

CASE REPORT

Mandibular Molar Protraction with the Forsus Appliance as Anchorage Reinforcement

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The etiology of dental agenesis is multifactorial, although genetics play an important role.^{1,2} The prevalence is slightly higher in females than in males, and the mandibular arch is more commonly

affected than the maxillary arch.¹⁻³ Excluding the third molars, the lower second premolars are the most frequently missing teeth (3.4%), followed by the upper lateral incisors (2.2%).^{1,4}



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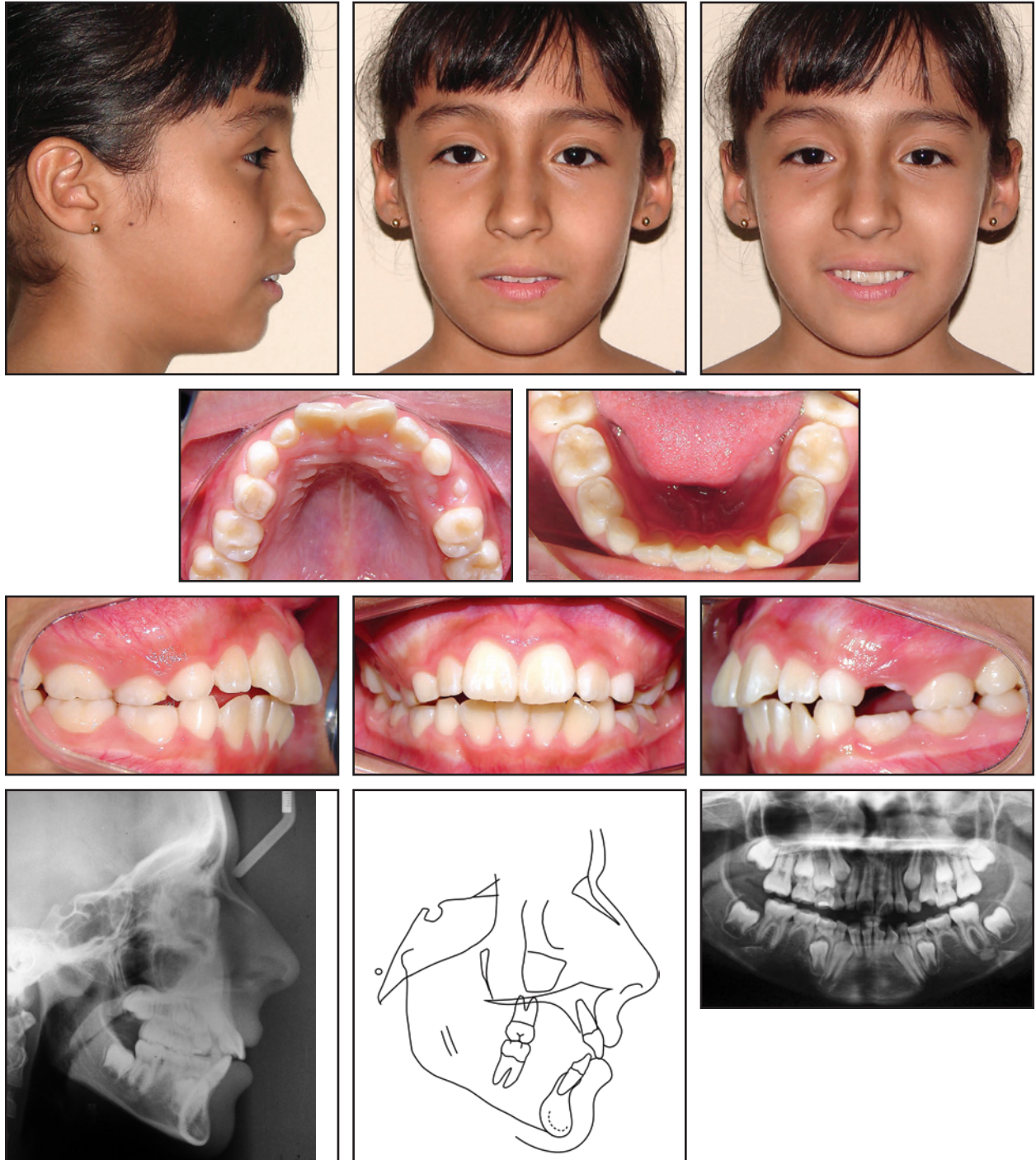
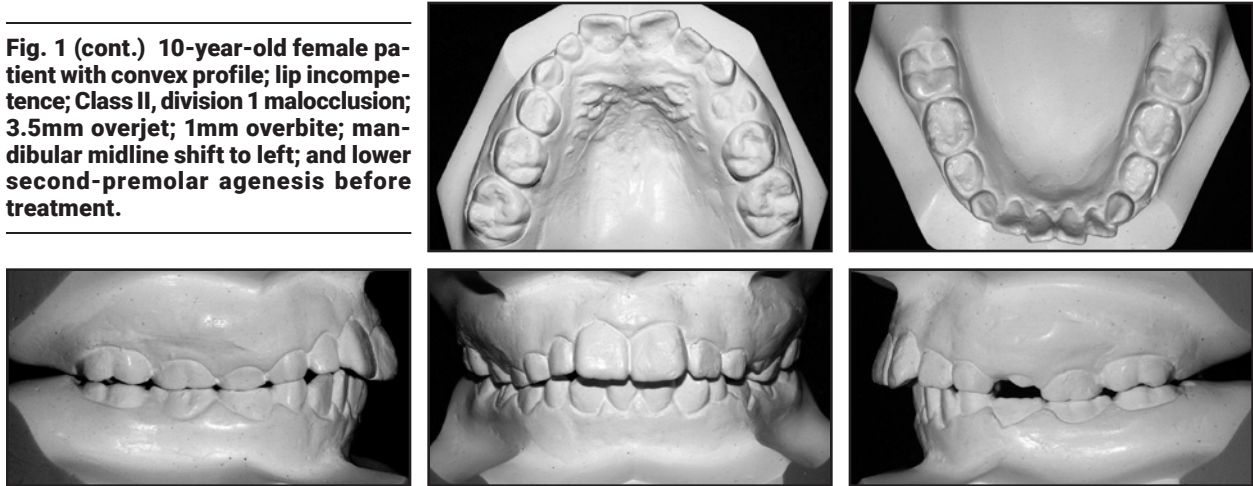


