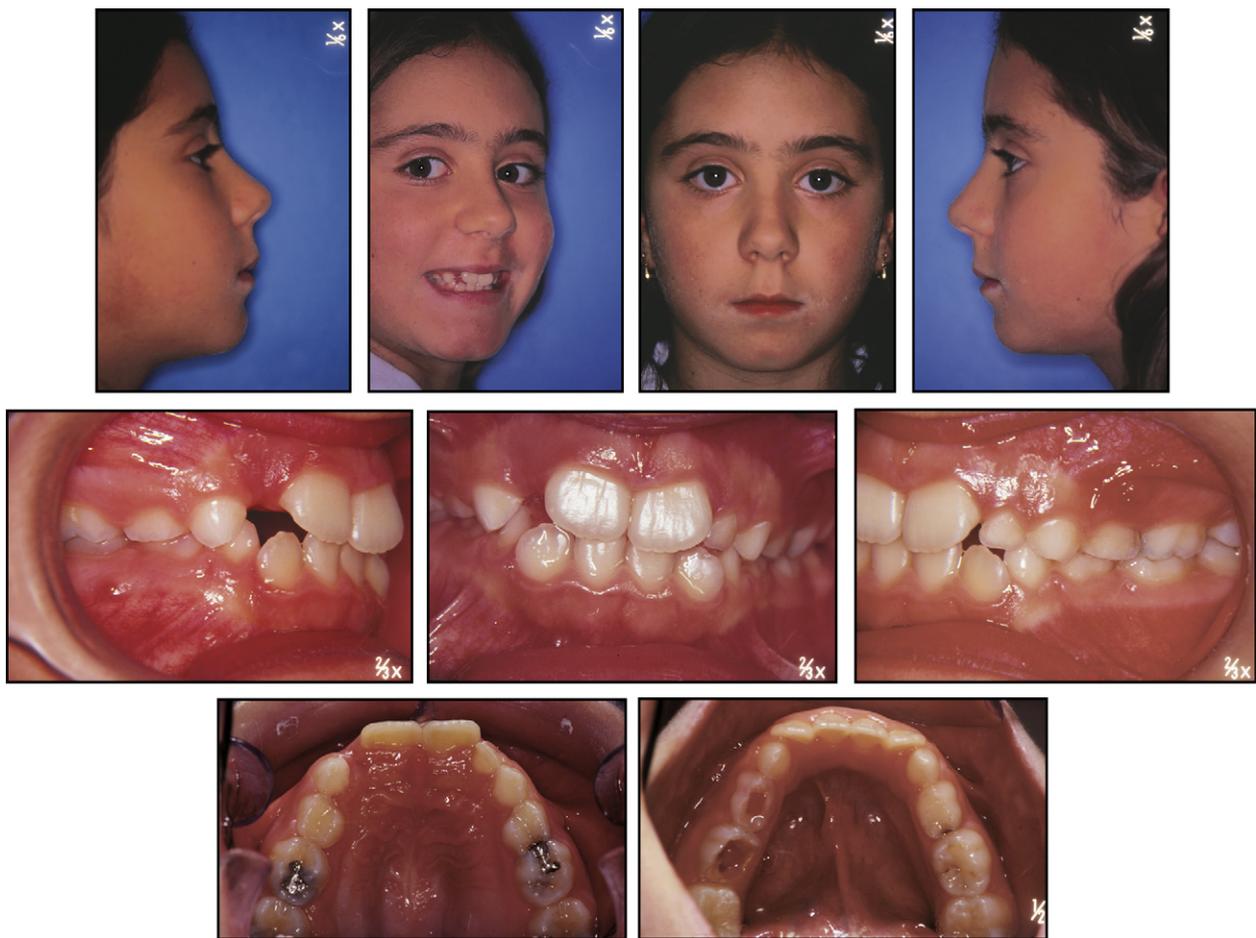
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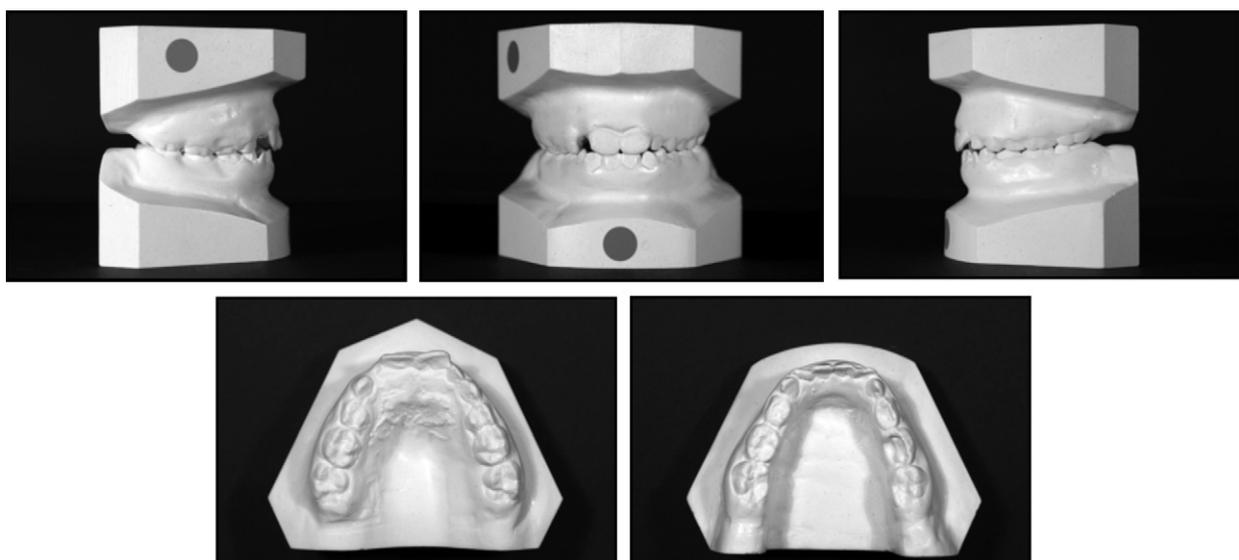
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