

The Indirect Palatal Miniscrew Anchorage and Distalization Appliance

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Distalization of the upper molars is an important treatment option for the correction of Class II malocclusion.^{1,2} Although extra- or intraoral devices have traditionally been used in such cases,^{2,3} the esthetic and social concerns associated with headgear and the undesirable anchorage loss caused by intraoral devices have prompted clinicians to investigate the possibility of using miniscrew implants as anchorage devices.⁴⁻⁶

Most of the miniscrew-supported intraoral appliances used to distalize the upper molars are adaptations of preexisting non-compliance devices, such as the Distal Jet* or Pendulum,** anchored to miniscrews in the paramedian palate or midpalatal suture.⁷⁻¹² Although these appliances are capable of producing significant distal molar movement, they are difficult to fabricate and, when palatal acrylic buttons are used, tend to impede oral hygiene.¹⁰⁻¹²

To overcome these issues while allowing the effective use of miniscrew implants, we developed the indirect palatal miniscrew anchorage and distalization appliance (iPanda).¹³ The iPanda can easily be connected to and removed from midpalatal miniscrews for active distalization or indirect anchorage of the upper molars (Fig. 1). It also offers sufficient skeletal anchorage for orthodontic forced eruption or intrusion.

Appliance Fabrication

A pair of 1.6mm x 6mm self-drilling, conical-type titanium miniscrew implants with large heads*** are implanted in the midpalatal suture, following the protocol described by Suzuki and Suzuki.¹⁴ An approximate distance of 10mm between the miniscrews is recommended for stable anchorage.



Fig. 1 Indirect palatal miniscrew anchorage and distalization appliance (iPanda) fit to maxillary arch.

The iPanda is fabricated on the patient's working cast. An .035" round stainless steel archwire is bent with a Young plier to produce a 12mm-long, 2mm-wide loop, which is then customized to create a self-locking system between the iPanda and the midpalatal miniscrew heads. This system allows easy and quick connection to and removal from the miniscrews without the need for ligatures or composite materials, thus facilitating proper oral hygiene (Fig. 2A). The self-locking system also provides three-dimensional stabilization while

*American Orthodontics, Sheboygan, WI; www.americanortho.com.

**Ormco Corporation, Orange, CA; www.ormco.com.

***Dual Top Anchor System, Jeil Medical Co., Seoul, Korea; www.jeilmedical.en.ec21.com.

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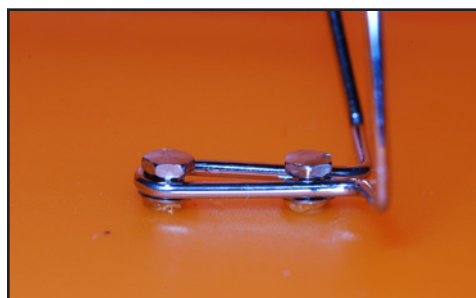
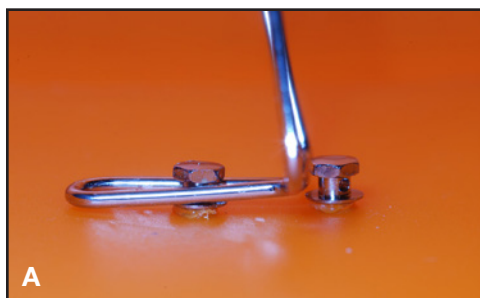
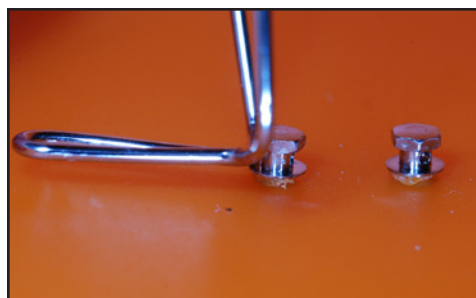
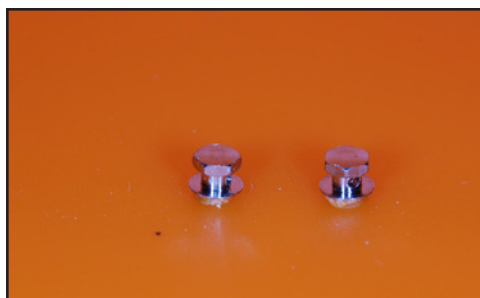


Fig. 2 A. Self-locking system allows iPanda to be quickly connected to and removed from midpalatal mini-screw heads; minimal clearance between iPanda and palatal mucosa avoids impingement. **B.** Self-locking system provides stabilization for bilateral or unilateral distalization.