Fig. 1 10-year-old female patient with convex profile; lip incompetence; Class II, division 1 malocclusion; 3.5mm overjet; 1mm overbite; mandibular midline shift to left; and lower second-premolar agenesis before treatment (continued on next page).

Fig. 1 (cont.) 10-year-old female patient with convex profile; lip incompetence; Class II, division 1 malocclusion; 3.5mm overjet; 1mm overbite; mandibular midline shift to left; and lower second-premolar agenesis before treatment.



Orthodontic treatment of patients with agenesis of the lower second premolars and retained lower second molars can be challenging.^{5,6} Potential approaches include simply maintaining the second deciduous molars, which could develop root resorption, ankylosis, or infra-occlusion^{3,7}; maintaining the deciduous molars and redistributing the space through interproximal reduction and composite recontouring^{8,9}; extracting the deciduous molars and closing the spaces with orthodontic appliances¹⁰; or extracting the deciduous molars and replacing them with implants and crowns or fixed bridges.^{8,11}

There are two primary treatment options for younger patients: maintaining the lower second

deciduous molars until the end of growth and development, or extracting the molars and closing the spaces, thus avoiding the wait for facial growth as well as the risks and costs associated with implant and crown placement.^{1,9,12} In subjects with agenesis of the lower second premolars, the long-term survival rate of deciduous molars is more than 90%.^{6,13}

The Forsus fixed functional appliance has been shown to be effective in correcting Class II malocclusion, with effects including restraint of maxillary sagittal advancement, distalization and intrusion of the upper molars, extrusion of the lower first molars, retroclination of the upper incisors, and proclination of the lower incisors.¹⁴⁻¹⁶ Few authors have described its utilization as anchorage reinforcement for mandibular molar protraction,¹⁷ however, particularly in patients with lower second-premolar agenesis. This article describes such a case.