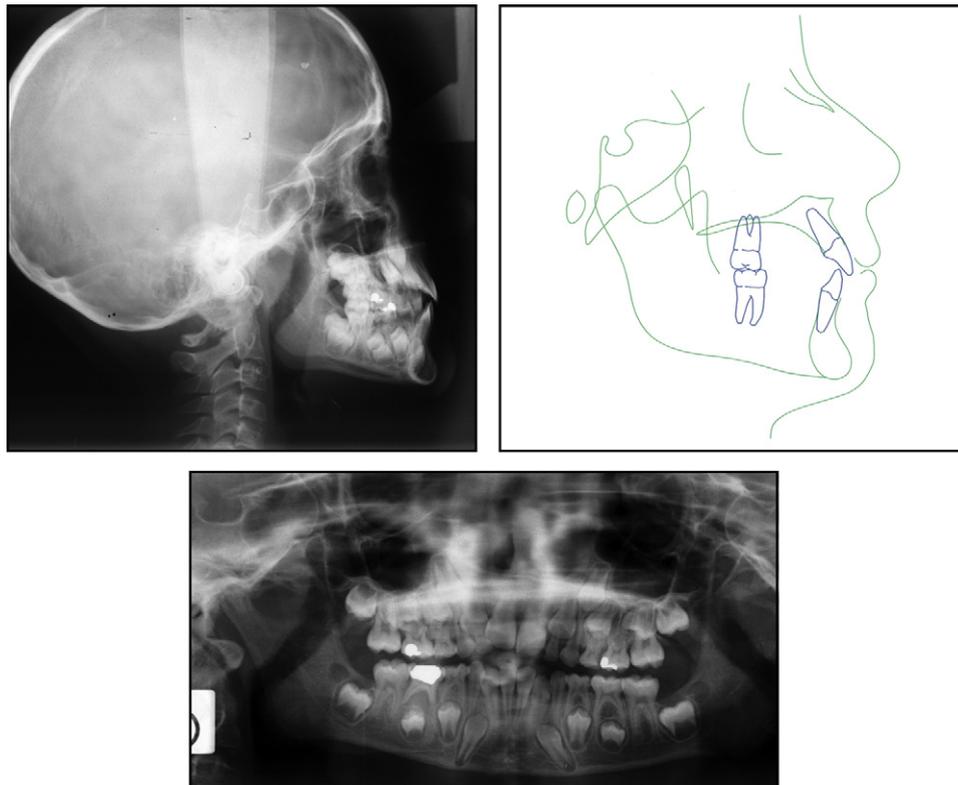
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**Fig 1.** Pretreatment facial and intraoral photographs.



