

A Modified Palatal Anchorage Plate for Simple and Efficient Distalization

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Mini-implants are often placed in the non-tooth-bearing area of the palate because of the superior quality of the bone, the reduced risk of damage to dental roots, and the lack of interference with tooth movement during treatment.¹ The Onplant System* was the first temporary anchorage device developed for palatal placement; unfortunately, its invasive surgical design requires considerable healing time after implantation.²⁻⁴ Furthermore, while various tooth movements are possible with palatal anchorage, they often involve complicated procedures and bulky structures, including transpalatal arches, sheaths, and bonded composite.⁵⁻⁷

In an attempt to simplify the insertion and application of palatal anchorage, Chung and colleagues designed the C-palatal plate, which is placed in the midpalatal suture for retraction of the maxillary anterior teeth in adults.⁸ Our modified

C-palatal plate (MCP) further simplifies the placement procedure, reduces patient discomfort, and increases the efficiency of tooth movement. The MCP is highly effective in distalization of the maxillary dentition in adolescent patients as well as adults.

Appliance Design and Placement

The MCP** contains three holes for 6mm-long, 1.8mm-diameter screws,** two posterior and one offset anterior, located so as to avoid the midpalatal suture in adolescent patients (Fig. 1). Two extended lever arms have three notches each.

A 1mm-diameter stainless steel palatal wire

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A Modified Palatal Anchorage Plate for Simple and Efficient Distalization

is soldered to the upper first molar bands, and closed-coil springs or power chains are attached between hooks on the palatal wire and the notches on the lever arms (Fig. 2). The direction of force can be changed by varying the hook positions and using different plate notches.

The miniscrews for the MCP are usually placed in the posterior portion of the palate, about

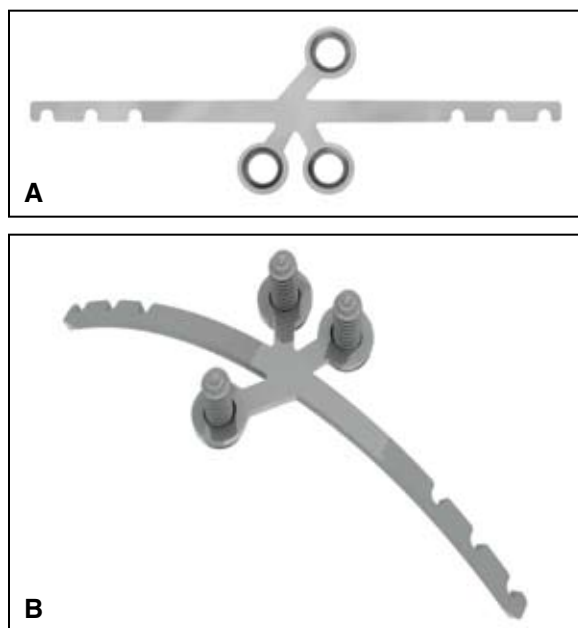


Fig. 1 A. Modified C-palatal plate includes three short arms for miniscrew anchorage and two extended lever arms, each with three notches. B. Two posterior holes and one asymmetrical anterior hole accommodate 6mm-long, 1.8mm-diameter screws.

2mm on either side of the midpalatal suture. Before delivering the appliance, bend the bases of the extension arms 1-2mm away from the palate on the plaster cast, then adjust them to follow the contours of the palate. In the mouth, after administration of local anesthesia, place the sterilized plate with self-drilling mini-implants, using a screwdriver at 30rpm with less than 30Ncm of force. Blanching of the palatal tissue during placement indicates excessive pressure. Immediately after placement of the palatal plate and palatal arch, distalization can begin with elastics or nickel titanium closed-coil springs.

In cases of bimaxillary protrusion, the MCP can be used with Class III elastics for simultaneous retraction of both arches. For unilateral distalization of posterior teeth, one lever arm and posterior hole are cut away from the MCP, which is then placed on the appropriate side of the midpalatal suture.

Case 1

An 11-year-old female in the late mixed dentition presented with the chief complaint of a labially blocked-out maxillary left canine. She had a slightly protrusive upper lip, a long lower face, Class II canine and molar relationships, and an open bite. The maxillary dental midline was deviated 3mm to the left, and the lower dentition showed minor crowding (Fig. 3). Radiographic evaluation revealed a retained maxillary right second deciduous molar, erupting second permanent molars, and third molar tooth germs.