Diagnosis and Treatment Planning

A 10-year-old female presented with the chief complaint of proclined teeth (Fig. 1). Clinical examination showed a convex profile and lip incompetence. The patient was in the mixed dentition, with a Class II, division 1 malocclusion and a peg-shaped

KRAVITZ KEYS

- A Forsus* fixed functional appliance was used as anchorage reinforcement during lower-molar protraction.
- The appliance corrected the Class II malocclusion while avoiding lower-incisor overretraction.
- The bilateral Forsus was placed on a .019" × .025" stainless steel archwire and activated monthly.
- Consolidation was retained with labial wires bonded between the lower first premolars and molars.

*Trademark of 3M, Monrovia, CA; www.3M.com.

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TABLE 1
CEPHALOMETRIC ANALYSIS

	Pretreatment	Post-Treatment	One Year after Treatment
SNA	78.5°	78.0°	78.0°
SNB	72.0°	72.0°	72.0°
ANB	6.5°	6.0°	6.0°
AO-BO	4.0mm	0.5mm	0.0mm
Facial angle	82.0°	80.5°	82.5°
Convexity	12.5°	12.0°	12.0°
FMA	33.0°	36.0°	34.5°
GoGn-SN	41.0°	43.0°	42.0°
Y-axis	64.0°	66.5°	64.5°
1-NA	4.0mm	1.5mm	1.5mm
1-NA	26.0°	20.0°	18.0°
1-NB	7.0mm	7.0mm	6.5mm
1-NB	35.0°	32.5°	32.0°
IMPA	100.5°	96.5°	96.0°
Interincisal angle	113.0°	122.0°	124.0°
Z-angle	65.0°	65.0°	71.0°

upper right lateral incisor. The overjet was 3.5mm, and the overbite was 1mm; the lower midline was shifted 1.5mm to the left.

The panoramic radiograph revealed the absence of the lower second-premolar germs. Cephalometric analysis (Table 1) indicated a skeletal Class II relationship (ANB = 6.5°) and a vertical growth pattern (FMA = 33°, GoGn-SN = 41°). The upper and lower incisors were proclined (1-NA = 26°, 1-NB = 35°).

Treatment objectives were to level and align the dental arches, obtain Class I molar and canine relationships, correct the mandibular midline deviation, maintain the facial profile, and obtain lip competence. The first treatment option involved high-pull headgear for distalization and intrusion of the upper molars to correct the Class II, division 1 malocclusion and control the vertical dimension.

This would be followed by a second phase of fixed appliances, maintaining the lower second deciduous molars. A second alternative was to extract the upper first premolars for correction of the Class II, division 1 malocclusion; extract the lower second deciduous molars; and close the extraction spaces by mesialization of the lower first and second permanent molars. The final option was to distalize the upper first molars with mini-implant anchorage for Class II correction while maintaining the lower second deciduous molars for future implant and crown placement.

The patient had been unable to comply with high-pull headgear during 18 months of attempted Phase I treatment, and the parents rejected the possibility of mini-implant insertion and future implant placement. Therefore, the second treatment option was selected.

Fig. 2 Upper first premolars extracted and .022" × .028" MBT*-prescription brackets bonded.

