

Space Closure for Congenitally Missing Lower Second Premolars Using Temporary Anchorage Devices

SEUSS KASSISIEH, DDS, MS
NATASHA BODIROGA, DMD
JAY GOUSMAN, DMD

Lower second premolars are the most common congenitally missing teeth next to third molars, with a prevalence of 2.5-5% in the United States and Europe.¹ A reliable diagnosis usually requires waiting until the patient is at least 9 years old to confirm whether the permanent teeth are absent.^{2,3} This case series highlights the use of temporary anchorage devices (TADs) for orthodontic space closure.

Treatment Protocol

All five patients and their parents chose space closure with skeletal anchorage after being presented with various treatment options.

Following bracket placement and initial leveling and alignment, the deciduous lower second premolars were extracted. TADs were placed between the lower canines and premolars for anchorage control, and .019" × .025" stainless steel sectional wires were attached from the TADs to the lower first premolars (Fig. 1). The eight mandibular teeth anterior to the edentulous areas were coligated to create an anchorage unit for simultaneous protraction of the lower first and second

KRAVITZ KEYS

- ➡ Temporary anchorage devices are placed between the lower canines and first premolars.
- ➡ Molars are protracted on an .019" × .025" stainless steel reverse-curve archwire.
- ➡ The teeth anterior to the edentulous space are coligated.
- ➡ An upper Essix* retainer prevents upper second molar supraeruption.

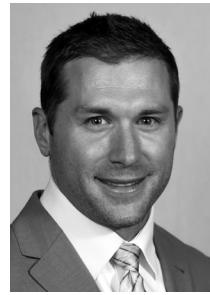
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Dr. Kasssieh



Dr. Bodioga



Dr. Gousman

Dr. Kasssieh is in the private practice of orthodontics in Scottsdale, Paradise Valley, and Ahwatukee, AZ, and a clinical professor at Arizona School of Dentistry & Oral Health, 5835 E. Still Circle, Mesa, AZ; e-mail: 1drseuss@gmail.com. Dr. Bodioga is in the private practice of dentistry in Woodburn, OR. Dr. Gousman is in the private practice of orthodontics in Phoenix.

molars on an .019" × .025" stainless steel reverse-curve archwire. Lingual buttons were used to counteract molar rotation and to enhance space closure. Class II elastics were worn throughout space closure to help protract the molars and to lose anchorage.

Finishing and detailing were performed before the brackets were debonded. A lower 3-3 retainer was bonded, and a removable upper Essix retainer was delivered. During periodic follow-ups, stability was verified and third-molar positions were monitored.



Fig. 1 Bilateral temporary anchorage devices placed between lower canines and first premolars following removal of retained deciduous second premolars.

SPACE CLOSURE FOR CONGENITALLY MISSING LOWER SECOND PREMOLARS

CASE 1

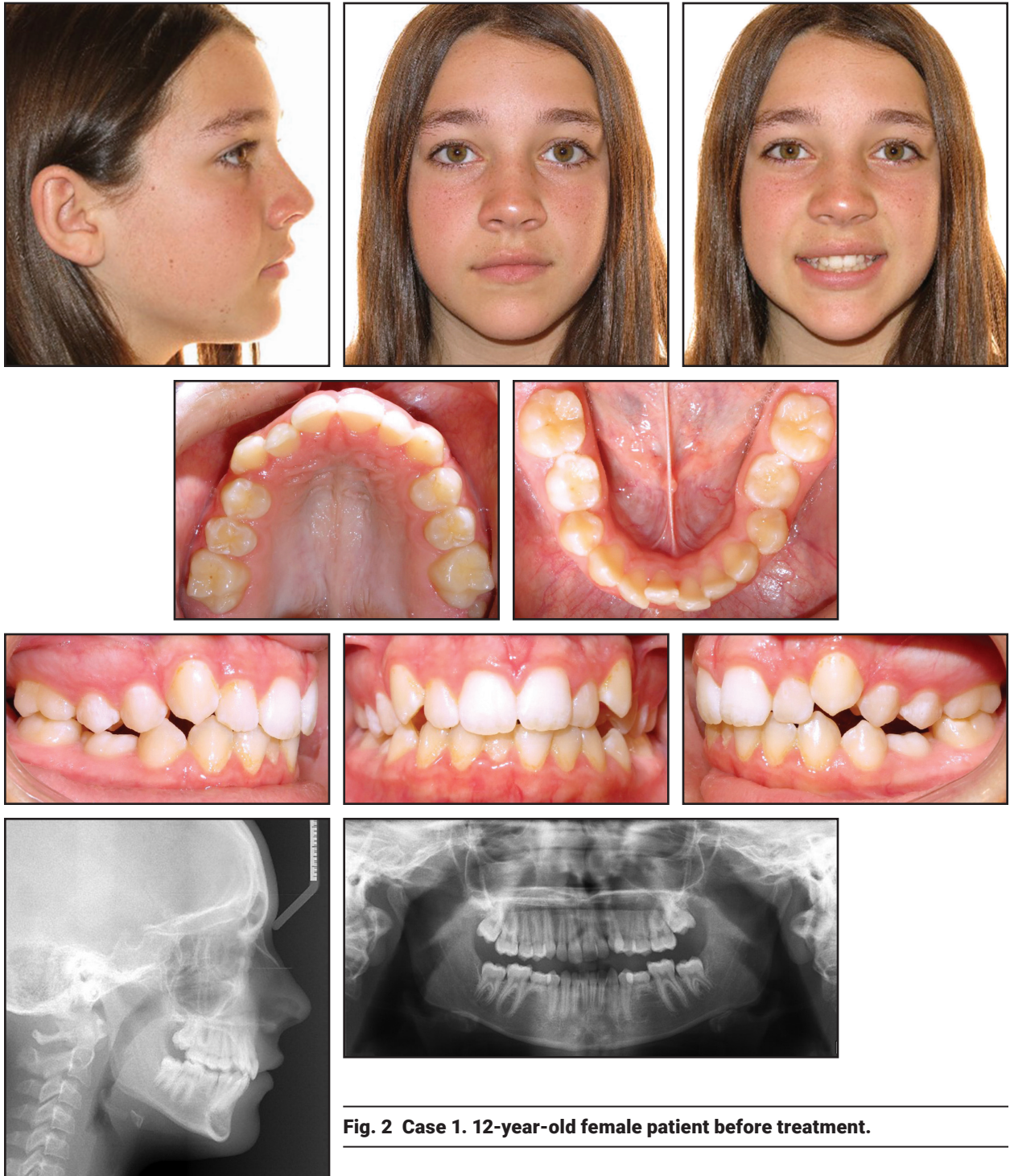


Fig. 2 Case 1. 12-year-old female patient before treatment.