Fig. 3 Extension arms connect closed-coil springs to upper first molars.

eliminating the risk of soft-tissue impingement (Fig. 2B). Because it prevents accidental dislodgement of the palatal bar, it allows the orthodontist to simply remove or replace the bar at a regularly scheduled appointment.

Extension arms are incorporated into both sides of the appliance for connection to the first molars through a pair of .035" light-wire single tubes with hooks.[†] An omega loop is bent at the end of each extension arm for the insertion of a nickel titanium closed-coil spring or elastomeric chain (Fig. 3).

The tubes are bonded to the lingual surfaces of the upper first molars with a 4-META/MMA-TBB resin cement.[‡] The molar-distalizing force is usually delivered by a pair of 100g nickel titanium Sentalloy^{††} closed-coil springs, but 200-300g springs may be used for simultaneous distalization of the first and second molars. Elastomeric chain can be an alternative in some cases, since the springiness effect from the long arms of the iPanda allows relatively light and continuous forces to be delivered. With the upper molars effectively anchored to the midpalatal miniscrews, no adapta-

tions of conventional biomechanical systems, such as adjustable long hooks or lever arms, are needed to close extraction spaces.¹⁵ As a result, the iPanda provides enough flexibility for the application of either sliding or contraction-loop mechanics during orthodontic treatment.

Case 1

A 15-year-old female with a Class II molar relationship was referred to the orthodontic clinic for evaluation. Her chief complaint was an unattractive dental appearance and excessive anterior protrusion. Clinical examination indicated a skeletal Class II configuration with severe bimaxillary dentoalveolar protrusion (Fig. 4). Surgery was recommended to correct the skeletal discrepancy and facial profile, but the parents refused this option. The initial treatment plan, therefore, was to extract the upper and lower first premolars and to distalize the upper molars using paramedian miniscrews connected to a palatal bar (Fig. 5A). After eight months of treatment, the paramedian miniscrews had become mobile and the palatal bar was impinging on the palatal mucosa (Fig. 5B). The upper first molars had actually moved mesially into a full Class II relationship. To resolve this problem, an iPanda was connected to the midpalatal miniscrews and bond-

[†]Tomy International, Inc., Tokyo, Japan; www.tomyinc.co.jp.

[‡]Superbond C&B, Sun Medical, Kyoto, Japan; www.sunmedical.co.jp.

^{††}Registered trademark of Dentsply GAC International, Bohemia, NY; www.gacintl.com.



Fig. 4 Case 1. 15-year-old female patient with Class II malocclusion and severe bimaxillary dentoalveolar protrusion before treatment.

TABLE 1
CASE 1 CEPHALOMETRIC ANALYSIS

	Pretreatment	Progress (18 months)	Post-Treatment
SNA	83.0°	83.5°	82.1°
SNB	74.5°	75.0°	76.5°
FMA (MP-FH)	37.0°	36.5°	36.0°
U1-FH	121.8°	112.5°	97.5°
IMPA (L1-MP)	98.5°	93.5°	90.3°

