

# CASE REPORT

## Molar-Stabilizing Power Arm and Miniscrew Anchorage for Anterior Retraction

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In severely protrusive patients, anchorage loss can occur with the use of conventional sliding mechanics for closure of first premolar extraction spaces.<sup>1-3</sup> Direct skeletal anchorage from miniscrews is often used to avoid this problem. The preferred miniscrew location to achieve the proper force vector, directed toward the center of resistance (CRes) of the posterior teeth, is between the roots of the second premolar and first molar or the first and second molars.<sup>4</sup> Because the attached gingiva is limited in the molar region, however, the screws must be placed in loose mucosa, where the risks of infection and failure

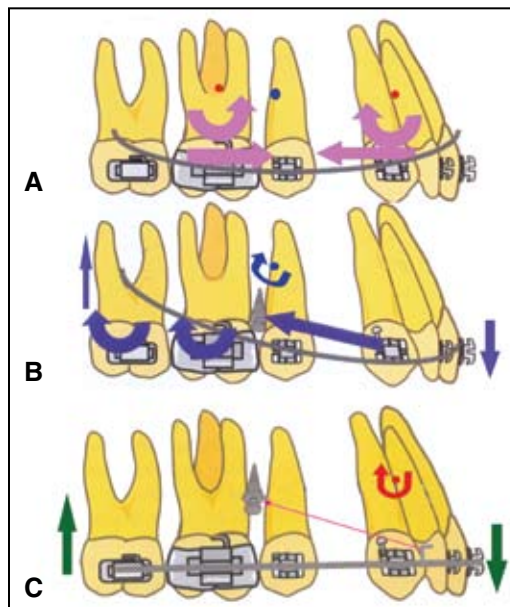
are higher.<sup>5-7</sup> In addition, undesirable biomechanical side effects are possible in all three planes of space when continuous-arch sliding mechanics are used with miniscrew anchorage.<sup>8</sup>

With conventional sliding mechanics and no skeletal anchorage, extraction spaces are typi-

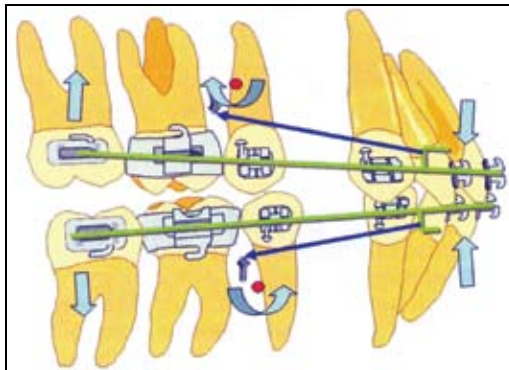
cally closed by attaching the retraction assembly between an anterior hook and the second molars. In the sagittal plane, the anterior and posterior segments rotate around their respective centers of rotation (CR), causing a bowing of the archwire (Fig. 1A). Use of curved archwires can pre-