CASE 1

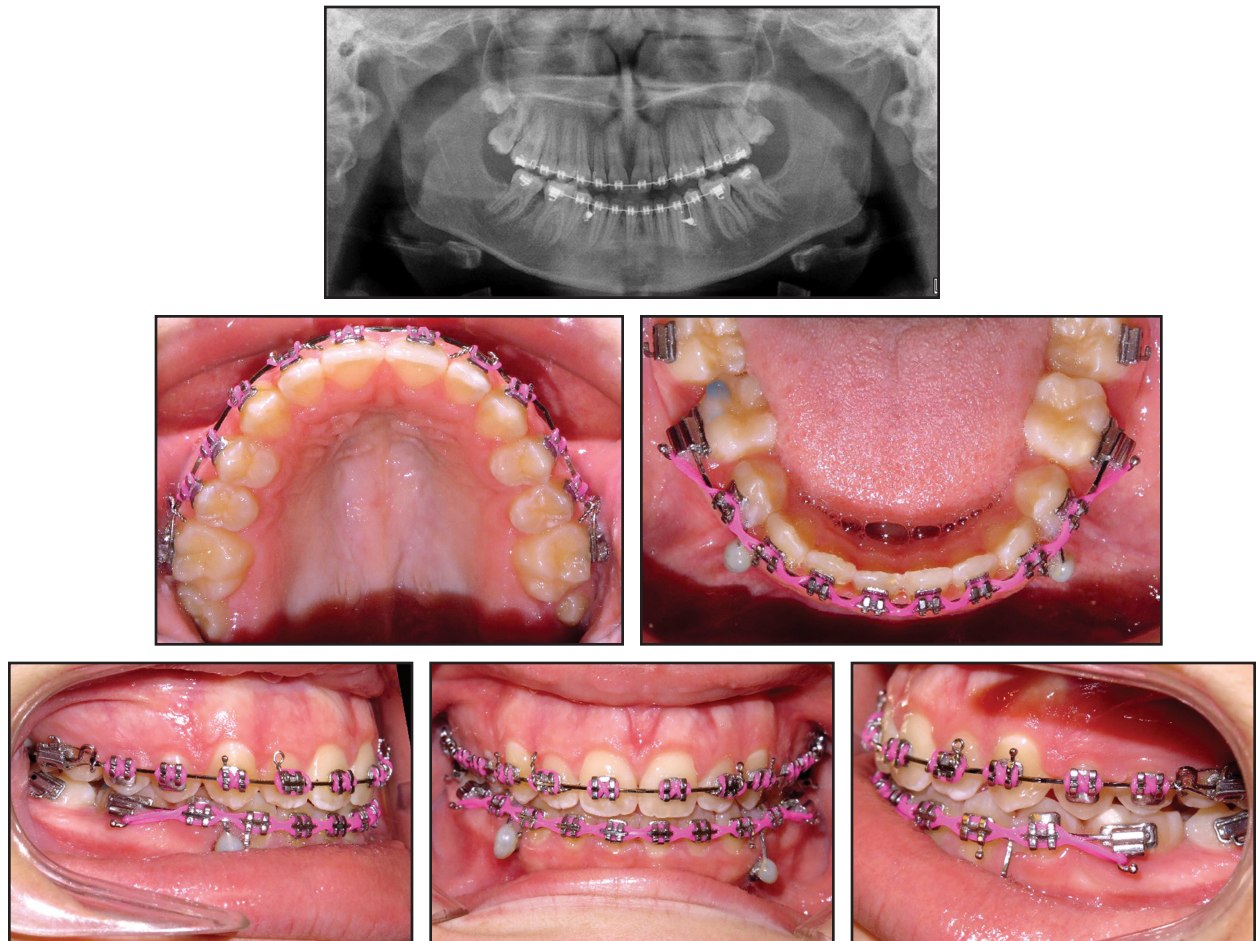


Fig. 3 Case 1. After 17 months of treatment.

SPACE CLOSURE FOR CONGENITALLY MISSING LOWER SECOND PREMOLARS

CASE 1

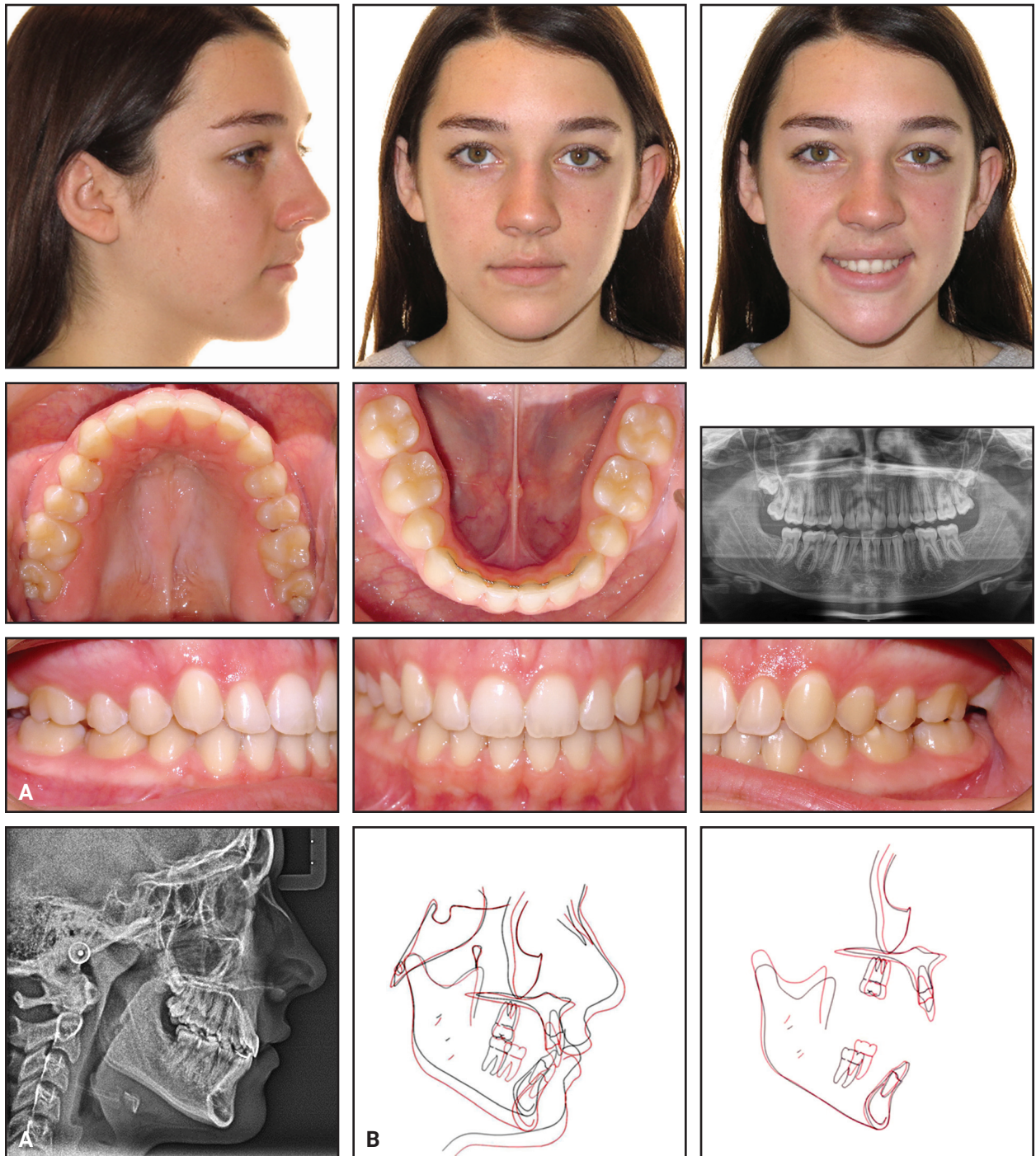


Fig. 4 Case 1. A. Patient after 27 months of treatment. B. Superimposition of pre- and post-treatment cephalometric tracings.