**Fig 2.** Pretreatment dental cast photographs.



**Fig 3.** Pretreatment lateral cephalometric radiograph with tracing; the panoramic radiograph showed a developing transposition. The erupting maxillary left permanent premolar was observed between the roots of the first molar.

with no crossbite. Only maxillary central incisors were present, with no space for the unerupted lateral incisors, whereas all mandibular incisors were erupted. Mild crowding in both arches and a tendency to open bite were observed with a tongue thrust (Figs 1 and 2).

The lateral cephalometric evaluation showed a Class I skeletal malocclusion (ANB,  $3^\circ$ ), vertical facial pattern (SnGoGn,  $37^\circ$ ), retroclined maxillary incisors (I/SN,  $99^\circ$ ), and proclined mandibular incisors (IMPA,  $98^\circ$ ). The facial profile was slightly convex. The panoramic radiograph showed a developing ectopic premolar (Fig 3). The erupting maxillary left permanent premolar was observed between the roots of the first molars. Moreover, all developing permanent teeth, except the mandibular third molars, were present.

The patient's medical and dental histories were unremarkable, with no trauma to the deciduous teeth, and no familial occurrences were reported.

#### TREATMENT OBJECTIVES

The treatment objectives for this patient were to correct the arch-length discrepancy, prevent an anterior

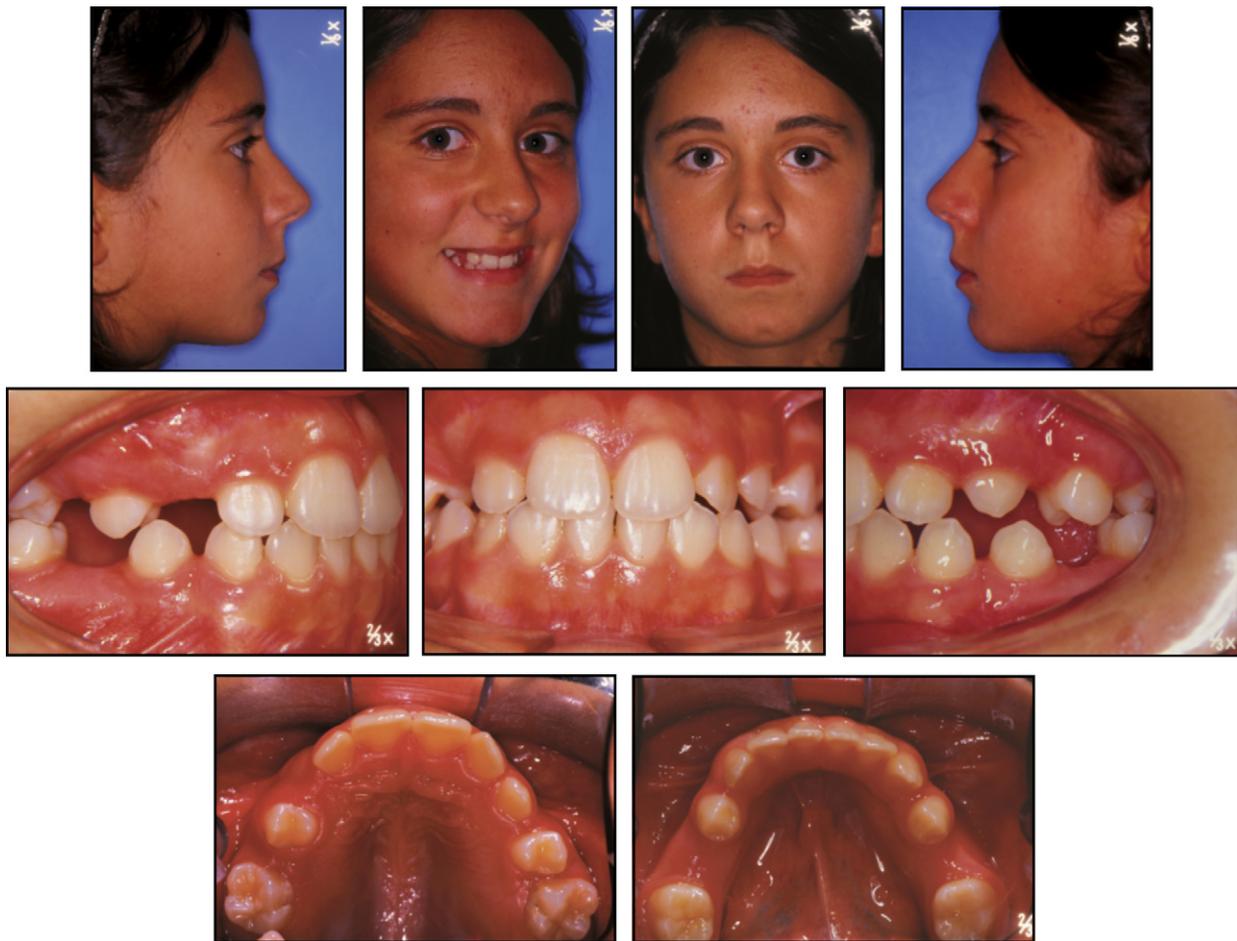
open bite, and correct the developing ectopic maxillary left permanent premolar.

#### TREATMENT ALTERNATIVES

We considered the following treatment alternatives.

1. Extract the ectopic maxillary premolar and restore it with a fixed prosthesis or an implant.
2. Extract the ectopic maxillary premolar and close the space with mesial movement of the first molar, which would then be carried into a Class II relationship.
3. Extract the ectopic maxillary premolar along with the other 3 premolars, as the tendency to open bite, the vertical facial pattern, and the convex vertical profile might suggest. However, the arch-length discrepancy required no tooth extractions, nor did the facial profile.
4. Surgically expose the ectopic maxillary premolar to move it into the proper position.

Treatment alternatives for the ectopic maxillary premolar could not include the traditional options to align