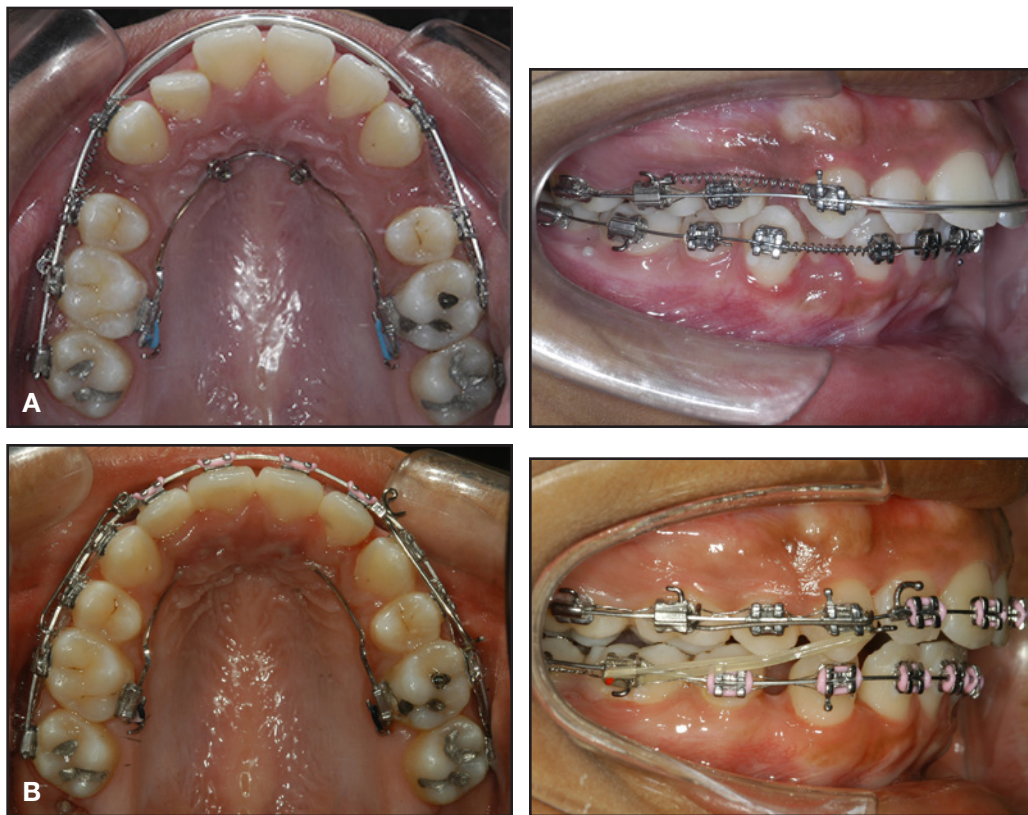


Fig. 5 Case 1. A. Initial distalization appliance, with palatal bar attached to paramedian miniscrews. B. After eight months, miniscrews became mobile and palatal bar was impinging on mucosa.

ed to the upper first molars for simultaneous distalization of the upper first and second molars (Fig. 6). The distalizing force was applied to the upper first molars with a pair of 100g nickel titanium closed-coil springs.

Follow-up visits were scheduled monthly to evaluate the performance of the iPanda. It took eight months to move the upper molars into a Class I relationship (Fig. 7). The patient reported no pain or discomfort while chewing or eating. Excellent



Fig. 6 Case 1. Placement of iPanda, with bilateral 100g closed-coil springs for molar distalization.

oral hygiene was maintained throughout treatment, and the midpalatal miniscrews remained stable.

Following the establishment of a Class I molar relationship, the iPanda was left in place for another four months to ensure maximum anchorage of the upper molars during retraction of the anterior teeth (Fig. 8). Total treatment time, including orthodontic finishing, was 30 months.

Post-treatment records showed improved alignment and occlusion (Fig. 9A). Cephalometric

analysis demonstrated that the crowns of the upper molars had moved mesially by an average 2.5mm during initial treatment with the paramedian miniscrews and palatal bar. After placement of the iPanda, the upper first molars were moved distally by an average 6.5mm (Fig. 9B). No distal tipping of the upper molars was observed, and there were no significant changes in the inclination of the upper incisors, in the mandibular plane, or in lower facial height (Table 1).

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Both of these still need to be flipped left to right to fix the mirror imaging. Also, B on the first photo will be A, and A will be B.

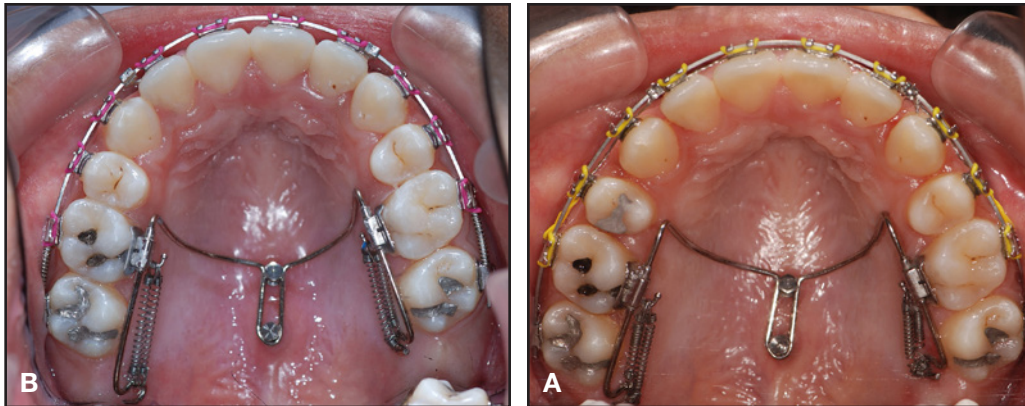


Fig. 7 Case 1. After six (A) and eight months (B) of distalization with iPanda.