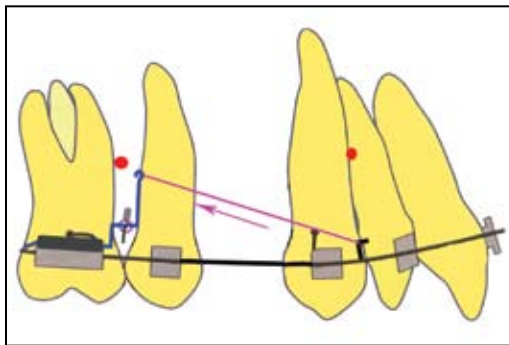
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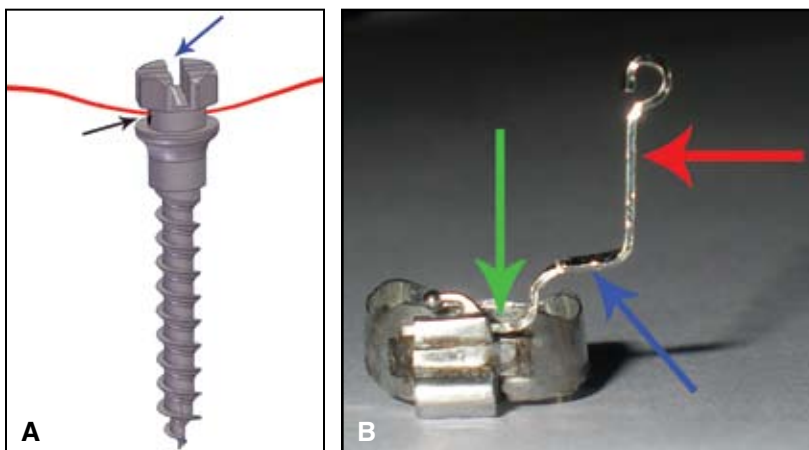
**Fig. 1** Effects of space closure with sliding mechanics. **A.** Anterior and posterior segments rotate around each center of rotation (CR); archwire is forced to bend near CR of entire arch. **B.** Retraction force from continuous archwire with miniscrew anchorage produces rotation of entire arch around CR. **C.** With rotation of anterior segment around CR, intrusive force on posterior teeth causes posterior open bite and anterior deep bite.



**Fig. 2** In severe bimaxillary protrusion case, space closure with sliding mechanics can produce posterior open bite and deep overbite.



**Fig. 3** Biomechanics of molar-stabilizing power arm (MSPA): vector of retraction force is directed upward and backward, toward center of resistance of posterior segment.



**Fig. 4** A. Miniscrew with rectangular slot (blue arrow) in bracket head; hole beneath and perpendicular to slot is used to thread ligature wire (black arrow) securing MSPA. B. MSPA components: hooked vertical end (red arrow), horizontal middle section (blue arrow), and horizontal end section for insertion into molar auxiliary tube (green arrow).

vent this effect.

Miniscrew anchorage yields different mechanics. Because the retraction force is not reciprocal, either the entire arch (Fig. 1B) or the anterior segment (Fig. 1C) will rotate around its CR. In cases of severe protrusion, where maximum anchorage is required in both arches, these mechanics can produce posterior open bite and anterior deep bite (Fig. 2). Curved archwires will exert an even stronger intrusive force on the posterior segment (Fig. 1B,C). Therefore, such mechanics must be used cautiously in low-angle and deep-bite cases.

In addition, because a loss of posterior occlusion can cause symptoms of TMD, the clinician must ensure that some posterior contact exists on both sides. This may require placement of additional anterior miniscrews for intrusion. In the horizontal plane, since the morphology of the upper molars provides less resistance to rotation, the upper molars tend to tip more palatally than the lower molars do, promoting the development of buccal crossbite.

This article shows how a molar-stabilizing power arm (MSPA) can be used to overcome the problems of posterior intrusion and intermolar constriction (Fig. 3) while avoiding the need for miniscrew placement in the loose mucosa.

## Technique

1. Insert miniscrews as needed for anchorage in the attached gingiva between the second premolar and first molar roots. Use a brack-

et-head screw with a ligature hole perpendicular to the slot (Fig. 4A). Keep the miniscrew slot as parallel as possible to the occlusal plane to promote optimal functioning of the MSPA.

2. Construct the MSPA from .017" × .025" stainless steel wire (for .018" appliances) or .019" × .025" stainless steel wire (for .022" appliances), in three parts: a hooked vertical end, a horizontal middle section, and a horizontal end section for insertion into the molar auxiliary tube (Fig. 4B). Determine the length of the MSPA's vertical end according to the depth of the buccal vestibule, and angle this end to position the hook near the CRes of the posterior teeth. Bend the hook into a rounded shape to avoid mucosal impingement.

3. Place 1st-order bends as required so that the MSPA's middle section will passively engage the slot in the miniscrew head after the distal end section is inserted into the auxiliary tube.

4. Thread a ligature wire through the hole beneath the miniscrew slot, then insert the end section of the MSPA into the auxiliary tube. Secure the middle section of the MSPA to the miniscrew slot by twisting the threaded ligature wire, and tuck in the wire ends.