**Fig 4.** Facial and intraoral photographs at the end of the first phase of treatment.

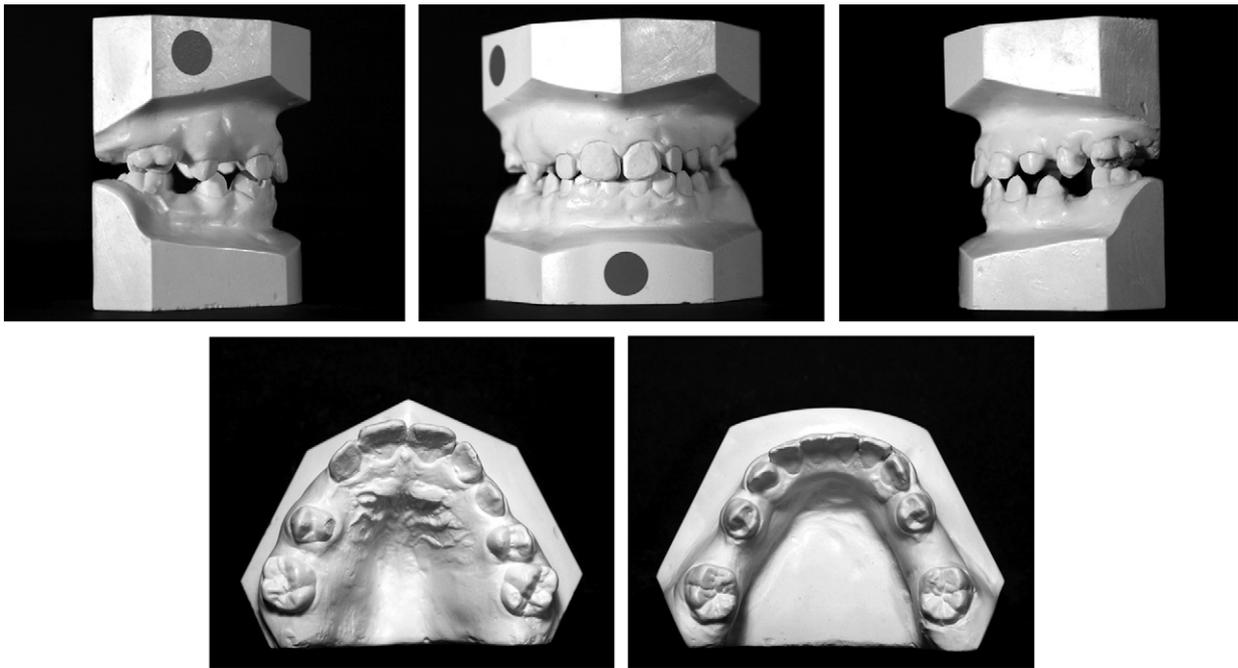
the involved teeth in their transposed position, because this alternative was not favorable for masticatory function.

#### TREATMENT PROGRESS

The first option seemed to be the easiest and more rational choice. The treatment started with an interceptive first phase, including a transpalatal bar in the maxillary arch and a lip bumper in the mandibular arch. After 2 years of treatment, the crowding was resolved, and the molars were derotated; consequently, the shapes of both arches were changed (Figs 4 and 5). The panoramic radiograph showed the recovery of the space for erupting teeth in the mandibular arch. However, in the maxillary arch, space was still needed for eruption of the right canine and both second premolars. The panoramic radiograph confirmed an ectopic maxillary left permanent premolar located between the maxillary first and second molars with the root parallel to the roots of the second molar (Fig 6).

However, functional considerations and the parents' and patient's motivation called for a challenging solution and an unusual treatment approach to align the ectopic tooth into its normal order in the arch. This last option was preferred because it avoided implants and permanent tooth extractions and would result in all teeth being in their correct positions. However, such repositioning has not been reported in the literature, and the required tooth movement would be complex, extensive, and time-consuming, with the risk of jeopardizing the roots and damaging the supporting structures. All risks, including inability to achieve the desired goal, were understood and accepted by the parents. Therefore, the surgical exposure of the ectopic maxillary premolar was planned through a palatal approach suggested by the swelling of the palatal mucosa.

The second phase of the treatment began with the placement of 0.022 × 0.028-in standard edgewise appliances. The maxillary molar bands had a prewelded triple



**Fig 5.** Dental cast photographs at the end of the first phase of treatment.

buccal tube, and high-pull headgear was applied to supplement the anchorage and achieve vertical control. Initial leveling of the teeth was accomplished with light Australian round wires, before 0.16- and then 0.18-in wires were used with open-coil springs. Finally, the left second premolar was surgically exposed from the palatal aspect. The tooth had enamel hypoplasia of the crown. A button for orthodontic traction was bonded on the premolar, and an elastomeric chain was applied (Fig 7).

The tooth was erupted palatally toward the distal cusp of the first molar. An elastomeric chain was used to slightly move it around the first molar (Fig 8). As soon as possible, the button was replaced with a bracket, and an 0.11-in red Elgiloy sectional wire (Rocky Mountain Orthodontics, Denver, Colo) with a large T loop was used to move the premolar buccally. Great care was taken to prevent contact between the roots of the teeth. This sectional wire was tied to the 0.018-in round Australian wire used to maintain the space needed to reposition the premolar.

Composite was used on the occlusal first molar surfaces to slightly open the bite and facilitate the movement of the premolar from the lingual to the buccal side. As soon as the premolar was in the buccal position, the composite was removed. Rectangular archwires were used to move the roots progressively buccally and to complete the leveling of the arch (Fig 9).