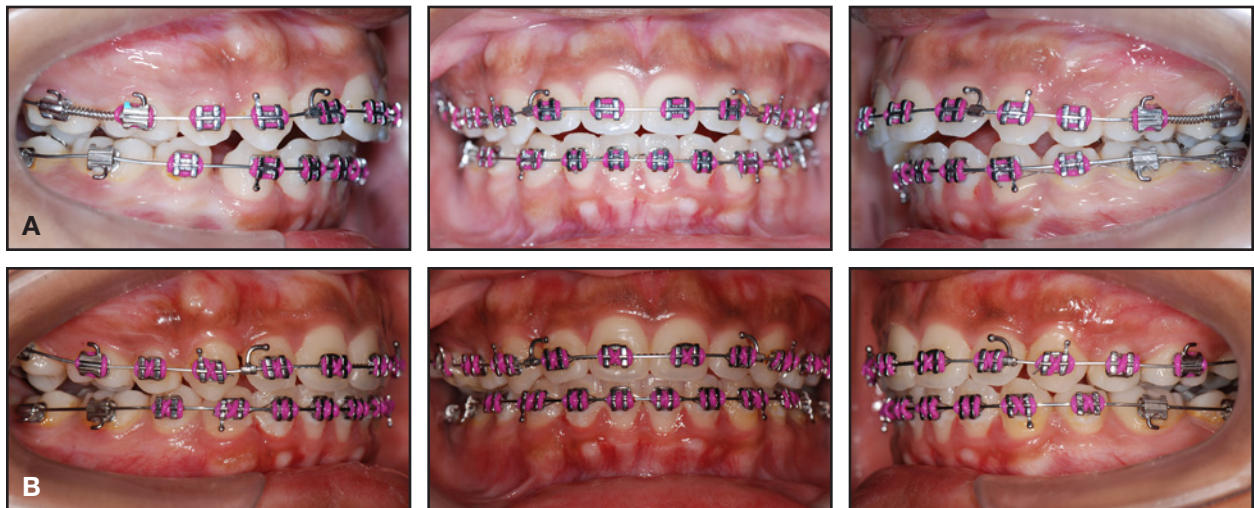


Fig. 8 Case 1. After 18 (A) and 26 (B) months of treatment.