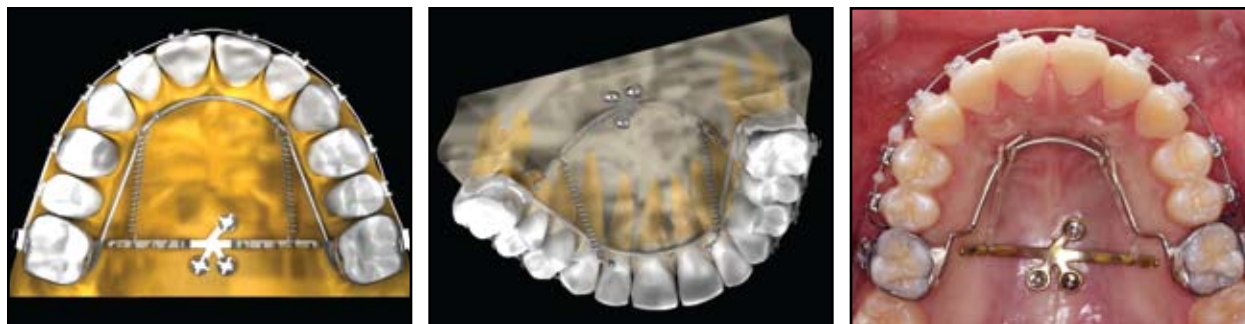


Fig. 2 Attachment of various distalizing forces to MCPs.

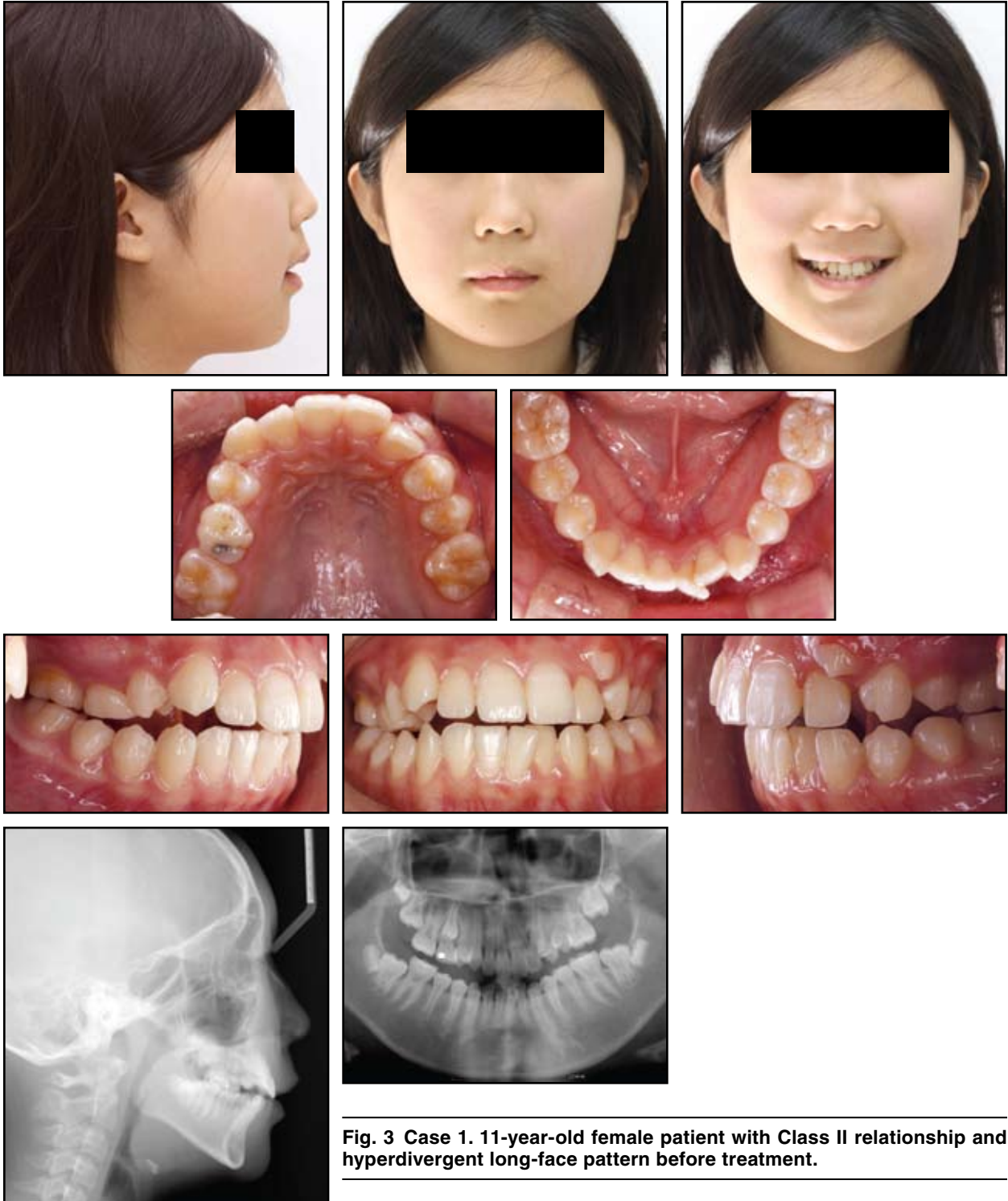


Fig. 3 Case 1. 11-year-old female patient with Class II relationship and hyperdivergent long-face pattern before treatment.