6. Connect a nickel titanium coil spring from the hook of the MSPA to an anterior archwire hook (3-5mm long). The coil spring will generate upward and backward retraction forces.

7. Adjust the hooked vertical end of the MSPA so that the retraction assembly clears the alveolar mucosa.

**TABLE 1**  
**CEPHALOMETRIC DATA**

|                    | Pretreatment | Post-Treatment |
|--------------------|--------------|----------------|
| SNA                | 82.8°        | 81.8°          |
| SNB                | 80.3°        | 79.3°          |
| ANB                | 2.5°         | 2.5°           |
| FMA                | 18.0°        | 19.0°          |
| U1-NA              | 33.9°        | 19.5°          |
| L1-NB              | 33.5°        | 19.7°          |
| U1-NA              | 10.0mm       | 5.0mm          |
| L1-NB              | 9.0mm        | 4.0mm          |
| Interincisal angle | 110.0°       | 138.0°         |
| PFH/AFH            | 81.0%        | 80.0%          |
| FH-OP              | 3.0°         | 5.0°           |
| FH-UI              | 123.0°       | 109.0°         |
| U1-SN              | 116.5°       | 102.0°         |
| IMPA               | 105.0°       | 92.0°          |
| Z angle            | 59.0°        | 76.0°          |
| Upper lip-E line   | 2.0mm        | -2.0mm         |
| Lower lip-E line   | 4.0mm        | 0.0mm          |
| U1-APog            | 12.0mm       | 5.0mm          |
| Holdaway ratio     | 10.0mm       | 3.0mm          |
| Wits               | 0.0mm        | 0.0mm          |

### Diagnosis and Treatment Planning

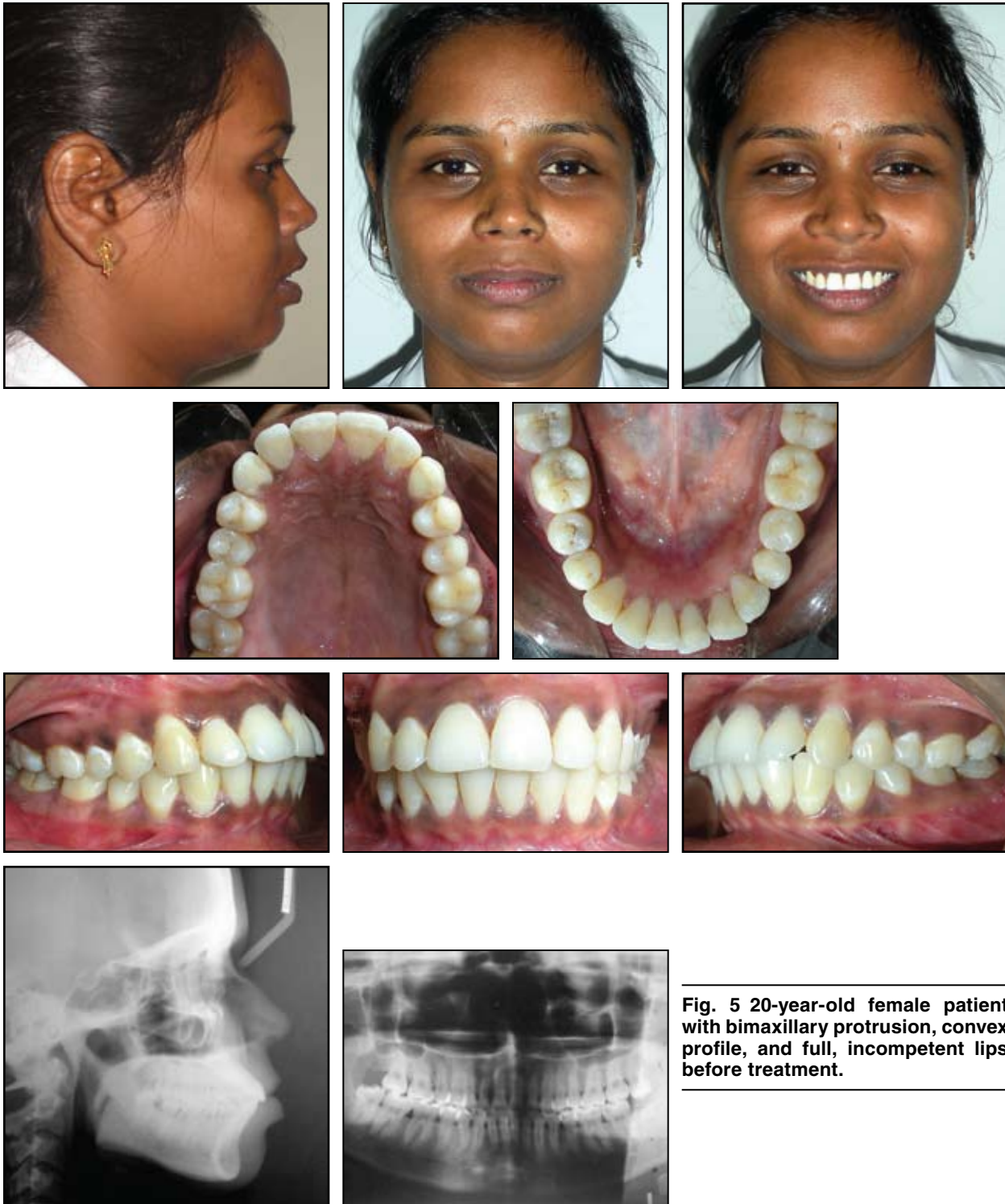
A 20-year-old female presented with bimaxillary protrusion, a convex profile, and full and incompetent lips (Fig. 5). She had a skeletal and dental Class I malocclusion with bialveolar protrusion and an average growth pattern (Table 1).