Considerable time and effort were required for the finishing procedures, including torquing, uprighting,

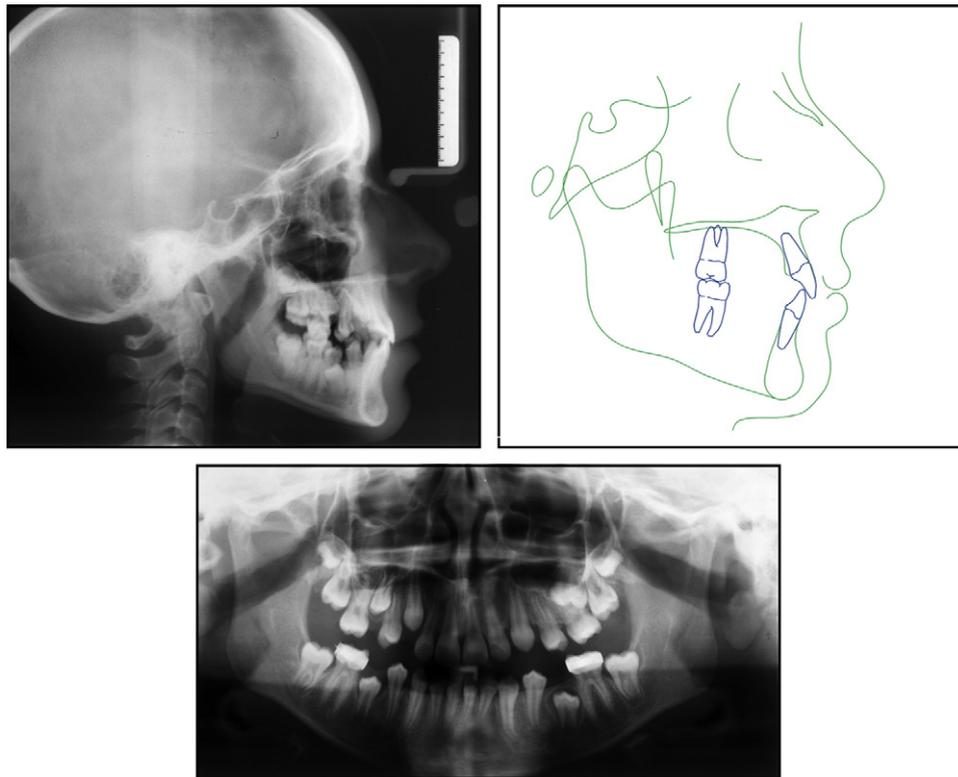
and paralleling of the premolar and molar roots. After active orthodontic treatment, the brackets were removed. Maxillary and mandibular Hawley retainers were used for retention.

The fixed phase lasted 18 months, and the patient was motivated and cooperative throughout the entire treatment.

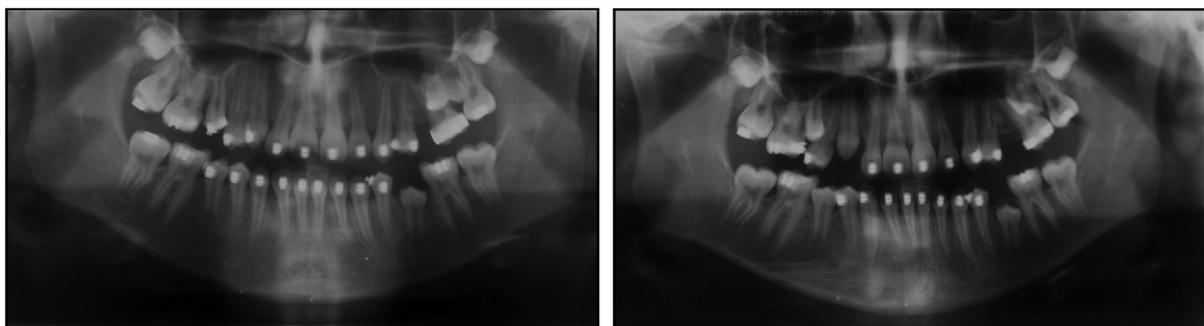
#### TREATMENT RESULTS

The progress panoramic radiograph during treatment (Fig 9) showed that the maxillary left second premolar was brought into its correct position in the dental arch with its root apex in the new position. The root was distorted, and the apex showed slight root resorption, but the premolar maintained its original color and responded normally to a vitality test. The radiolucency area at the premolar level improved in the next 6 months.

The final occlusion was good, although the ectopic maxillary left second premolars had an ovoid shape and required reshaping with composite materials. Moreover, the gingival level at the labial aspect of the left premolar was as high as desired. Facial esthetics were preserved (Figs 10-12). The total treatment time was 3 years 6 months. Patient cooperation was excellent; oral hygiene was good to moderate. Fifteen months after the orthodontic treatment, the left second premolar remained asymptomatic. Bilateral Class I molar and canine relationships and ideal overjet and



**Fig 6.** Lateral cephalometric radiograph with tracing at the end of the first phase of treatment. The panoramic radiograph showed the recovery of the space for erupting teeth in the mandibular arch. However, in the maxillary arch, space was still needed for the eruption of the right canine and both second premolars. Moreover, the maxillary left permanent premolar was located ectopically between the roots of the first and second molars.