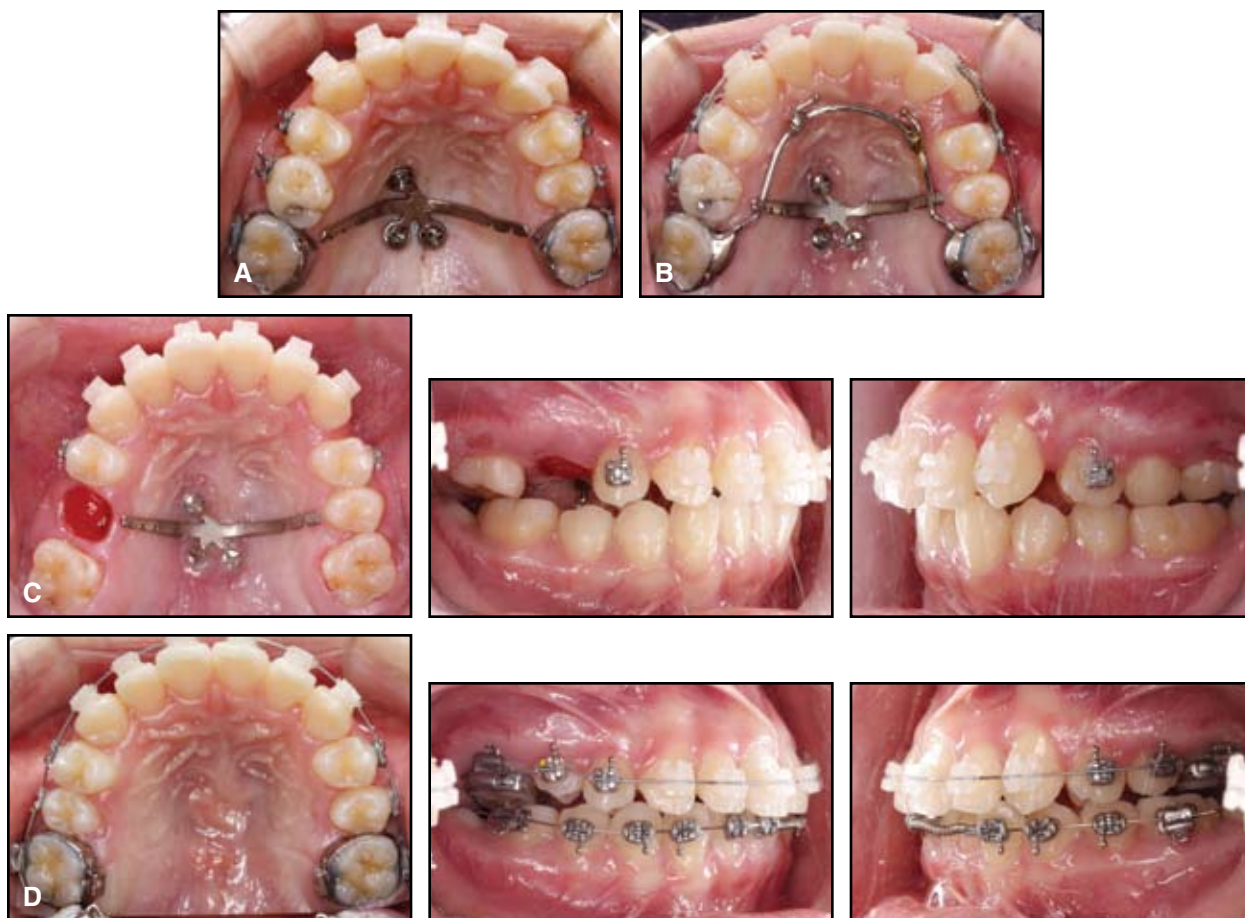


Fig. 4 Case 1. Treatment progress in upper arch. A. Placement of MCPP. B. After three months, open-coil spring placed to correct midline deviation and open space for blocked-out canine. C. After six months of distalization and midline correction and extraction of retained second deciduous molar. D. Two months later, after removal of MCPP.

Cephalometric analysis indicated a hyperdivergent growth pattern (Table 1).

Because the patient refused extraction treatment, the treatment plan involved maxillary-arch distalization with the MCPP. After placement of the device (Fig. 4A), a palatal arch with hooks was inserted and power chains engaged to begin distalization. Force vectors were designed to help correct the open bite.

After three months of treatment, about 4mm of arch space had been gained; an open-coil spring was then placed between the maxillary left lateral incisor and first premolar to open space for the blocked-out canine and to begin correction of the upper midline deviation (Fig. 4B). After six months, the retained upper right second deciduous molar was removed. At that point, the blocked-out canine had been almost completely incorporated into the arch (Fig. 4C).