The treatment plan called for extraction of the first premolars, followed by sliding mechanics with miniscrew anchorage. MSPAs were selected for application of the retraction forces to avoid undesirable biomechanical side effects.

### Treatment Progress

After two and a half months of leveling and alignment with .018" preadjusted edgewise brackets, the four first premolars were extracted. Miniscrews (12mm long, bracket heads\*) were placed bilaterally in the attached gingivae of both arches, between the second premolar and first molar roots (Fig. 6A). MSPAs were then inserted into the auxiliary molar tubes and the slotted heads of the miniscrews (Fig. 6B). Curved, continuous .016" × .022" stainless steel archwires were placed

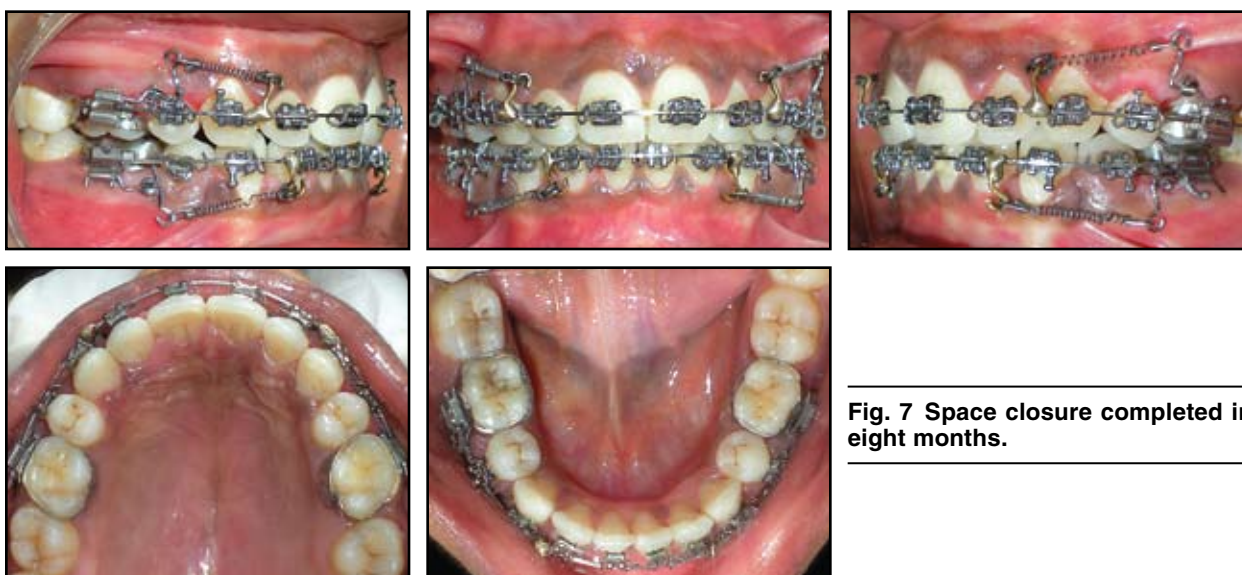
\*Mondeal, Inc., P.O. Box 500521, San Diego, CA 92150; www.mondeal.com.