CASE 2

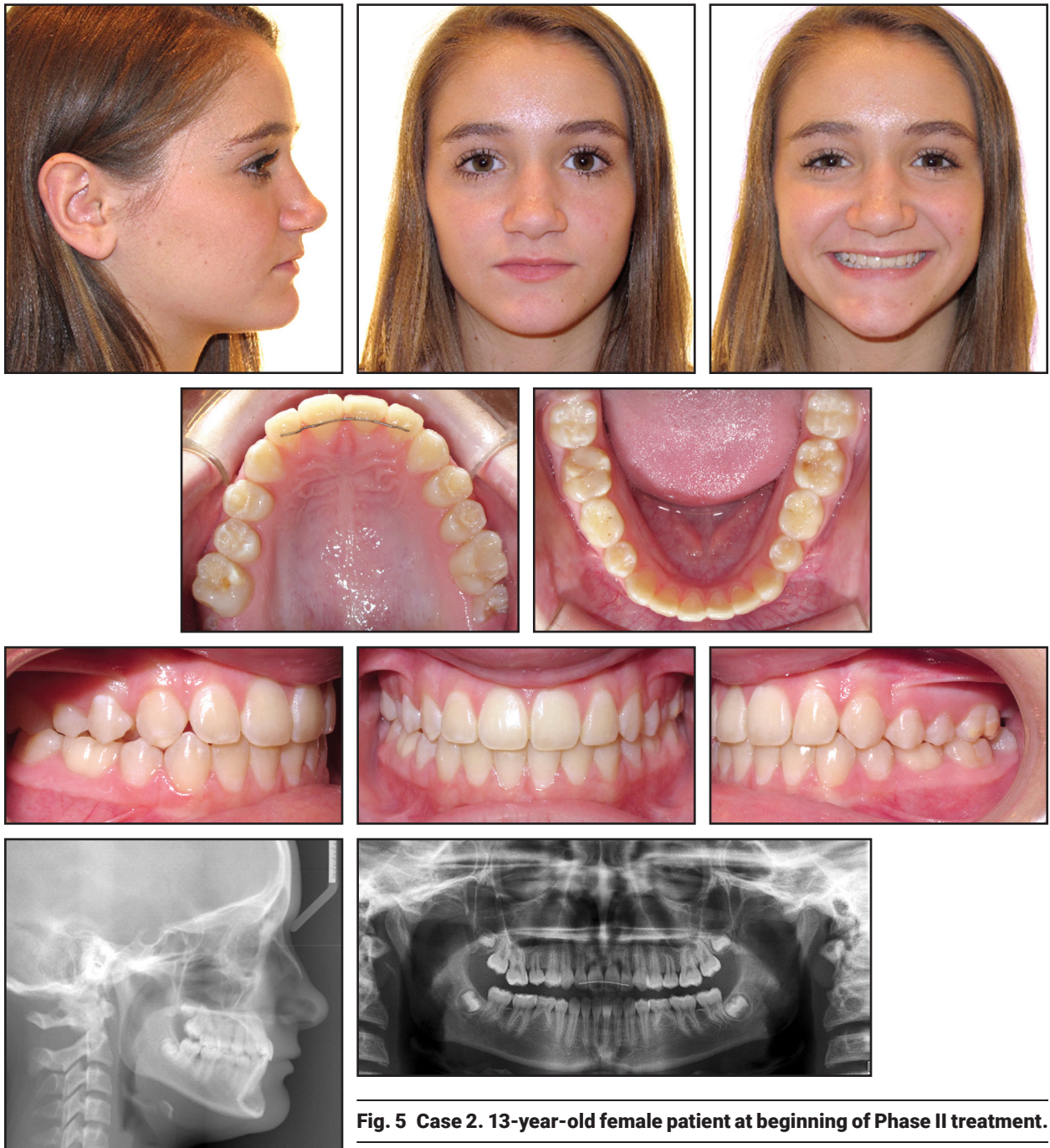


Fig. 5 Case 2. 13-year-old female patient at beginning of Phase II treatment.

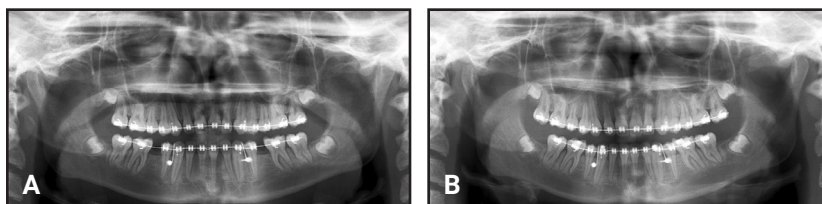


Fig. 6 Case 2. A. After 11 months of treatment. B. After 17 months of treatment.