Two months later, the MCPP was removed, and treatment in the mandibular arch was begun (Fig. 4D). Because the patient was unable to finish treatment for personal reasons, appliances were

**TABLE 1
CASE 1 CEPHALOMETRIC DATA**

	Pretreatment	Post-Treatment
SNA	79.0°	79.5°
SNB	76.0°	75.5°
ANB	3.0°	4.5°
SN-GoGn	41.5°	43.5°
FMA	38.5°	41.3°
PA facial-height ratio	60%	65%
FH-U1	102.0°	101.5°
Overjet	4.5mm	2.5mm
Overbite	-1.5mm	2.5mm
Nasolabial angle	96.0°	97.5°
TVL-Upper lip	4.5mm	4.5mm
TVL-Lower lip	-5.0mm	-3.0mm

removed after 16 months, and a tooth positioner was prescribed to help finish the occlusion. Despite the incomplete treatment, the patient's profile was considered acceptable (Fig. 5, Table 1).



Fig. 5 Case 1. A. After 16 months of treatment. **B.** Superimposition of pre- and post-treatment cephalometric tracings.

A Modified Palatal Anchorage Plate for Simple and Efficient Distalization

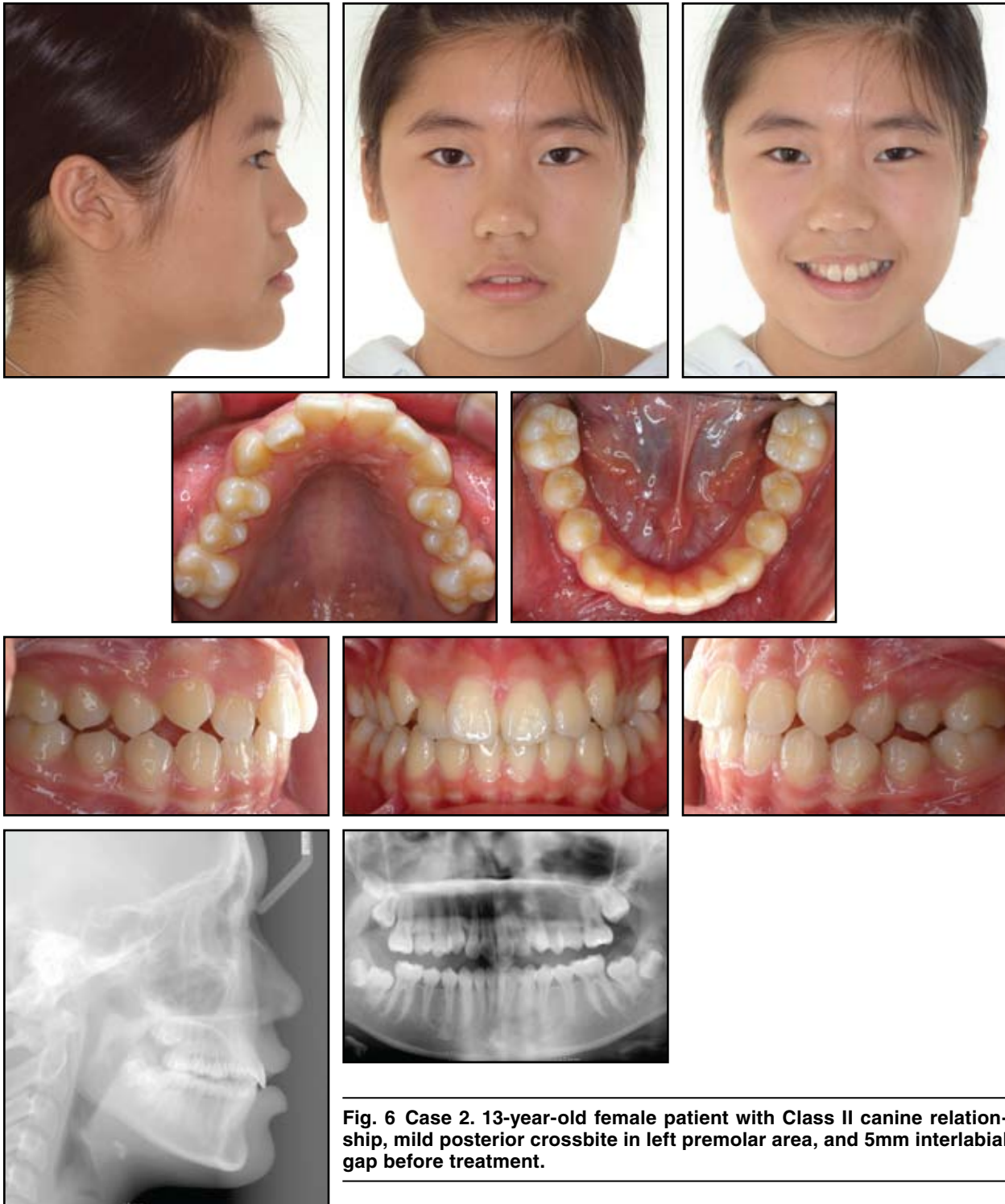


Fig. 6 Case 2. 13-year-old female patient with Class II canine relationship, mild posterior crossbite in left premolar area, and 5mm interlabial gap before treatment.