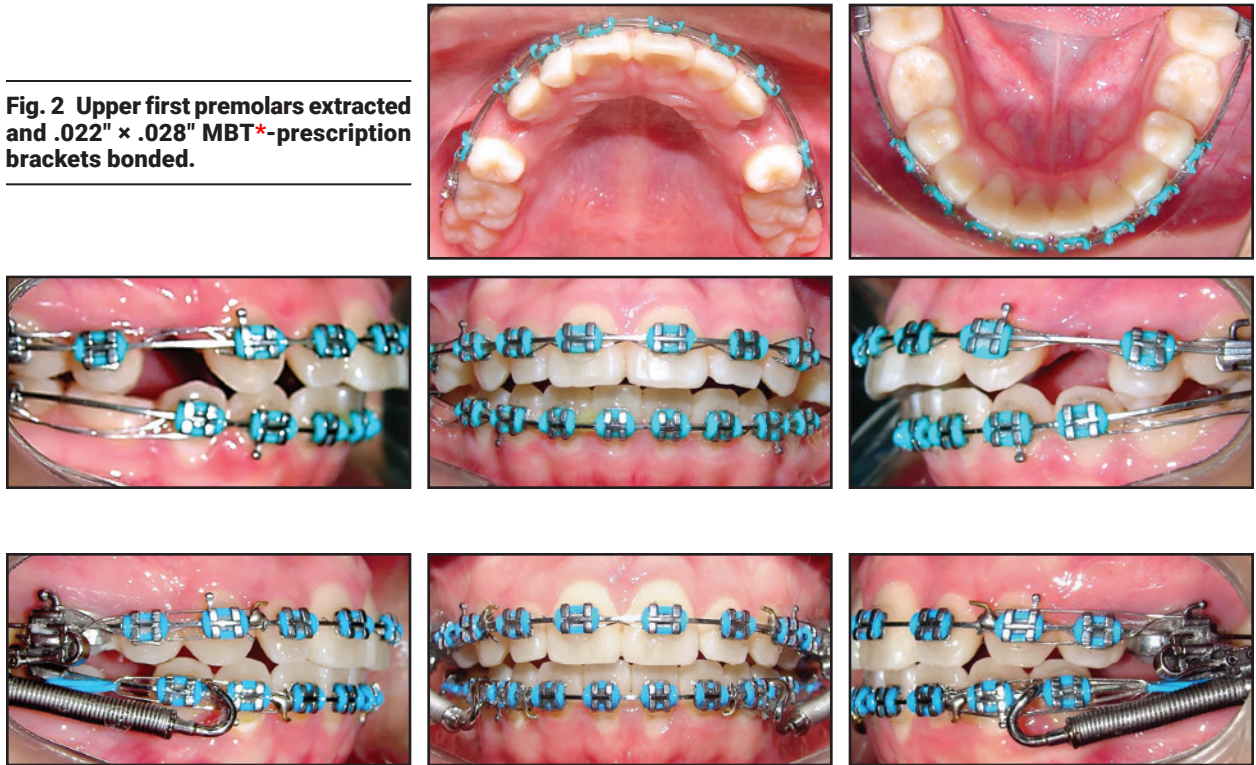


Fig. 3 After seven months of treatment, Forsus* fixed functional appliance placed for anchorage reinforcement during space closure.

Treatment Progress

The upper first premolars were extracted, and .022" × .028" MBT*-prescription metal brackets were bonded (Fig. 2). Leveling and alignment were begun using .016" and .019" × .025" heat-activated nickel titanium archwires. An .016" stainless steel upper 3-3 sectional wire was then used for occlusal seating with vertical elastics. Finally, .019" × .025" stainless steel archwires were placed six months after the full fixed appliances were bonded.

One month later, the leveling was completed and the lower second deciduous molars were extracted. Another week later, bilateral Forsus appliances were placed to reinforce anchorage in the lower anterior segment during space closure with sliding mechanics, thus avoiding unwanted distalization and promoting lower first- and second-molar

mesialization (Fig. 3). Activations were performed once per month for 15 months, and the Forsus was left passively in place for another three months.

Treatment Results

Total active treatment time was four and one-half years (Fig. 4). A removable wraparound retainer was delivered for the upper arch, and lower retainer wires were bonded lingually from canine to canine and buccally between the first premolars and first molars.