SPACE CLOSURE FOR CONGENITALLY MISSING LOWER SECOND PREMOLARS

CASE 2

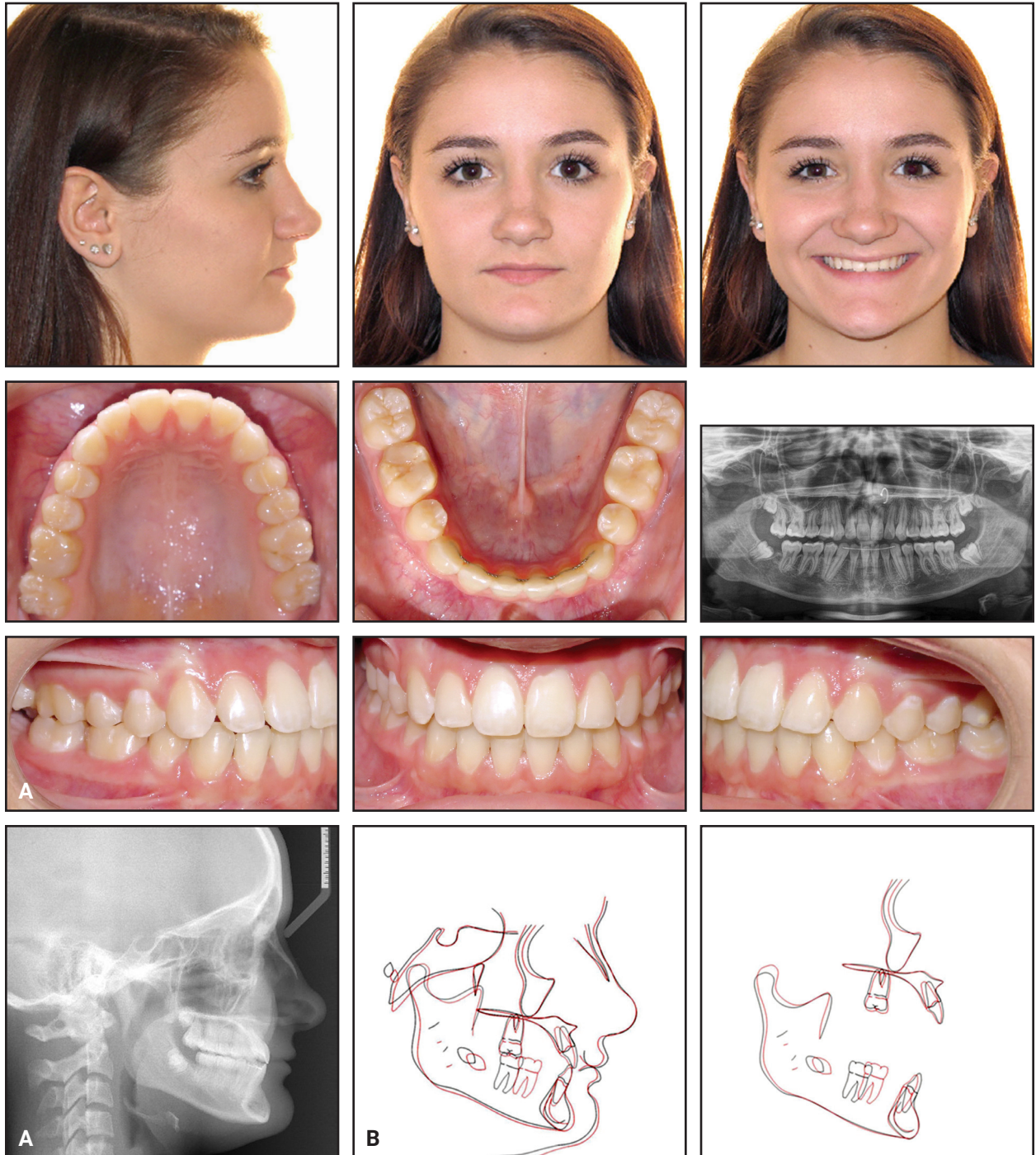
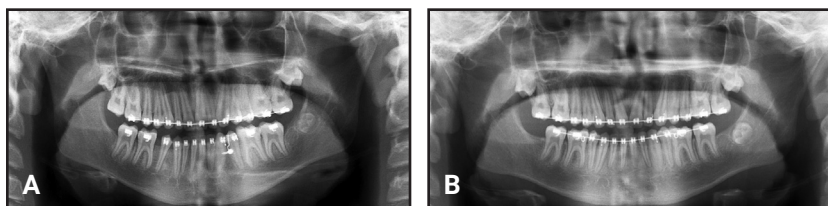
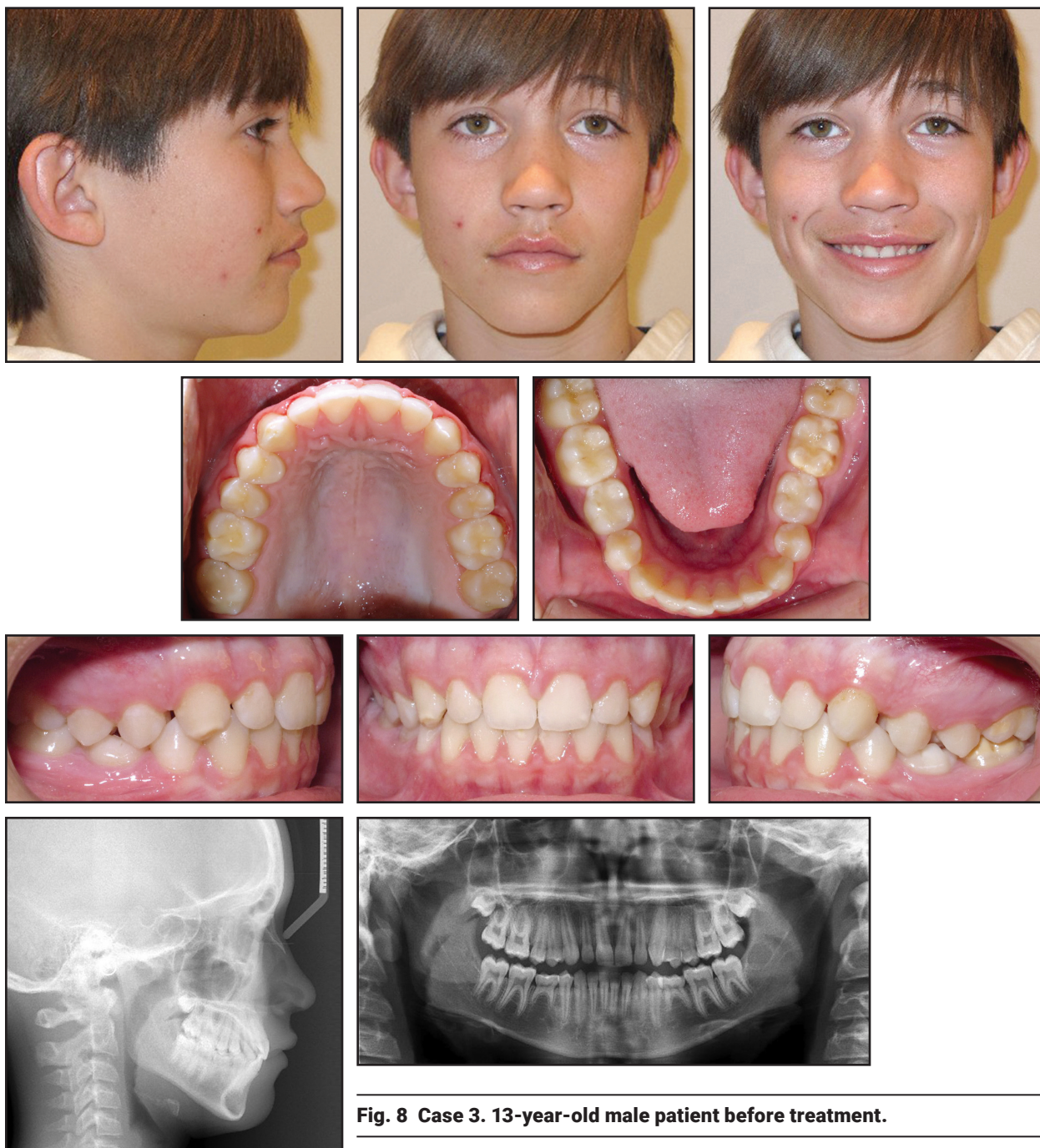


Fig. 7 Case 2. A. Patient after 24 months of treatment. B. Superimposition of pre- and post-treatment cephalometric tracings.