**Fig. 5** 20-year-old female patient with bimaxillary protrusion, convex profile, and full, incompetent lips before treatment.



**Fig. 6** A. After first-premolar extractions, four miniscrews placed in attached gingivae bilaterally between upper and lower second premolar and first molar roots. B. MSPAs inserted into auxiliary molar tubes and tied into miniscrew slots. C. Curved upper and lower archwires with soldered anterior hooks placed, and closed-coil retraction springs with 250-300g of force attached between MSPAs and archwire hooks.



**Fig. 7** Space closure completed in eight months.

in both arches to prevent deepening of the bite during retraction. Closed-coil springs, each exerting a retraction force of 250-300g, were engaged between the MSPAs and soldered anterior hooks on the archwires (Fig. 6C). Although the miniscrews were placed near the occlusal level, the forces exerted by the springs were directed more apically, toward the CRes of the anchor units. The MSPAs also exerted distal forces against the molars.

Space closure was completed without adverse effects in eight months (Fig. 7), and the bimaxillary proclination was resolved with no intrusion or mesial movement of the molars. There was no evidence of soft-tissue irritation or distortion of the MSPAs or retraction springs. Upper wrap-around and lower Hawley retainers were delivered.

## Treatment Results

After 14 months of treatment, the patient showed a good Class I dental relationship, with the upper and lower anterior teeth retracted and uprighted into near-normal positions over the basal bone (Fig. 8A). Space closure was completed without the development of a posterior open bite or deep overbite. With the retraction of the lips, the patient's profile and smile also improved. Some distal molar movement was seen (Fig. 8B, Table 1), and the maxillary right first molar remained mesially rotated, perhaps because

of transmission of the retraction force by the MSPA sliding through the miniscrew slot.

The upper left and lower right third molars, both without antagonists, were scheduled for extraction.

## Discussion

The MSPA works in three ways. First, it stabilizes the molar in all three planes of space. Miniscrew anchorage eliminates the intrusive forces that can occur with sliding mechanics, and support from the stabilizing portion of the MSPA avoids constriction of the molars and thus the need to bond the second molars and place a transpalatal arch. Second, although the miniscrew is placed in the attached gingiva, the MSPA allows the retraction force to be directed apically, toward the CRes of the posterior segment. Finally, the MSPA provides the posterior and superior vectors of force required for intrusion of anterior teeth.

Advantages of this technique include:

- The need for apical miniscrews near the CRes of the posterior teeth is eliminated.
- The risk of infection is lower, since the miniscrew is placed in the attached gingiva rather than the loose mucosa.
- The hooked vertical end of the MSPA can be adjusted in the buccopalatal direction, so that curvature of the archwire will not result in mucosal impingement by

the retraction spring or elastics.

- The force vectors in all three planes can be adjusted simply by adjusting or replacing the MSPA, without having to reposition the miniscrew.
- Intermaxillary elastics between the posterior teeth may not be needed, given the reduced risk of developing a posterior open bite.
- Because the posterior teeth are stabilized, there is less chance of rotating the occlusal plane and creating a deep bite by extruding the anterior teeth.