Class I molar and canine relationships were obtained, along with proper overjet and overbite, while the facial profile was maintained and lip competence was achieved. The post-treatment panoramic radiographic showed root parallelism and no obvious signs of root resorption. Cephalometric analysis (Table 1) confirmed that the skeletal Class

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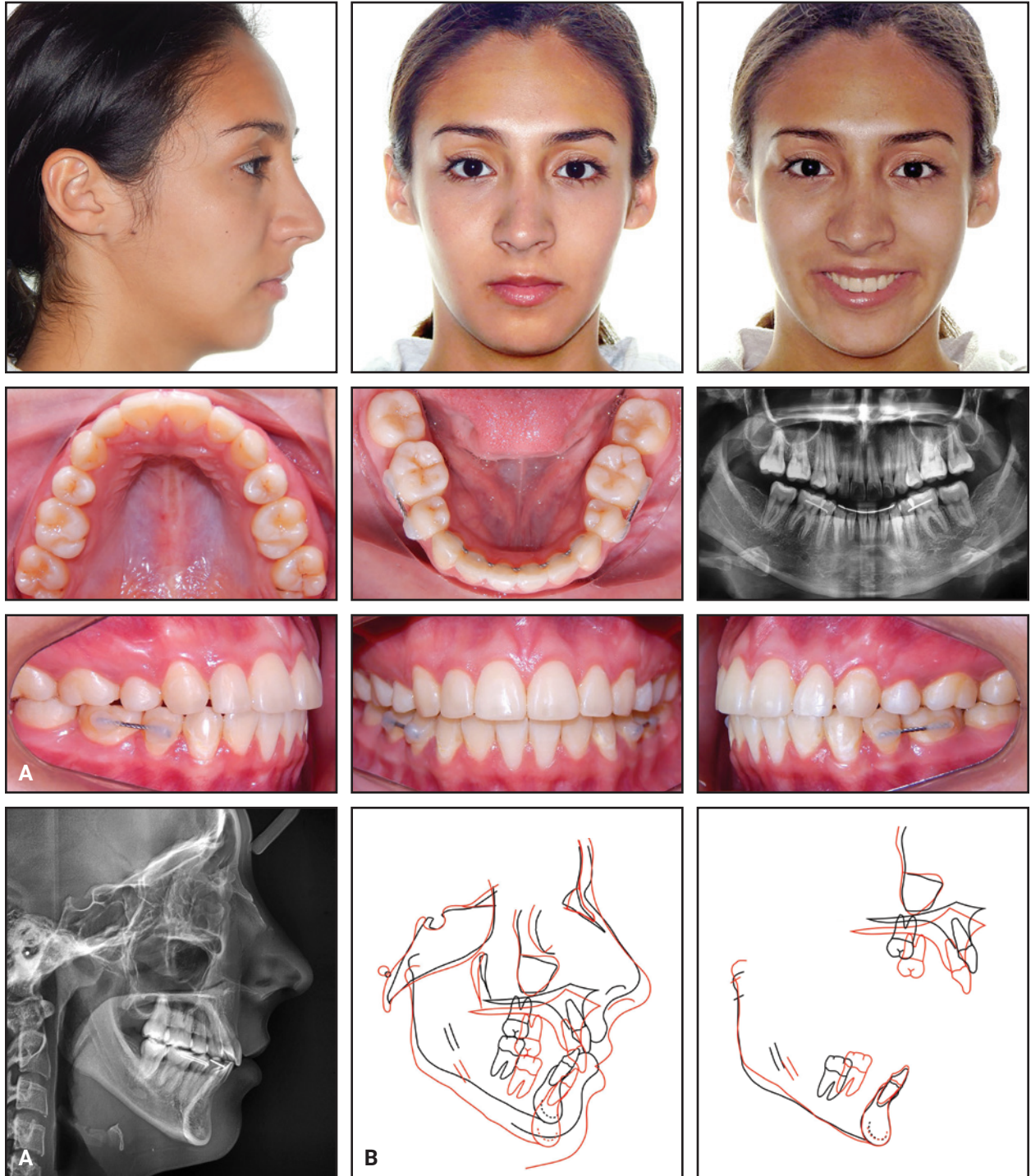
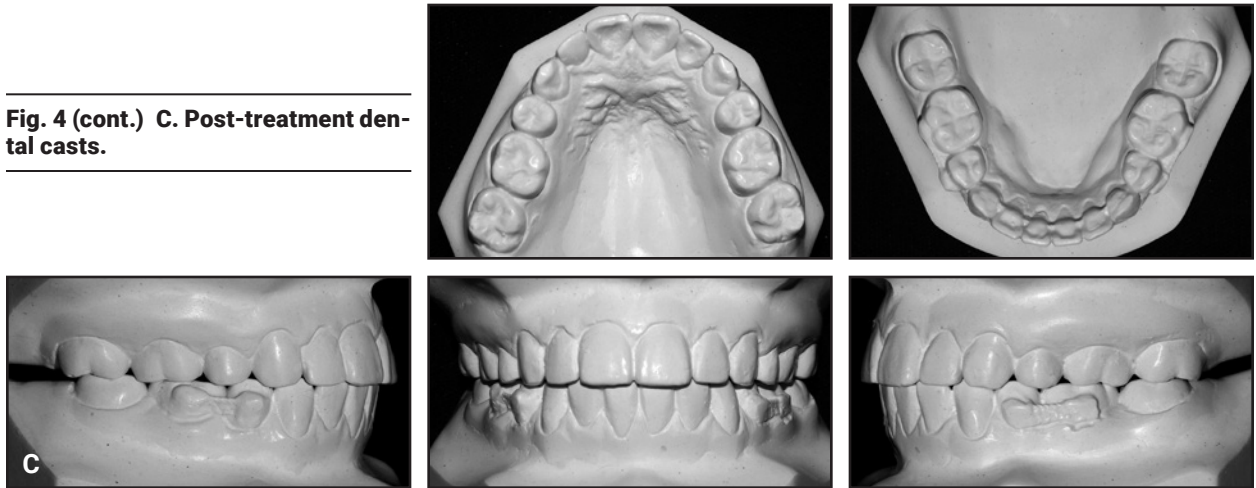