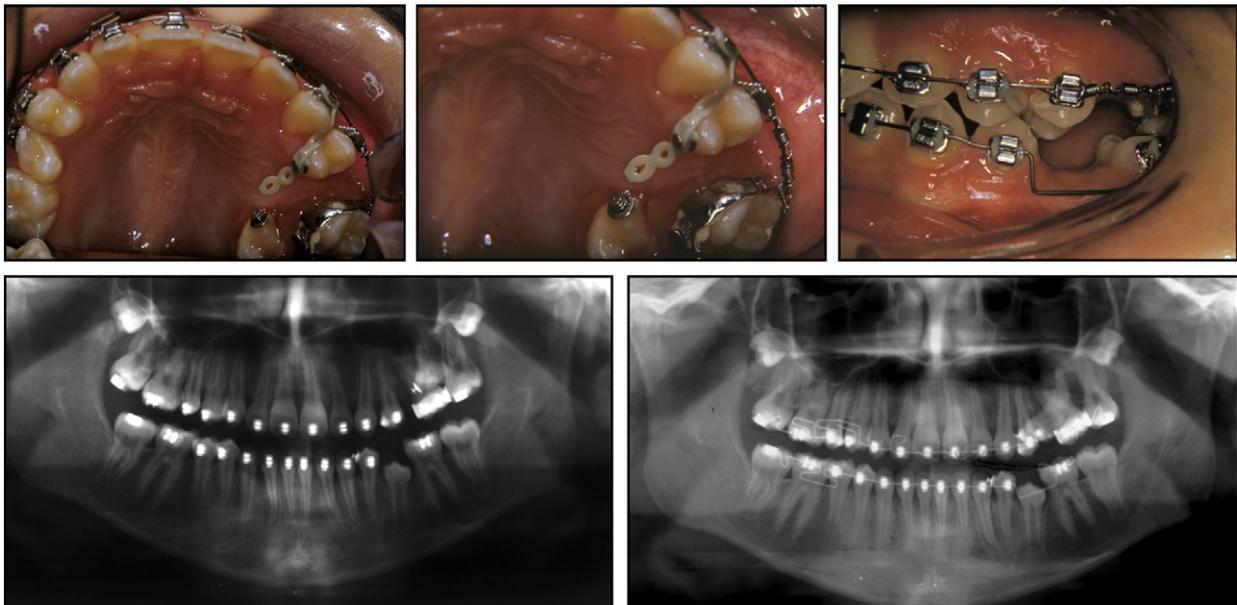
**Fig 7.** Two panoramic radiographs showing the progressive recovery of space needed for the eruption of the right canine and both second premolars.

overbite were achieved. The first and second premolars were correctly seated into occlusion and showed good mucogingival health. The final radiographs indicated normal bone levels and no root resorption. A crown plasty procedure was performed on the left second premolar. The cephalometric analysis at the end of the

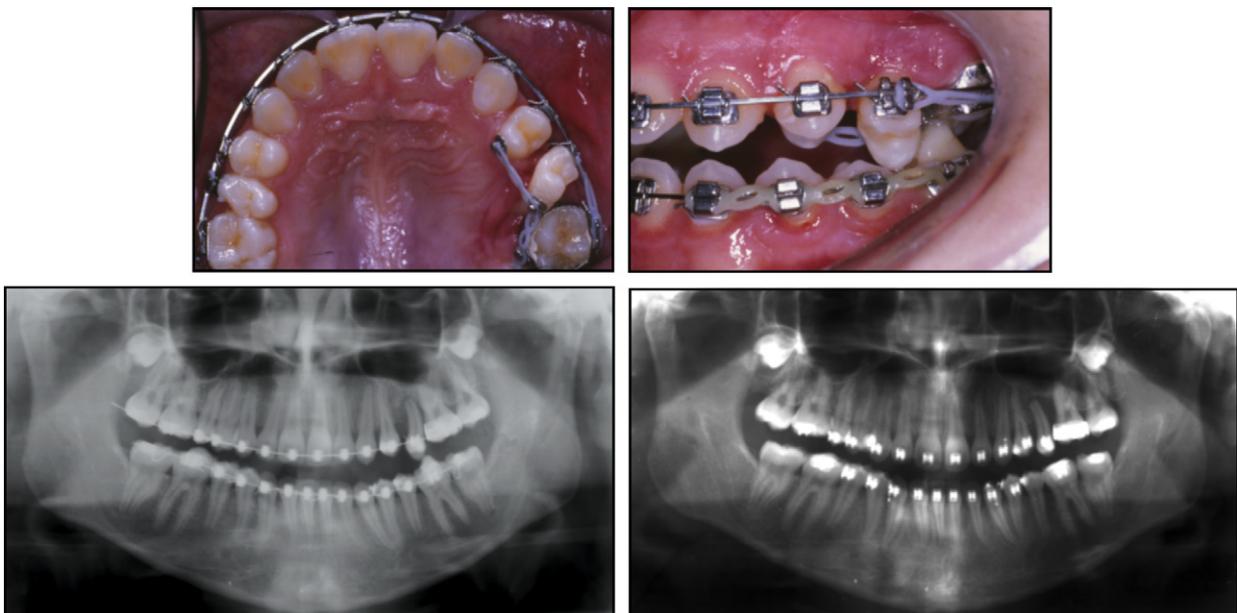
treatment showed a good maxillary and mandibular relationship (Figs 13 and 14).