CASE 3



SPACE CLOSURE FOR CONGENITALLY MISSING LOWER SECOND PREMOLARS

CASE 3

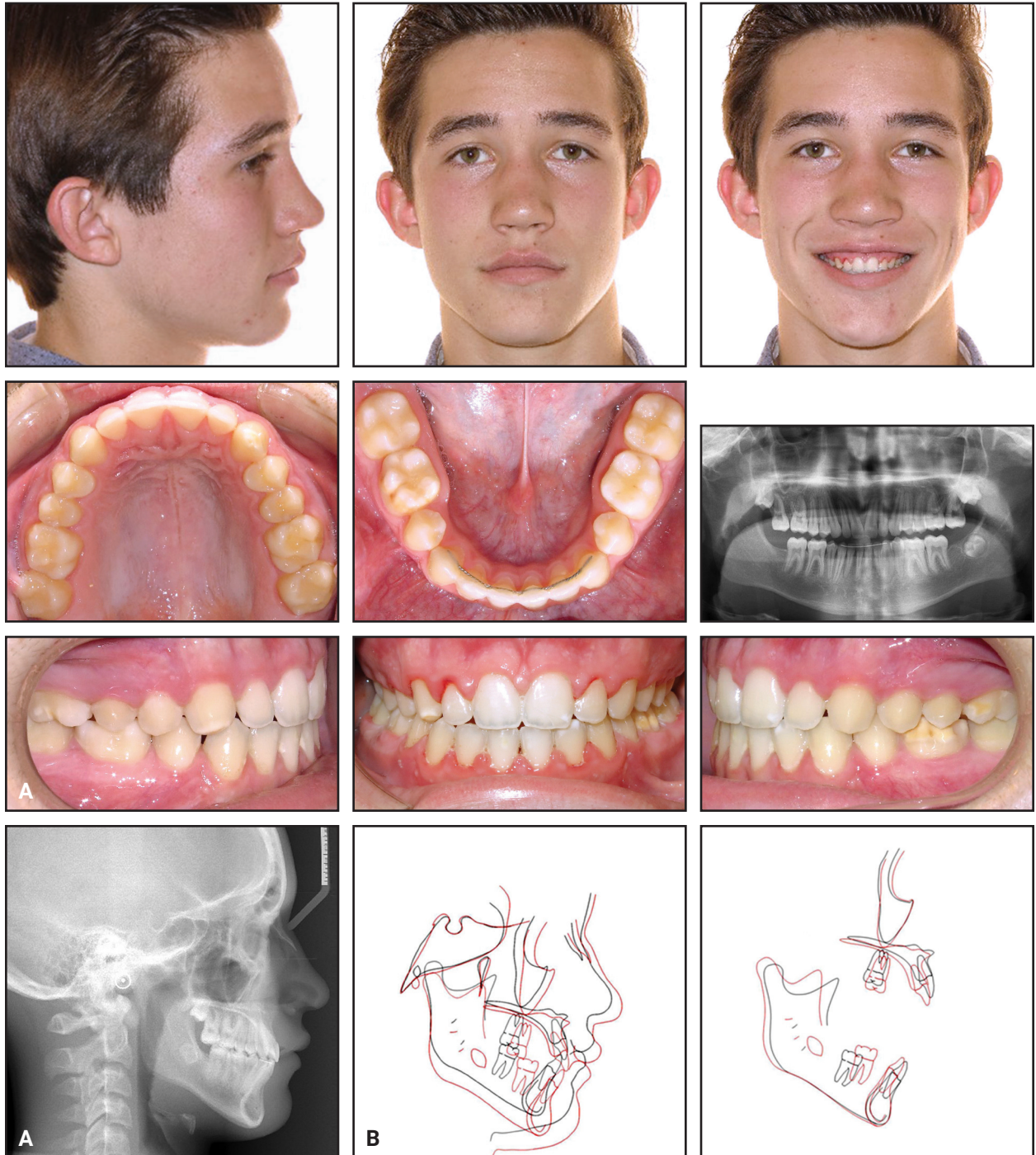


Fig. 10 Case 3. **A.** Patient after 26 months of treatment. **B.** Superimposition of pre- and post-treatment cephalometric tracings.