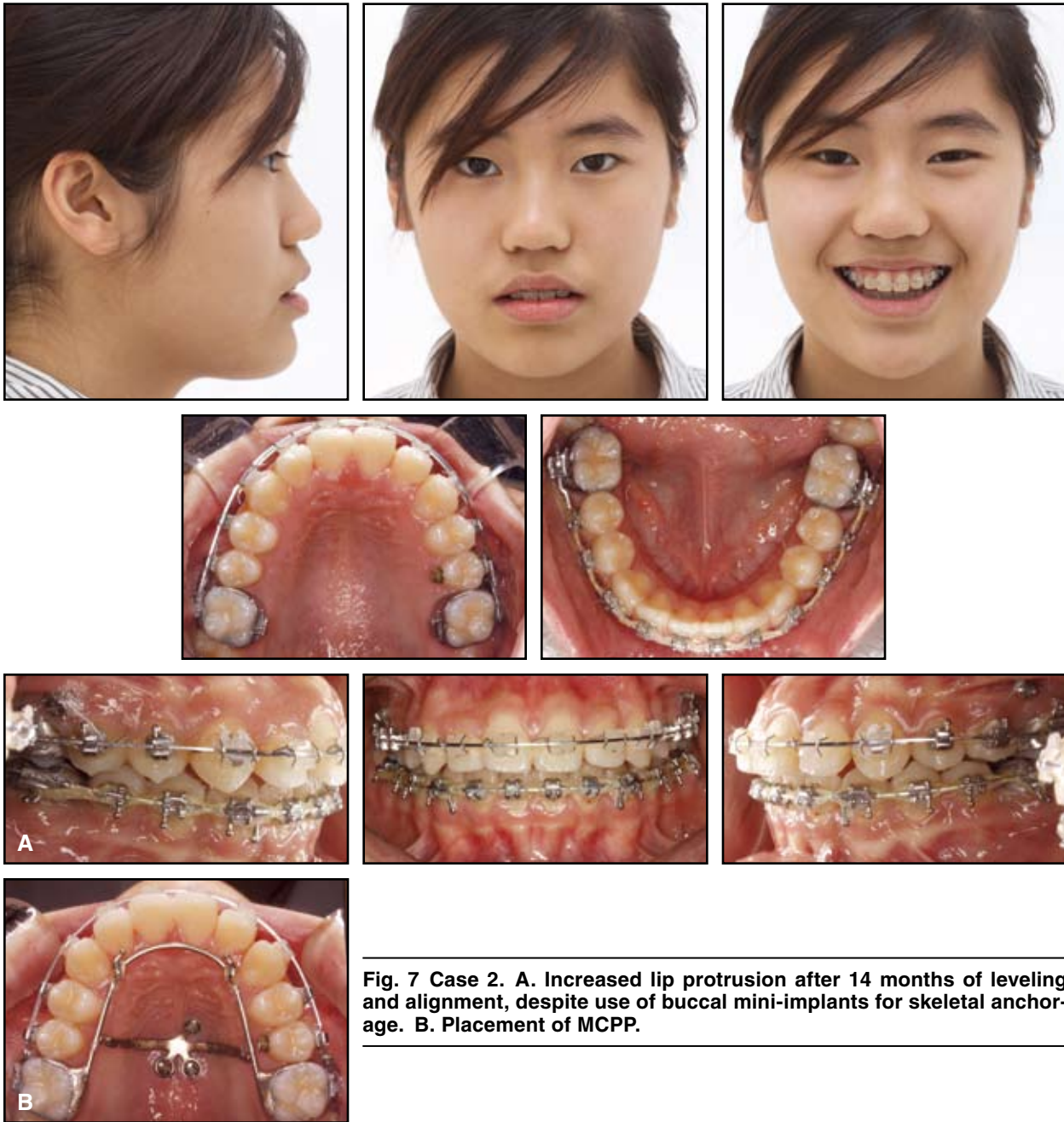


Fig. 7 Case 2. A. Increased lip protrusion after 14 months of leveling and alignment, despite use of buccal mini-implants for skeletal anchorage. B. Placement of MCPP.

Case 2

A 13-year-old female presented with the chief complaint of crooked teeth. She had a Class II canine relationship, a mild posterior crossbite in the left premolar area, slightly protrusive lips, and a 5mm interlabial gap (Fig. 6). Erupting second molars and third-molar germs were evident in the radiographs. Skeletal parameters were within normal limits (Table 2).

The initial treatment plan was to distalize the upper anterior teeth with anchorage from two

mini-implants placed buccally between the second premolars and first molars.⁹ The screws were also to be used as anchorage for Class III elastics to retract the lower dentition.¹⁰ After 14 months of leveling and alignment and retraction, however, the patient's lip protrusion had worsened (Fig. 7A, Table 2). Her nasolabial angle had decreased, subnasale vertical to the upper and lower lips had increased, and FH-U1 had also increased. Further distalization was limited by the mini-implants' location between the roots and the lack of interdental space.