#### DISCUSSION

This patient had an ectopic premolar that could have developed into a complete maxillary left premolar-molar



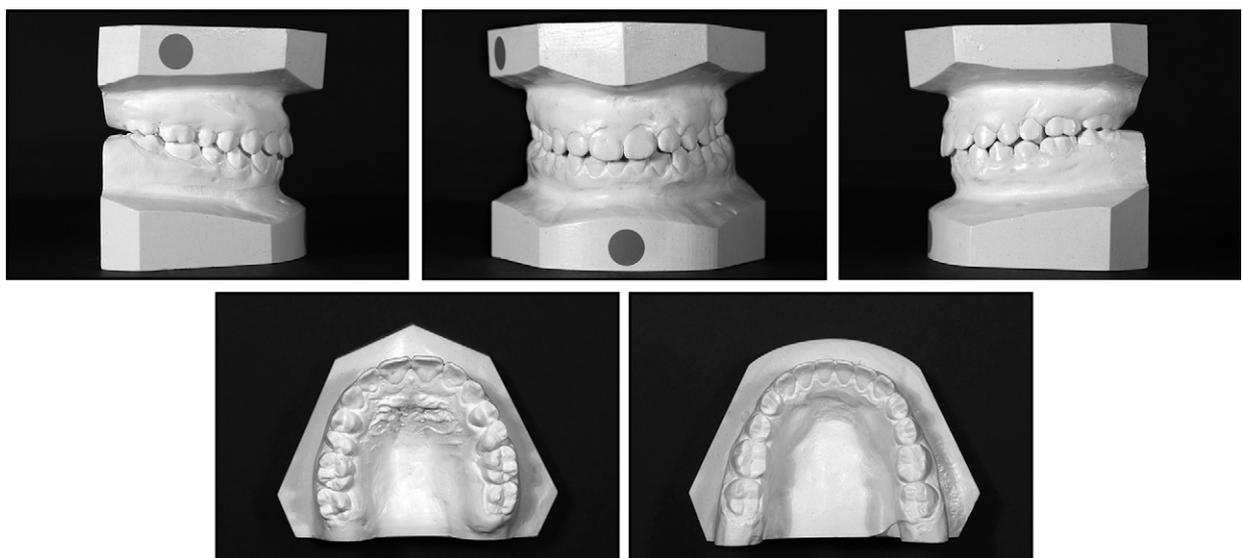
**Fig 8.** Intraoral photographs and 2 panoramic radiographs showing the alignment and surgical exposure of the transposed maxillary premolar in order to move it into the proper position. A button for elastic orthodontic traction was bonded on the premolar. Using the right direction, the ectopic tooth erupted palatally, level with the distal cusp of the first molar. An elastic chain was used to slightly move it around the first molar.



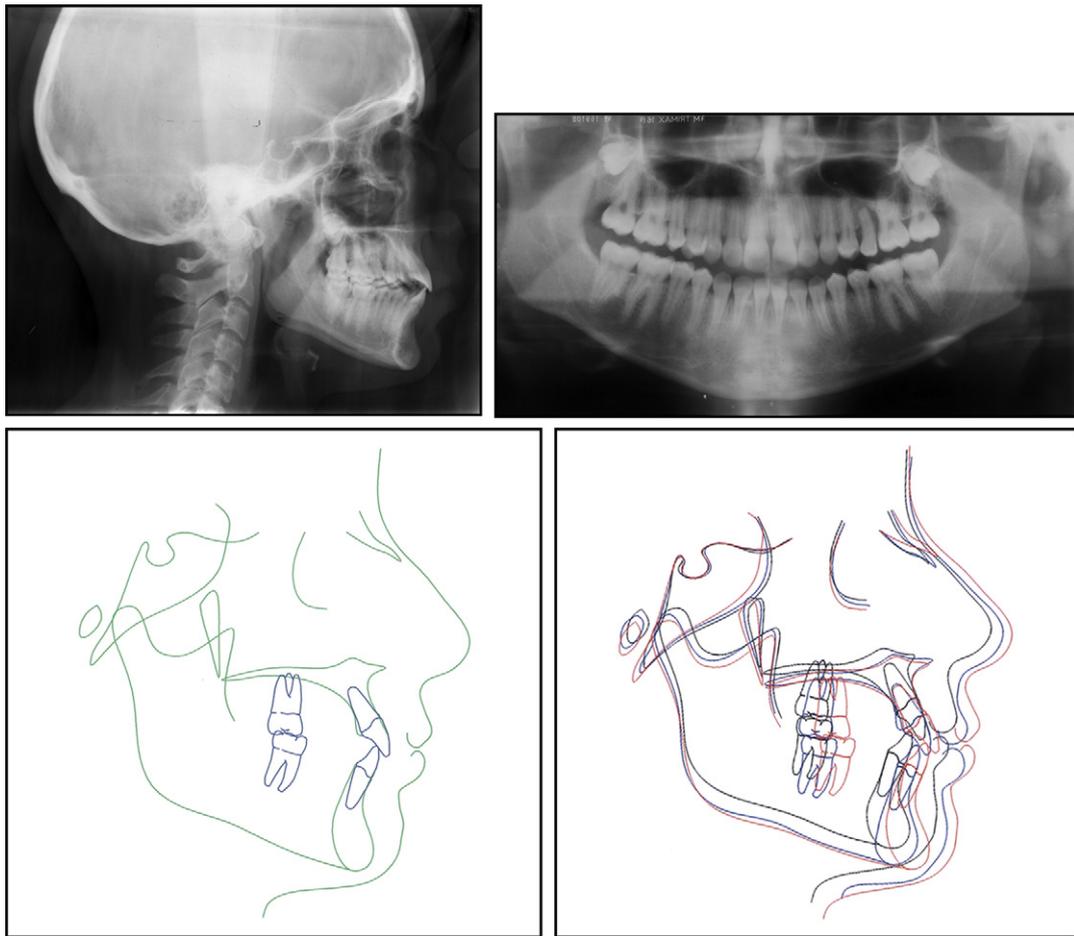
**Fig 9.** Intraoral photographs and panoramic radiographs showing the passage from the lingual to the buccal side of the premolar. Composite on the occlusal first molar surfaces was used to slightly open the bite and facilitate the course of the premolar. To improve the torque of the premolar, an informed bracket was used, and a 0.017 × 0.025-in nickel-titanium wire was engaged so that the roots could be buccally positioned.