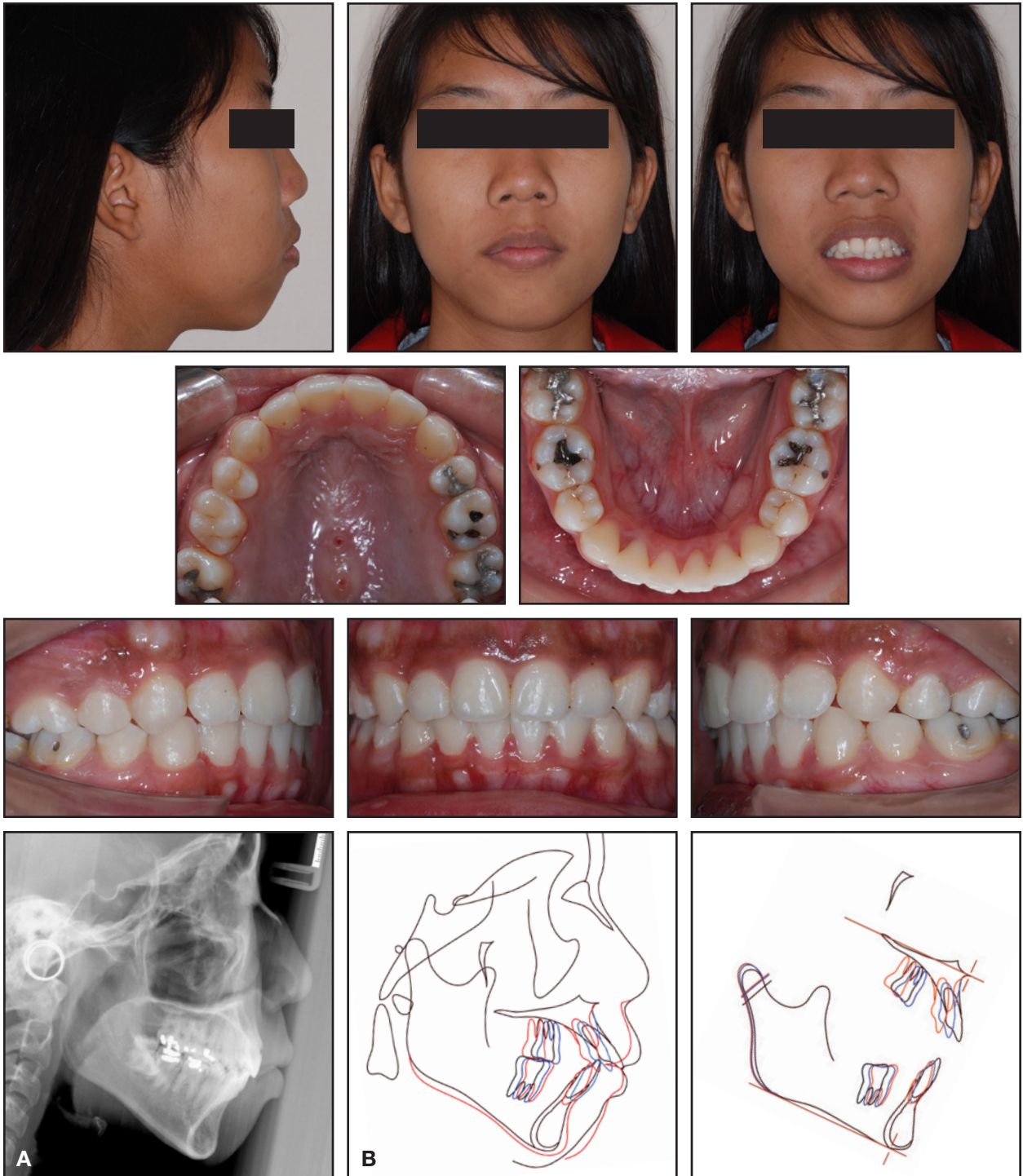


Fig. 9 Case. 1 A. Patient after 30 months of treatment. B. Superimposition of pre- and post-treatment cephalometric tracings.



Fig. 10 Case 2. 21-year-old female patient with skeletal Class II malocclusion, severe bimaxillary dentoalveolar protrusion, and deep bite before treatment.

Case 2

A 21-year-old female presented with a severely protrusive maxilla. Clinical examination showed a skeletal Class II configuration with severe bimaxillary dentoalveolar protrusion and a deep bite (Fig. 10). A surgical approach was rec-

ommended to correct the skeletal discrepancy and facial profile, but the patient refused. We therefore presented an alternative treatment plan involving extraction of the first premolars, followed by distalization of the upper molars with the iPanda. Simple elastomeric ligatures were used to deliver light and continuous distalizing forces to the upper

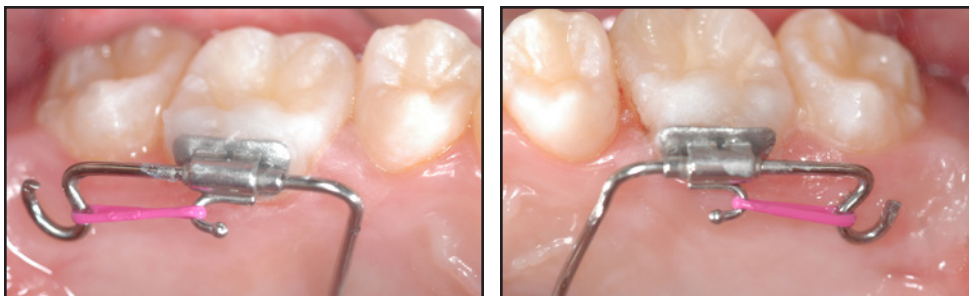


Fig. 11 Case 2. Placement of iPanda, with simple elastomeric ligatures for bilateral distalization.