Fig. 4 A. Patient after four and one-half years of active treatment. **B.** Superimposition of pre- and post-treatment cephalometric tracings (continued on next page).

Fig. 4 (cont.) C. Post-treatment dental casts.



II relationship ($ANB = 6^\circ$) and the vertical growth pattern ($FMA = 36^\circ$, $GoGn-SN = 43^\circ$) remained almost unchanged. The upper incisors were well positioned ($1-NA = 20^\circ$), but the lower incisors remained proclined ($1-NB = 32.5^\circ$) because of the Class II dental camouflage treatment. These results remained stable one year later (Fig. 5).

Discussion

The treatment plan for a case involving mandibular second premolar agenesis must be based on the patient's individual characteristics.^{9,12,18} Space closure after extraction of retained deciduous molars with no permanent successors is indicated when the patient exhibits lip protrusion, incisor proclination, anterior crossbite, or crowding. On the other hand, the option of preserving healthy lower second deciduous molars is a viable alternative in a case where space closure would be unfavorable for the facial profile, or in the presence of Class II malocclusion or excessive overjet and overbite. In the present case, the upper first premolars and lower second deciduous molars were extracted despite the Class II malocclusion, since the parents declined the option of maintaining the deciduous molars for future implant rehabilitation.

To avoid undesirable side effects such as lower-incisor distalization and loss of a Class I canine relationship during space closure by lower-

molar protraction, the anchorage needs to be reinforced in the lower anterior segment. This can be achieved with the use of mini-implants as direct or indirect temporary skeletal anchorage^{19,20} or with fixed functional appliances.¹⁷ In the case shown here, the Forsus prevented loss of anchorage and kept the lower anterior teeth in their desired positions during space closure. In the upper arch, the Forsus distalized and intruded the molars and retroclined the incisors. In addition, unlike Class II elastics or removable functional appliances, the fixed Forsus device does not depend on patient compliance.²¹ Although breakage and soft-tissue irritation have been reported as disadvantages of the Forsus,²² these issues did not arise in our case.

Lower second-premolar agenesis is often associated with microdontia of the upper lateral incisors.²³ Interdisciplinary treatment involving orthodontics and prosthodontics should always be considered to provide the best possible esthetic results.⁹ In our patient, the undersize upper lateral incisors, especially the peg-shaped right lateral incisor, were cosmetically recontoured before finishing and removal of the fixed appliances.