**Fig 10.** Posttreatment facial and intraoral photographs.



**Fig 11.** Posttreatment dental casts.



**Fig 12.** Posttreatment lateral cephalometric radiograph with tracing and superimposition. Facial esthetics had no appreciable changes. The panoramic radiograph shows the complete transposition and paralleling of the premolar and molar roots. The apex showed slight root resorption.

transposition: both the crown and the root apex were displaced. Interestingly, the patient was female, and the transposition was observed on the left side as reported by the literature for other types of transpositions.

A literature search of dental transpositions treated by correcting the order of the teeth resulted in only a few reports<sup>1,12,14-16</sup> of canine-premolar<sup>12,14</sup> or canine-lateral incisor<sup>1,12,15,16</sup> transpositions. Cases of maxillary molar-premolar transposition were not reported in literature; therefore, no treatment options were suggested. Thus, the most rational approach for this malformation was to extract the ectopic tooth and treat the resulting malocclusion orthodontically.

However, according to the patient's and parents' motivation, it was decided to reposition the ectopic maxillary left premolar into its normal order in the arch. The extensive repositioning was a great challenge because the left premolar had to be moved in a wide arc from

the its original position, between the roots of the first and second molars, first to the palatal position to allow its circumnavigation of the molar and then to the buccal side. Such extensive movement had biomechanical difficulties and the risk of jeopardizing the roots and damaging the supporting structures.

The parents and the patient preferred to avoid implants and permanent tooth extractions and to have all teeth in their correct positions. Moreover, even functional considerations suggested that the maxillary second premolars are considered important keystones in the dental arch. All the pros and cons of both alignment and correction were discussed. All the risks, including not being able to achieve the desired goal and the need for good cooperation, were understood and accepted by the parents. Even failures caused by ankylosis, loss of periodontal insertion, and external root resorption with root exposure after traction were illustrated.



**Fig 13.** Intraoral photographs after 15 months of retention show the left first and second premolars seated normally into occlusion.



**Fig 14.** Lateral cephalometric and panoramic radiographs after 15 months of retention show good bone healing near the tooth transposition. A crown plasty procedure was performed on the left second premolar at the end of the treatment.

The treatment goals were achieved. The esthetic results of the repositioning were satisfactory, although the premolar shape needed to be modified with restorative dentistry. The gingival level at the labial aspect was high, as desired. The final result was almost ideal, and the outcome was rewarding for the clinicians and appreciated by the patient and her parents. This justified the efforts spent during this uncommon treatment regimen.

The key points of this treatment option were the light forces applied and the patient's motivation. Early diagnosis of an ectopic premolar developing in a premolar-molar transposition is based only on radiographs. Early diagnosis and treatment might prevent the developing molar-premolar transposition, because the crown of the erupting premolar was already between the roots of the first and second molars. The active phase of orthodontic treatment of transposition is possible only after the guided eruption of the permanent teeth.

## CONCLUSIONS

Ectopic eruption and the resulting transposition are among the most difficult challenges for orthodontists. As shown by the esthetic and functional outcome of this clinical case, early diagnosis and treatment are suggested, albeit this requires a complex and lengthy treatment protocol and a cost-benefit evaluation. Light forces and extra care are required to prevent any possible damage to the teeth and the supporting structures. Therefore, the orthodontist is challenged to carefully consider unusual treatment approaches. This article

reports an unusual case of tooth transposition between a molar and a premolar. The correction of this transposition is important and must be done as soon as possible. Pediatric dentists should correctly identify transpositions and understand the therapeutic possibilities.

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