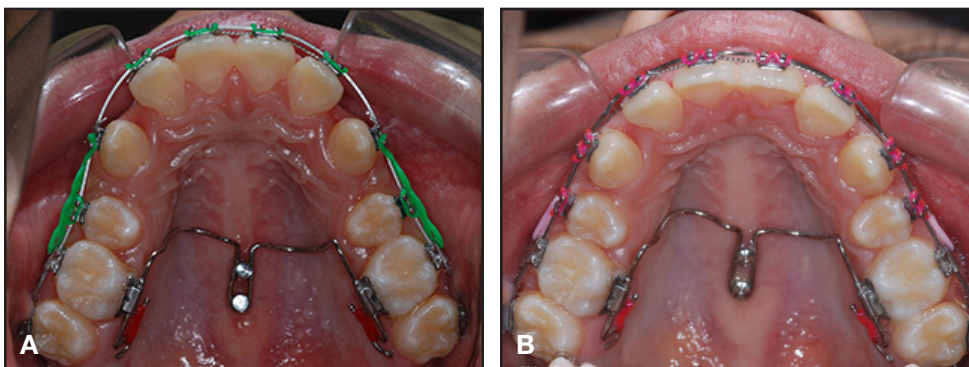


Fig. 12 Case 2. After seven (A) and 12 (B) months of distalization with iPanda.

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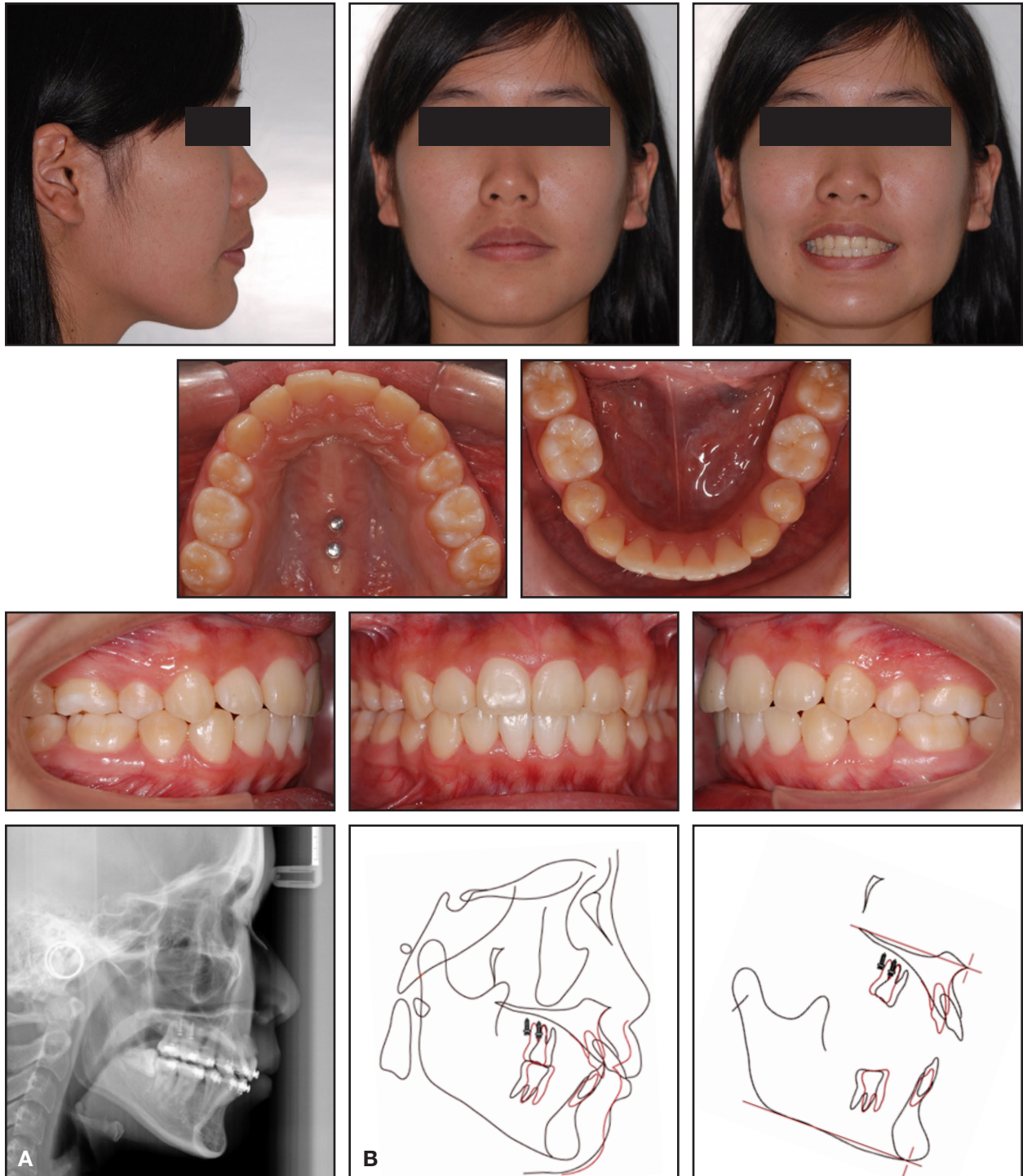


Fig. 13 Case 2. A. Patient after 22 months of treatment. **B.** Superimposition of pre- and post-treatment cephalometric tracings.