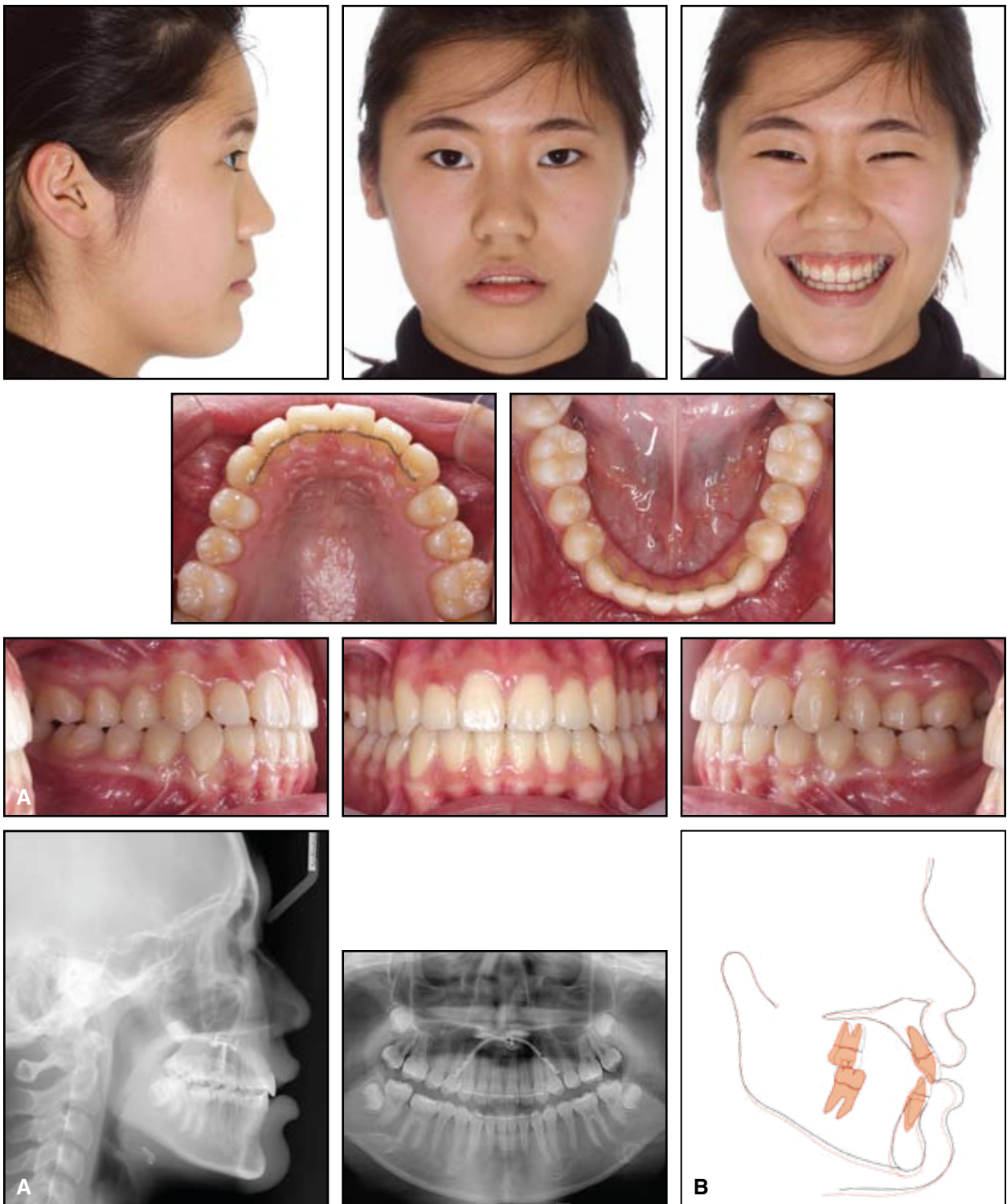


Fig. 8 Case 2. A. Patient after 27 months of treatment (radiographs taken at end of MCPP phase). B. Superimposition of pre- and post-treatment cephalometric tracings.

After the patient rejected any treatment plan involving extractions, the buccal mini-implants were removed, and an MCPP was placed for distalization of the entire arch. Power chains were engaged to hooks on the palatal wire, an .016" × .022" stainless steel maxillary archwire was

cinched back distal to the first molars, and 450-500g of distalizing force was applied (Fig. 7B). Class III elastics were attached between hooks on the upper first molar tubes and on the lower archwire between the lateral incisors and canines to simultaneously retract the mandibular dentition.

