

The Mandibular Protraction Appliance No. 3

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The Mandibular Protraction Appliances have proven reliable and efficient in the correction of various aspects of Class II malocclusions, including overjet, overbite, midline shift, spacing, and molar position.^{1,2}

Unfortunately, problems of breakage, restricted opening, and patient discomfort associated with the MPA No. 1 (Fig. 1) and the difficulty of chairside construction of the MPA No. 2 (Fig. 2) have discouraged many orthodontists from using these appliances. Archwire breakage has been a particular problem with .018" bracket systems, since they are unable to accommodate the larger and stronger archwires available for .022" appliances.

Nevertheless, the results obtained with the MPAs compare favorably with those of other appliances that attempt to reposition the mandible forward, such as the Herbst appliance,³⁻⁵ the Jasper Jumper,⁶ the Fränkel appliance,⁷ and the Eureka Spring.⁸

Many of the limitations of the first two MPA designs have been overcome with the development of the MPA No. 3. This version eliminates much of the archwire stress and permits a greater range of jaw motion while keeping the mandible in a protruded position. The new appliance still resembles the Herbst, but its smaller size and improved function make it much more tolerable than previously developed MPAs or Herbst appliances, and its ease of construction and insertion reduce stress and discomfort for both doctors and patients.

Appliance Construction

The parts needed for the construction of the MPA No. 3 (Fig. 3) are:

- Two maxillary tubes of .045" internal diameter, each about 27mm long
- Two maxillary loops of .040" stainless steel wire, each about 13mm long, with a loop bent into one end at an angle of about 130° to the horizontal
- Two mandibular rods of .036" stainless steel wire, each about 27mm long
- Four pieces of band material
- Two short lengths of annealed .036" stainless steel wire, each with a loop in one end, for attaching the appliance to the maxillary molar headgear tube

Using a good electronic welder that does not darken or weaken the wire by annealing, weld each maxillary tube to a maxillary loop (Fig. 4). Weld two pieces of band material around the combined wires; this will eliminate the need for soldering (Fig. 5).

Prepare a stainless steel edgewise mandibular archwire by bending an "O" loop on each side distal to the cuspid, winding the wire twice around a Tweed loop-forming plier (Fig. 6). I prefer at least an .019" X .025" wire, but smaller and more flexible wires such as .016" X .022" and .017" X .025" have reportedly resisted breakage with the MPA No. 3.⁹

Prepare each .036" mandibular rod by making a 90° bend at one end (Fig. 7). Place a small piece of tubing over the same end, then crimp and weld it so it stays fixed. Insert the longer leg of the mandibular rod through the "O" loop in the archwire from the lingual. Manipulate the rod upward

until it is nearly perpendicular to the wire (Fig. 8).

Appliance Placement

Place the mandibular archwire in the mouth so that enough wire extends distal to the molar tube for a bend-down tieback. Whenever possible, include the second molars to increase anchorage. Although mandibular bicuspid brackets can be included, there is less interference and more working space if a simple 2 X 6 bonded appliance is placed.

The maxillary arch can be fully or partially bonded, using any type and size of archwire – round or edgewise, stainless steel or nickel titanium. This wire can be tied back or not, depending on whether en masse movement of the maxillary teeth or merely distal molar movement is desired.

Attach the maxillary tube to the distal end of the maxillary first molar headgear tube by threading the short, annealed stainless steel pin through the loop of the MPA tube and then through the headgear tube. Bend the annealed pin down mesial to the headgear tube (Fig. 9A). Alternatively, the maxillary tube can be looped over the maxillary archwire mesial to the headgear tube (Fig. 9B), or the annealed pin can be inserted at the mesial end of the headgear tube (Fig. 9C). Either modification will shorten the tube enough that the mandibular rod will sometimes slip out, but the rod can easily be replaced by the patient.

Ask the patient to position the mandible to correct any overbite, overjet, and midline deviation, then use the assembled maxillary tube to measure the distance from the distal end of the headgear tube to the "O" loop on the mandibular archwire. Mark and cut the tube at this point (Fig. 10).

The MPA No. 3 allows almost unrestricted opening, to at least 50-55mm (Fig. 11). As with the other MPAs, it can be used unilaterally; patients generally find this version more comfortable than the bilateral variety.