CASE 4

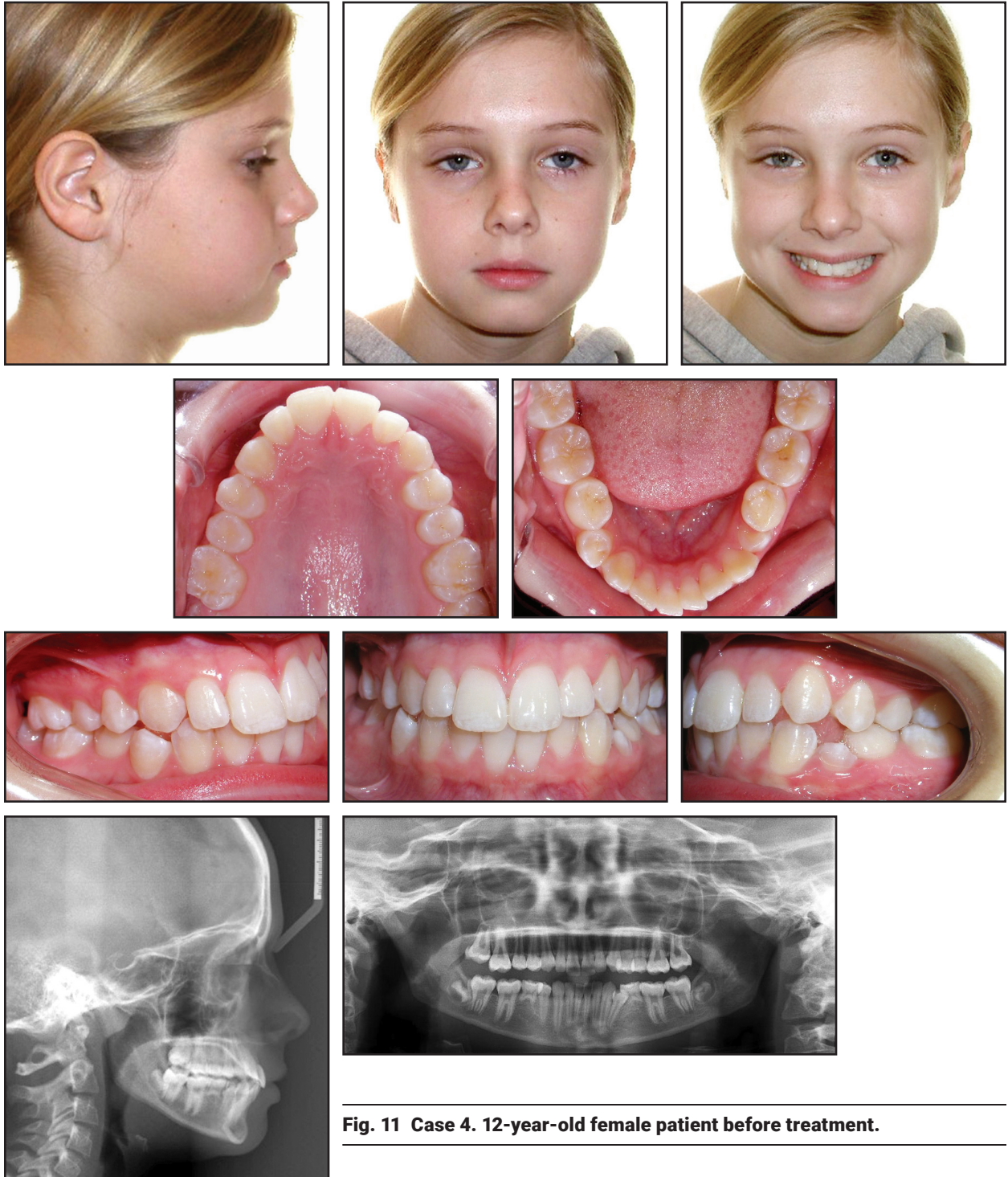


Fig. 11 Case 4. 12-year-old female patient before treatment.

SPACE CLOSURE FOR CONGENITALLY MISSING LOWER SECOND PREMOLARS _____

CASE 4

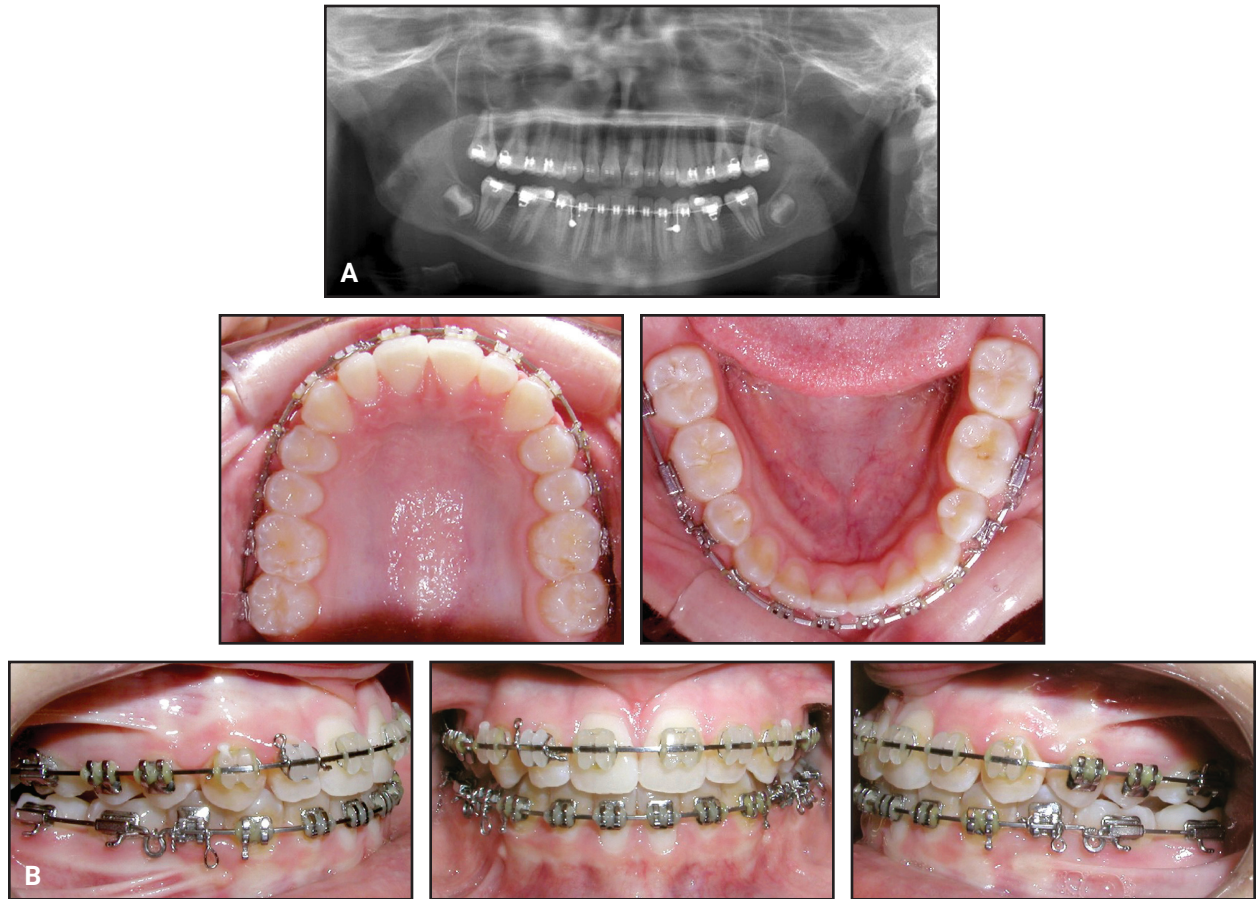


Fig. 12 Case 4. A. After 13 months of treatment. B. After 20 months of treatment.