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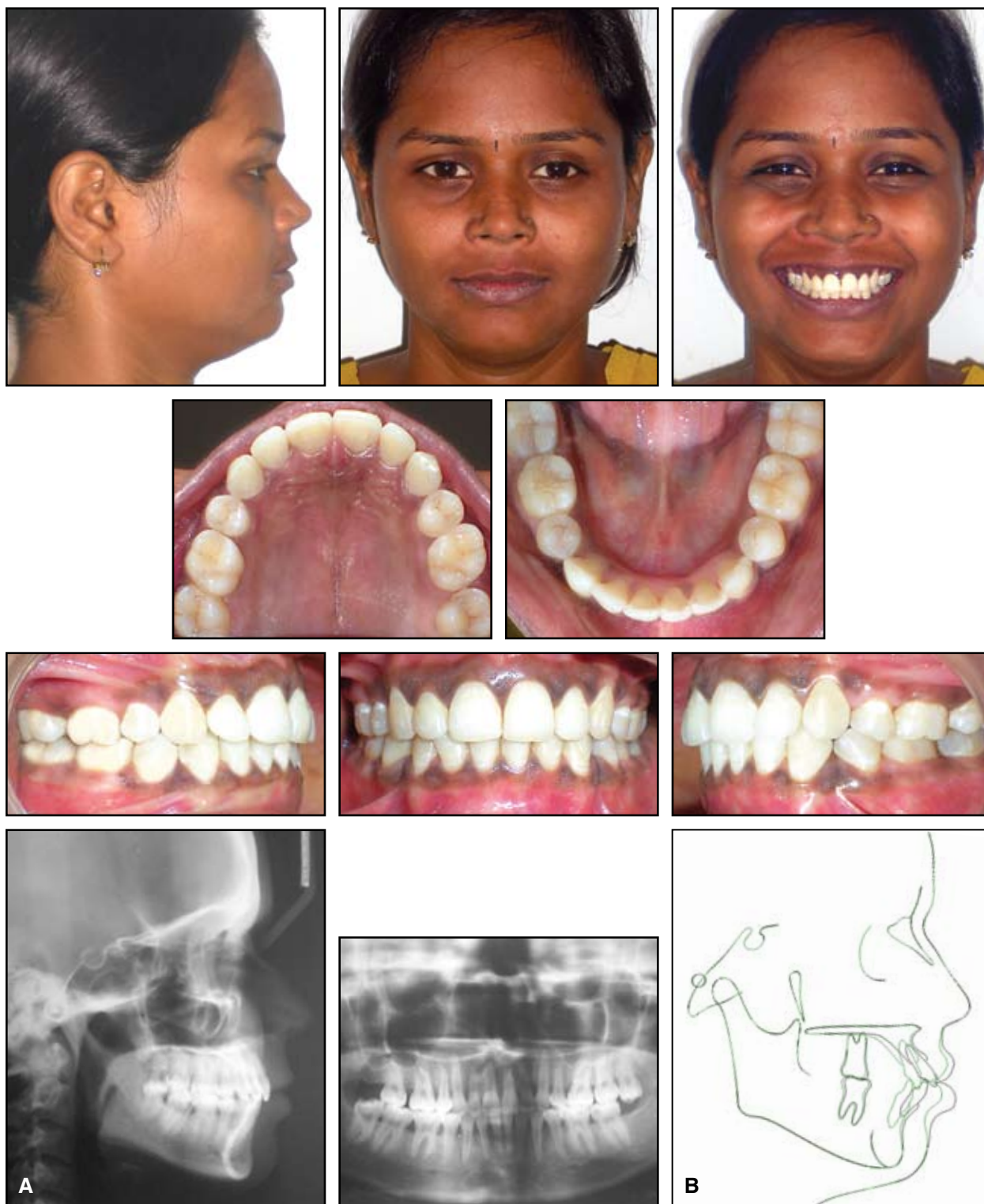


Fig. 8 A. Patient after 14 months of treatment. B. Superimposition of pre- and post-treatment cephalometric tracings.