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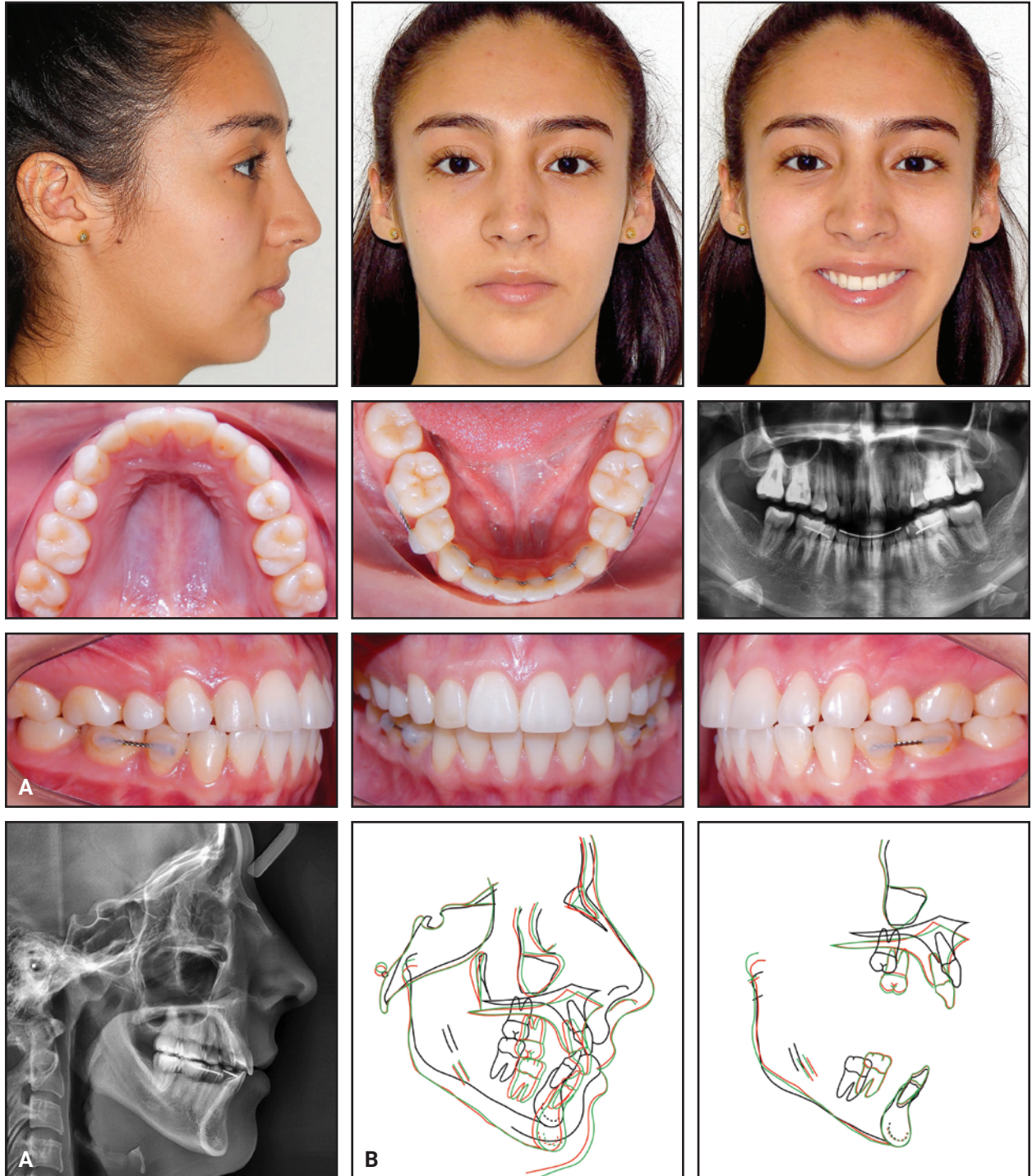


Fig. 5 A. Patient one year after treatment. **B.** Superimposition of pretreatment, post-treatment, and one-year post-treatment cephalometric tracings.

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