CASE 4

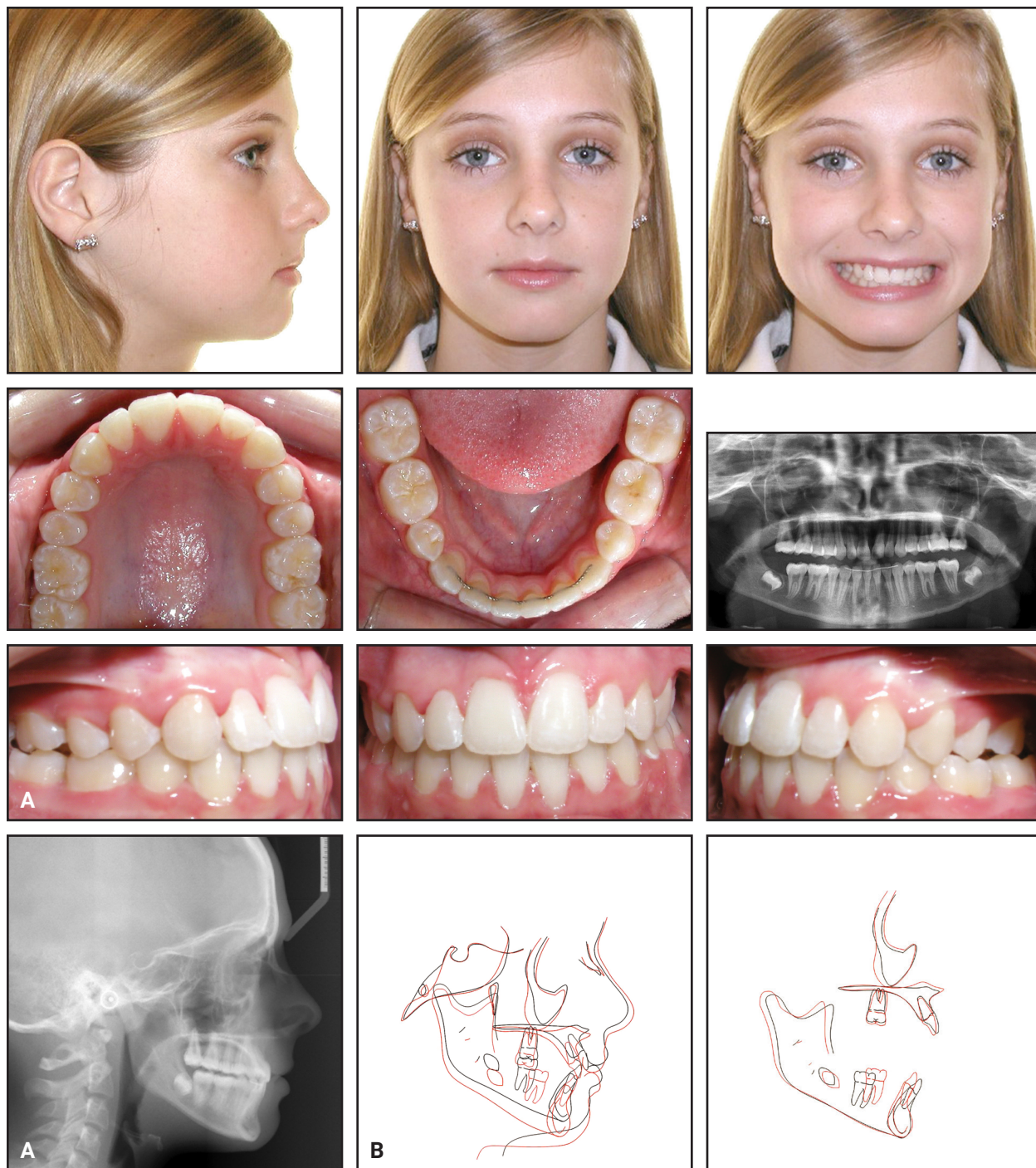


Fig. 13 Case 4. A. Patient after 27 months of treatment. B. Superimposition of pre- and post-treatment cephalometric tracings.

SPACE CLOSURE FOR CONGENITALLY MISSING LOWER SECOND PREMOLARS

CASE 5

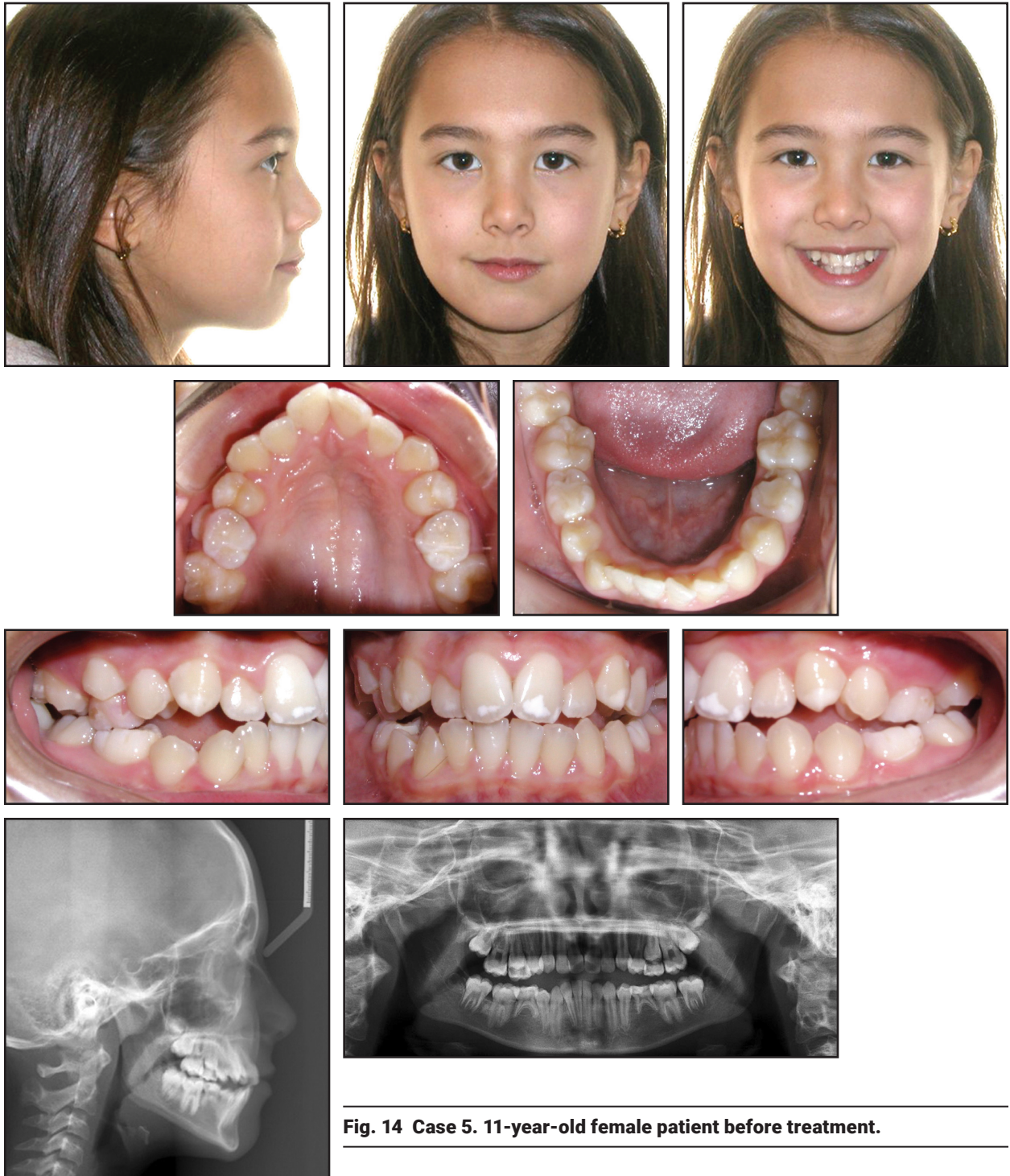


Fig. 14 Case 5. 11-year-old female patient before treatment.

CASE 5



Fig. 15 Case 5. After 21 months of treatment.