Adaptations of the MPA No. 3

If the maxillary tube assembly is cut short of a fully protruded mandibular position, a nickel titanium open-coil spring (.045" internal diameter) can be placed over the mandibular rod between the maxillary tube and the end of the rod (Fig. 12). Although this design reduces orthopedic protrusion, it provides a gentle, continuous Class II force that is effective in resolving malocclusions and similar in principle to the Eureka Spring.⁸ The force is small enough that the mandibular rod can rest against the cuspid bracket without risk of breakage. However, when this version is used, the clinician will have to contend with mesial rotation of the mandibular cuspid.

By reversing the direction of the appliance, the MPA No. 3 can be used to correct Class III malocclusions and anterior crossbites. This design requires the tube to be attached to the mandibular arch, either by threading the annealed pin through the first or second molar headgear tube or by looping the tube over the mandibular archwire adjacent to the molar tube or bracket. The tube should be short enough to accommodate an open-coil spring between the rod loop and the tube (Fig. 13). Upon complete mouth closure, the coil compresses to create the necessary forward maxillary and backward mandibular forces. The design shown in Figure 14 will produce a more horizontal Class III force against the maxilla, limiting the intrusion and flaring of the maxillary incisors.

The Class III version of the MPA No. 3 provides maxillary anterior anchorage for mesial movement of the posterior teeth (Fig. 15). Like the Class II design, it allows ample opening.

Conclusion

The versatile MPA No. 3 is no more effective in correcting malocclusions than previous models, but it has the following advantages:

- It is more comfortable for the patient, and thus promotes better compliance.
- It offers greater range of motion.
- It is equally simple and inexpensive, but easier to place.
- It is adaptable to either Class II or Class III cases.
- It can be used for mandibular positioning or dentoalveolar movement.
- It causes less breakage of archwires and appliances and thus fewer emergency appointments. □

FIGURES

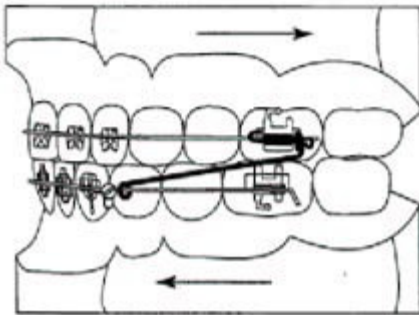


Fig. 1 MPA No. 1.

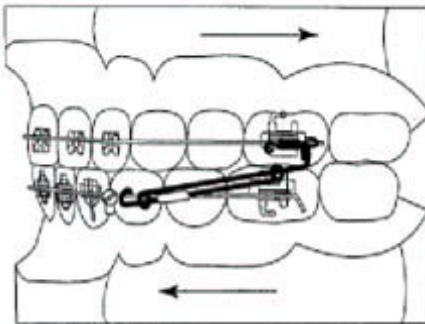


Fig. 2 MPA No. 2.

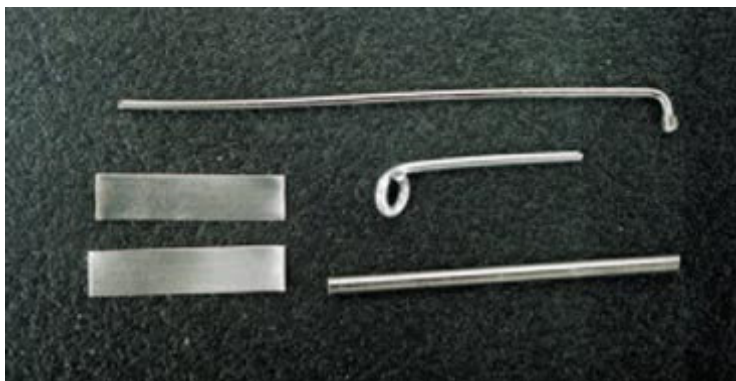


Fig. 3 Components of MPA No. 3



Fig. 4 Maxillary loop welded to maxillary tube.



Fig. 5 Two pieces of band material welded around maxillary components.



Fig. 6 Mandibular archwire with "O" loops distal to cuspids.