TABLE 2
CASE 2 CEPHALOMETRIC ANALYSIS

	Pretreatment	Post-Treatment
SNA	87.6°	84.9°
SNB	80.6°	79.8°
FMA (MP-FH)	26.0°	26.2°
U1-FH	139.8°	105.9°
IMPA (L1-MP)	103.8°	106.2°

TABLE 3
CASE 3 CEPHALOMETRIC ANALYSIS

	Pretreatment	Post-Treatment
SNA	83.1°	81.5°
SNB	76.5°	74.5°
FMA (MP-FH)	31.2°	33.0°
U1-FH	114.8°	100.5°
IMPA (L1-MP)	104.5°	98.1°

molars (Fig. 11). After seven months of treatment, the desired amount of distalization had been obtained. The iPanda was then maintained in position, with light elastomeric ligatures placed to minimize anchorage loss during anterior retraction¹³ (Fig. 12).

During 10 months of treatment with the iPanda, there was 3mm of distal molar movement on the right side and 2mm on the left. After a total 22 months of treatment, the patient had a Class I molar relationship and a significantly improved facial profile (Fig. 13A). The midpalatal mini-screws were kept in place for the final cephalometric radiograph to allow precise superimposition (Fig. 13B). A controlled bodily distalization of the upper molars was observed, with no tipping or extrusion of the molars and a substantial amount of maxillary retraction (Table 2).

Case 3

A 17-year-old female with a Class I molar

relationship and mild bimaxillary protrusion was referred to the orthodontic clinic for evaluation (Fig. 14). The initial treatment plan involved extraction of the four first premolars to correct the maxillary protrusion. Because the patient had a missing right first molar, however, the second molar had drifted mesially. No upper third molars were present. Consequently, the final plan was to perform unilateral distalization of the right second molar, using a half-iPanda activated with elastomeric chain, to avoid extraction of the upper right first premolar (Fig. 15).

A total 4mm of bodily molar distalization was obtained in three months of treatment, without any tipping or extrusion. The upper right canine and premolars spontaneously moved distally along with the molars (Fig. 16).

After 18 months of treatment, the patient had a Class I molar relationship and a significantly improved facial profile (Fig. 17, Table 3).

(text continued on p. xxx)



Fig. 14 Case 3. 17-year-old female patient with Class I malocclusion and mild bimaxillary protrusion before treatment.



Fig. 15 Case 3. Half-iPanda activated with elastomeric chain.



Fig. 16 Case 3. After four (A) and seven (B) months of unilateral distalization with iPanda.

Case 4

A 15-year-old female presented with impacted upper right and left canines. Conventional forced eruption was planned using two surgical procedures, starting with the upper right canine, for the patient's convenience. The crown of the right canine was exposed to bond an attachment, and elastomeric chain was connected to the main orthodontic archwire. Four months later, after this approach proved unsuccessful, a half-iPanda was placed, with a long power arm attached to provide sufficient traction for eruption of the impacted canine (Fig. 18A). Successful canine eruption (6mm of tooth movement) was achieved in three months (Fig. 18B).

Because this iPanda configuration was relatively fast and predictable, the same approach was used for the upper left canine (Fig. 18C). Successful canine eruption (5mm of tooth movement) took another three months (Fig. 18D).

Discussion

The midpalatal suture has been considered a safe, viable, and stable alternative for miniscrew placement when the quantity and quality of interdicular bone are insufficient.^{16,17} This type of placement is complicated, however, since intraoral accessories such as transpalatal bars or extension arms may be needed to connect the miniscrews to the dentition.¹⁵ Moreover, there are a limited number of intraoral devices available to provide adequate anchorage from midpalatal miniscrews for distalization of the upper molars.