TABLE 2
CASE 2 CEPHALOMETRIC DATA

	Pretreatment	Progress	Post-Treatment
SNA	85.5°	85.5°	84.5°
SNB	83.5°	83.5°	81.5°
ANB	2.0°	2.0°	3.0°
SN-GoGn	32.0°	32.0°	33.5°
FH-U1	117.0°	120.5°	112.0°
Overjet	3.5mm	3.5mm	3.5mm
Overbite	3.5mm	3.5mm	2.5mm
Nasolabial angle	81.5°	78.5°	82.5°
TVL-Upper lip	8.0mm	9.5mm	7.5mm
TVL-Lower lip	7.5mm	12.0mm	4.5mm

Following 11 months of whole-arch distalization, the MCPD was removed.

After 27 months of treatment, the patient's soft-tissue profile was improved; she had no complaints involving the TMJs and was pleased with the treatment results (Fig. 8A, Table 2). Superimposition of the pre- and post-treatment tracings showed distalization of both arches (Fig. 8B).

Case 3

A 24-year-old female presented with the chief complaint of dental protrusion. She had Class II molar and canine relationships, an interlabial gap of 7mm, a 9mm overjet, a high mandibular plane angle, and crowding of 5mm in the upper arch and 4mm in the lower (Fig. 9, Table 3). The patient rejected surgical correction, so an extraction plan utilizing the MCPD for distalization was proposed.

After extraction of the maxillary first premolars, an MCPD was placed for combined maxillary anterior retraction and molar distalization (Fig. 10). Class III elastics were applied at the same time to retract the lower dentition. The MCPD was placed more to the right than usual to increase the range of action of its left arm, so that the right arm was angled slightly more than the left. When the plate was removed after 10 months, the mucosa was slightly inflamed around the screw sites. This inflammation resolved within a few days.

Total treatment time was 28 months. The patient was satisfied with the final occlusion and profile (Fig. 11A, Table 3). Cephalometric superimpositions demonstrated the amount of tooth movement accomplished after placement of the MCPD (Fig. 11B,C).

TABLE 3
CASE 3 CEPHALOMETRIC DATA

	Pretreatment	Progress	Post-Treatment
SNA	77.0°	76.0°	75.0°
SNB	70.5°	68.5°	69.0°
ANB	6.5°	7.5°	6.0°
SN-GoGn	51.5°	52.5°	52.5°
FH-U1	123.0°	102.5°	94.5°
Overjet	5.0mm	3.5mm	2.5mm
Overbite	3.5mm	3.0mm	2.0mm
Nasolabial angle	99.0°	100.5°	103.5°
TVL-Upper lip	8.0mm	6.0mm	4.0mm
TVL-Lower lip	3.5mm	3.5mm	2.0mm
IMPA	94.0°	102.5°	96.5°
U1-SN	109.0°	89.0°	81.0°

Discussion

Mini-implants in the buccal regions have been successfully used as anchorage for distalization of groups of teeth in adult patients.⁹ Buccal mini-implant placement in the late mixed dentition is more difficult, however, because of the narrower interradicular spaces and erupting permanent teeth. In cases requiring movement of teeth over long distances, buccal mini-implants must often be relocated in midtreatment to allow for root movements. The MCPD is easier to place and does not need to be moved during treatment. In extraction cases, it provides absolute skeletal anchorage for retraction of anterior teeth, with the possibility of whole-arch distalization when the extraction space is insufficient to resolve the protrusion.

In adolescent patients, the distance between the two posterior holes of the MCPD is wide enough to avoid contact with the narrow midpalatal suture.^{11,12} Still, because palatal bone tends to be thinner laterally and posteriorly,¹³ the holes should be placed as close as possible to the midpalatal suture for stability.

In the cases presented here, distalization of the maxillary dentition required the application of 450-500g of force. We have used similarly high forces to retract an anterior corticotomized segment using a C-plate with three palatal screws.⁸ A single mini-implant might not be able to withstand such forces,¹⁴ especially in adolescent bone,¹⁵ even though the thickness of the palatal bone (about 6mm) would be sufficient for stable retention.¹¹

For better vertical control or when intrusion is desired during distalization, the palatal plate can be connected directly with power chains to buttons



Fig. 9 Case 3. 24-year-old female with Class II molar and canine relationships, significant upper and lower crowding, and 9mm overjet before treatment.



Fig. 10 Case 3. MCPP placed after closure of maxillary first premolar extraction spaces.