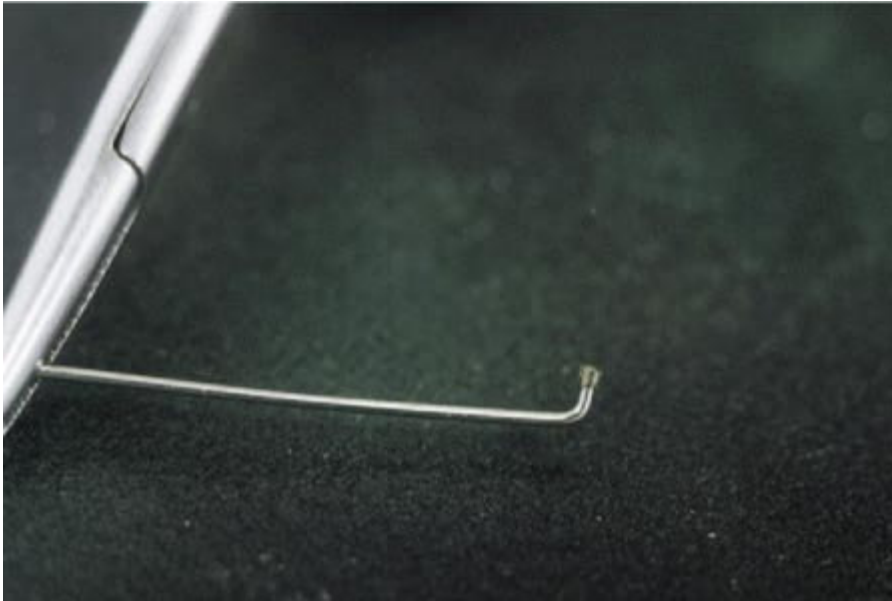


Fig. 7 Mandibular rod with 90° bend at one end and small piece of tubing welded to shorter leg.



Fig. 8 Mandibular rod inserted through "O" loop of archwire and manipulated upward.

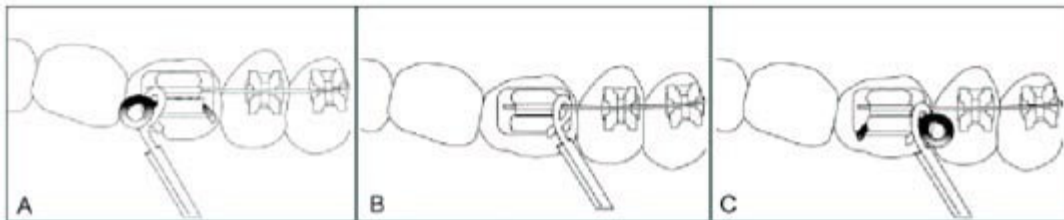


Fig. 9 A. Annealed .036" pin bent down mesial to headgear tube. B. Maxillary tube attached mesial to headgear tube. C. Annealed pin inserted at mesial end of headgear tube.



Fig. 10 Completed MPA No. 3, after sizing and cutting with mandible in corrected position.

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Fig. 11 Class II patient with MPA No. 3 in place, showing maximum opening.

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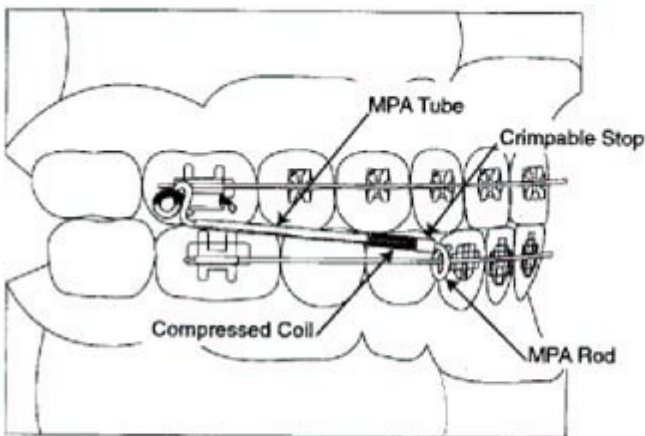


Fig. 12 Nickel titanium open-coil spring placed over mandibular rod, reducing orthopedic protrusion.