SPACE CLOSURE FOR CONGENITALLY MISSING LOWER SECOND PREMOLARS

CASE 5

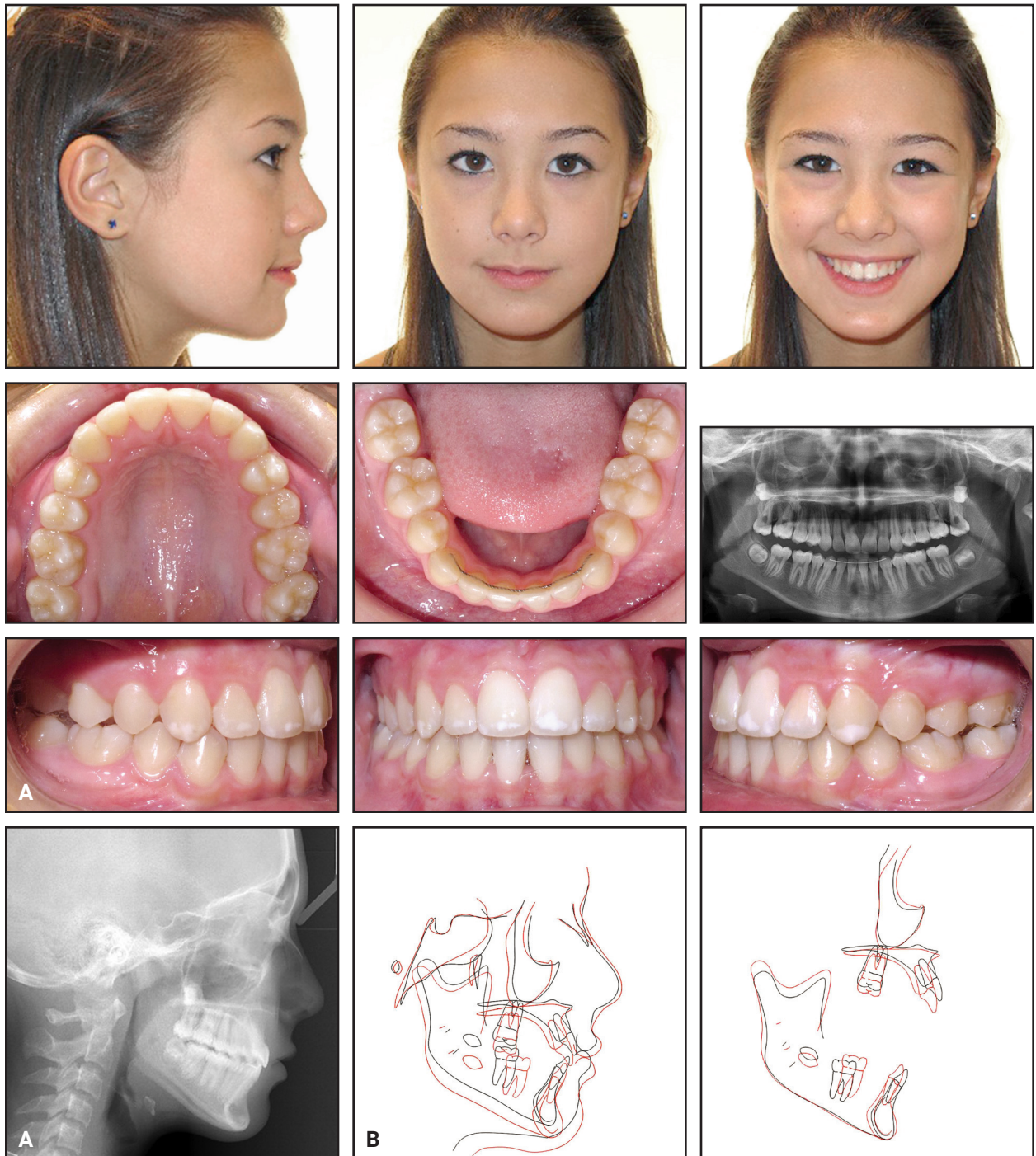


Fig. 16 Case 5. A. Patient after 34 months of treatment. B. Superimposition of pre- and post-treatment cephalometric tracings.

Discussion

Congenitally missing teeth have important implications for alignment of the permanent dentition. The amount of missing dental material must be compared to the space available before determining a treatment plan. Ultimately, the type of malocclusion, degree of crowding, and facial profile will be the driving factors.⁴

Several viable treatment options should be considered when treating a patient with congenitally missing lower second premolars (Table 1). Some cases indicate space closure, but other cases do not.

TABLE 1
TREATMENT OPTIONS FOR
CONGENITALLY MISSING LOWER
SECOND PREMOLARS

Treatment Option	Studies
Keep deciduous tooth (if not ankylosed)	Bjerklin and Bennett ⁵ Ith-Hansen and Kjaer ⁶
If deciduous tooth is ankylosed, restore with ceramic onlay	Evans and Briggs ⁷
Extract deciduous tooth and make space for implant placement	ADA Council ⁸ Sabri ⁹
Reduce mesiodistal width of second deciduous molar to make space for implant	Kokich and Kokich ¹⁰
Extract primary tooth and close space orthodontically	Fines et al. ¹
Autotransplantation	Andreasen et al. ¹¹ Josefsson et al. ¹²
Move lower first premolar into second-premolar site, then place implant in first-premolar site	Kokich and Fudalej ¹³
Close space using fixed appliances and functional appliance therapy	Postema ¹⁴

Although the deciduous tooth can be maintained if it is not ankylosed, its longevity is unpredictable due to the high risk of root resorption between ages 11 and 20.⁵ Ith-Hansen found that after age 20, the chances of resorption and negative sequelae are negligible, with expected survival in patients up to 60 years old.⁶ Most clinicians have chosen to leave the deciduous tooth in place as long as possible to maintain space; if the tooth exfoliates or needs to be extracted in adulthood, however, it will require prosthetic replacement and perhaps further orthodontic treatment. Others have advocated extraction of the second deciduous molars due to the risk of ankylosis, which could result in a vertical bone defect. This can lead to tipping of adjacent teeth and sometimes supraeruption of the opposing tooth (Fig. 17).^{15,16}

Extraction of the deciduous molars and eventual implant placement requires about 7-8mm of mesiodistal space to be created, with parallel adjacent roots. The outcome must then be retained, often for many years,^{17,18} since implants are normally placed only upon completion of facial growth (around age 17 for females and 21 for males).¹³ Further, the upper second premolars must not be allowed to erupt or supraerupt into the congenitally missing edentulous spaces. Placement of implants in the late teens or early 20s may require onlay bone grafts and additional bone grafting during implant placement.¹⁹ While the 10-year success rate of single-tooth implants



Fig. 17 Sequelae following ankylosis of tooth: vertical bone deficiency, tipping of adjacent teeth, and supraeruption of opposing tooth.

SPACE CLOSURE FOR CONGENITALLY MISSING LOWER SECOND PREMOLARS

in the mandible is reportedly 90-95%, the lifetime expectancy of such an implant is undetermined.²⁰ After the initial 1-1.5mm of leveling during the first year after implant placement, less than .2mm of bone loss is predicted to occur each year.²¹ The crown will likely need replacement every 10-15 years, however, due to material degradation or failure.²²

The use of TADs now facilitates treatment outcomes that were previously unattainable. Judicious biomechanics and controlled tooth movements can produce excellent health, function, and esthetics without surgical or prosthetic treatment and the accompanying financial and surgical burdens.

Perhaps the only drawback of the procedure described here is that the upper second molars may not finish in occlusion with the lower arch. Special care should be taken during the retention phase—including diligent wear of a vacuum-formed retainer that extends over the teeth—to prevent supraeruption of the upper second molars. If the lower third molars are present, they should not be extracted, since they can provide occlusal contacts for the upper second molars. Protraction of the lower first and second molars will provide adequate space to accommodate the lower third molars.

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