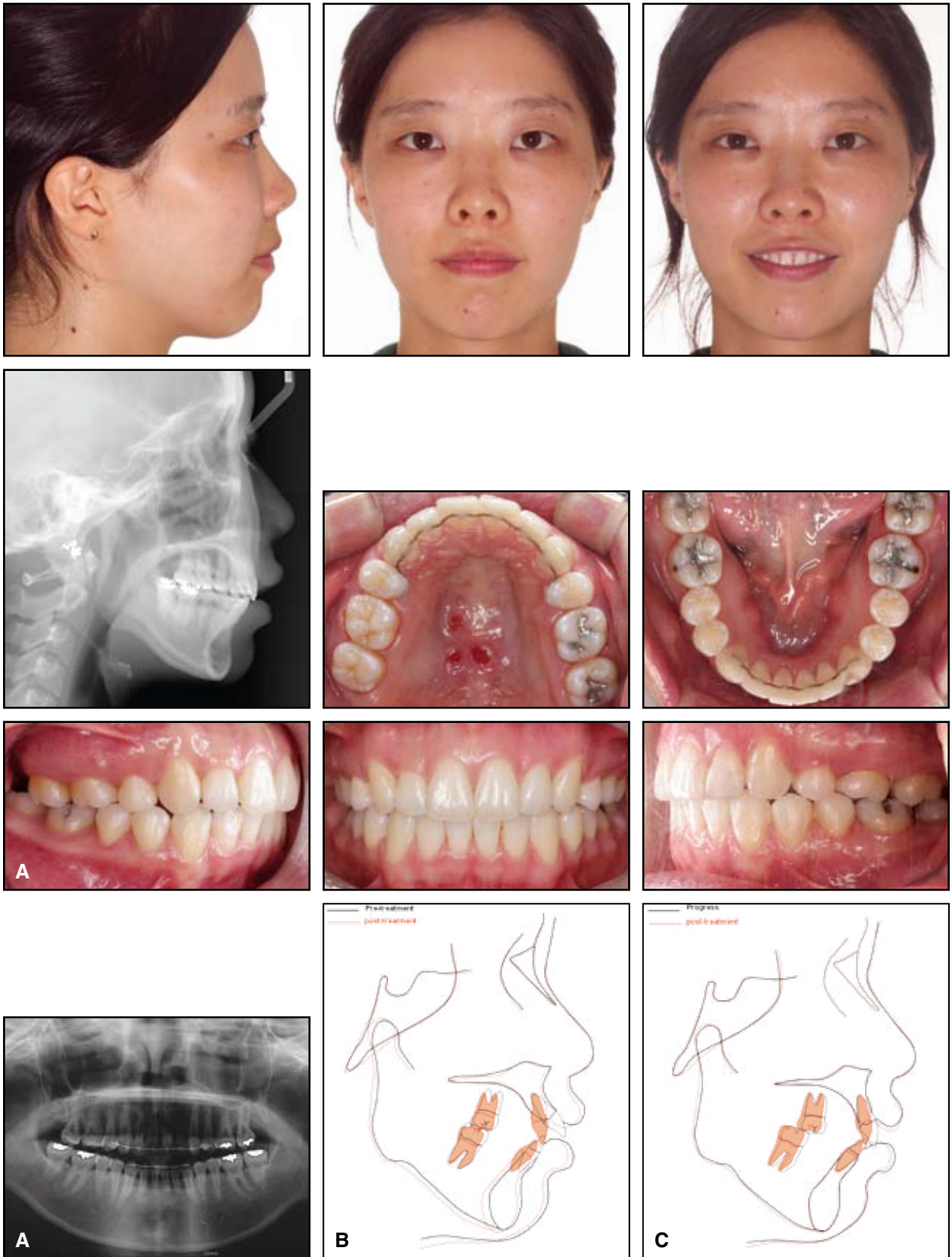


Fig. 11 Case 3. A. Patient after 28 months of treatment. B. Superimposition of pre- and post-treatment tracings. C. Superimposition of progress and post-treatment cephalometric tracings.

on the lingual surfaces of the molars. If elastics are attached to the palatal plate notch closest to the root apex, the maxillary first molar will translate distally and be slightly intruded.¹⁶

In Case 2, superimposition of the cephalometric tracings showed bodily movement of the maxillary dentition with minimal tipping (Fig. 8B). This important advantage of the MCPD over buccal mini-implants may indicate that the plate system can better control the force vector in relation to the center of resistance for each patient. Further study may be warranted to compare the application and treatment effects of the MCPD vs. buccal mini-implants.

SN-GoGn and FMA increased during treatment in all three cases shown here. Mandibular dental changes, such as extrusion of the mandibular molars, seem to have contributed to this clockwise rotation of the mandible. In each case, the mandibular first molars were extruded, and in Case 3, the maxillary first molars also tipped distally, resulting in an opening of the mandibular plane angle (Figs. 5B,8B,11B,C).

Conclusion

Advantages of the MCPD include ease of application, use of flapless surgical procedures, minimal risk of damage to neurovascular bundles, and lack of interference with growth. Unlike conventional mini-plates, it also offers the convenience of chairside insertion. Disadvantages can include gingival impingement and inflammation of the palatal mucosa. The mucosa of the hard palate has a high regeneration rate, and secondary healing¹⁷ should resolve any inflammation within a few days after plate removal. Still, the plate design may need refinement to minimize such occurrences.

The MCPD enables the clinician to distalize the entire maxillary dentition in a protrusive case without the need for extractions. We have found this technique to be simple and effective in both adolescents and adults.

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