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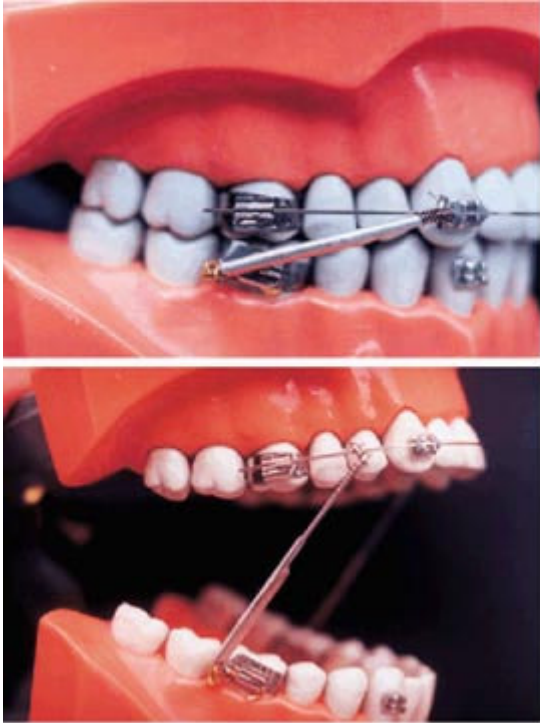


Fig. 13 MPA No. 3 reversed for Class III treatment, with open-coil spring between appliance tube and rod loop.

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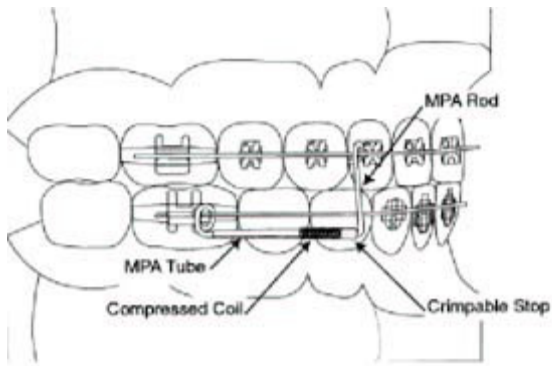


Fig. 14 Class III appliance with more horizontal force application.

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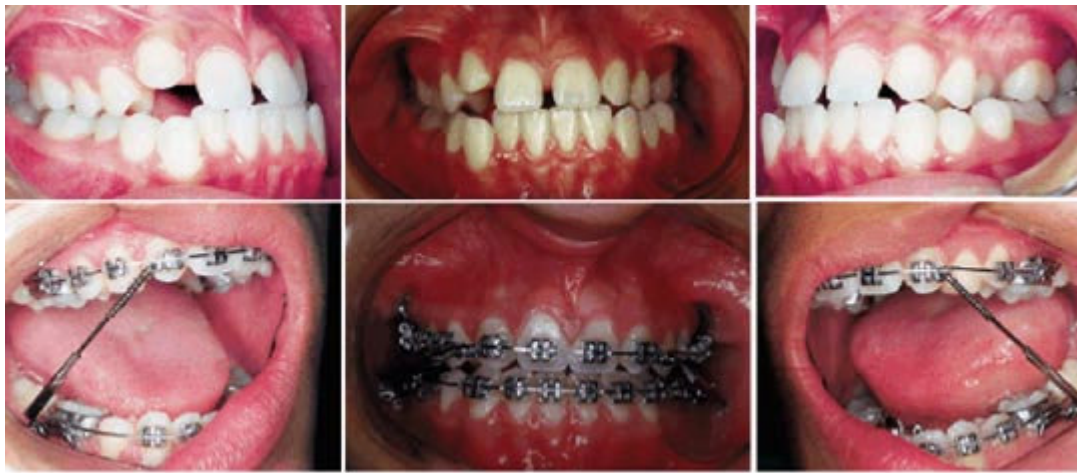


Fig. 15 A. Patient with agenesis of maxillary right lateral incisor. B. Class III version of MPA No. 3 provides maxillary anterior anchorage for mesial movement of posterior teeth.

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- 8 DeVincenzo, J.: The Eureka Spring, A new interarch force delivery system, *J. Clin. Orthod.* 31:453-467, 1997.
- 9 White, L.W.: Personal communication.

FOOTNOTES

- 1 Herbst, registered trademark of Dentaureum, Inc., 10 Pheasant Run, Newtown, PA 18940.
- 2 Jasper Jumper, American Orthodontics, 1714 Cambridge Ave., Sheboygan, WI 53082.
- 3 Eureka Spring, 1312 Garden St., San Luis Obispo, CA 93401.