We designed the iPanda for a variety of applications, including simultaneous first- and second-molar distalization, unilateral upper-molar distalization, and orthodontic forced eruption. Because the iPanda is securely fixed to the midpalatal miniscrews, it provides skeletal anchorage for significant upper-molar distalization without anchorage loss.¹³ It can easily be fabricated at the chair using relatively simple orthodontic materials, thus reducing laboratory costs. Once distalization has been completed, the iPanda can be left in place

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Fig. 17 Case 3. A. Patient after 18 months of treatment. **B.** Superimposition of pre- and post-treatment cephalometric tracings.

to provide indirect anchorage for the molars while the remaining teeth are retracted.

We use this technique to distalize and anchor the upper molars in all midpalatal miniscrew cas-

es at our university. Although we have not seen any accidental dislodgement or breakage of the iPanda, further studies are needed to evaluate the treatment effects of the device.

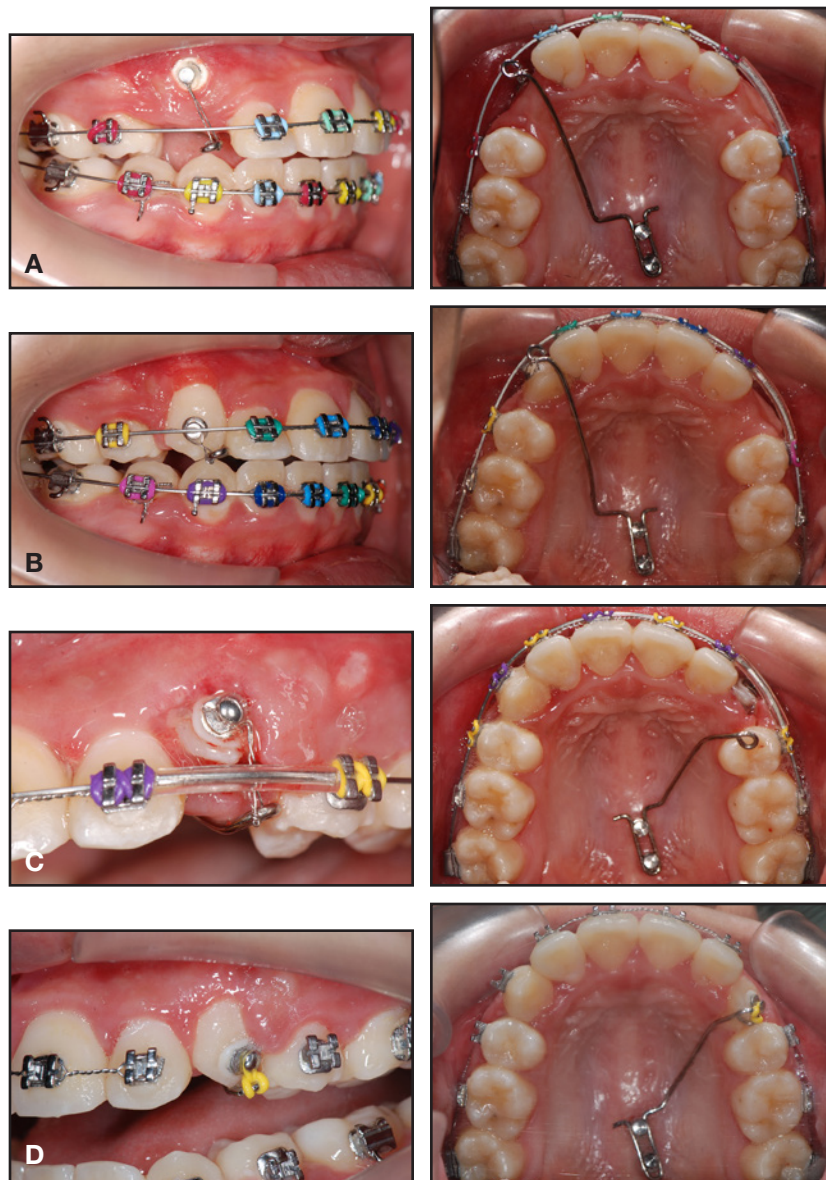


Fig. 18 Case 4. 15-year-old female patient with impacted upper right and left canines. **A.** After four months of unsuccessful forced eruption with elastomeric chain, upper right canine attached to half-iPanda with long power arm. **B.** After three months of forced eruption with half-iPanda. **C.** Two months later, upper left canine attached to half-iPanda. **D.** After three months of forced eruption with half-iPanda.

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