JCO-Online Copyright 2003 - VOLUME 37 : NUMBER 07 : PAGES (352-359) 2003

A Modified Pendulum Appliance for Anterior Anchorage Control

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Some orthodontists have reported a loss of anterior anchorage with the Hilgers Pendulum appliance--in other words, a protrusion or proclination of the incisors during molar distalization. Two cases will demonstrate how we counteract this tendency by using a modified version, the M-Pendulum,1,2 which has a mesially oriented loop and removable arms.

Case 1

A 15-year-old male presented with a unilateral Class II (right), division 2 malocclusion and midline deviation (Fig. 1). The upper right cuspid was in crossbite, and the upper left cuspid in labial ectopic eruption.

The molars were distalized with an M-Pendulum appliance for six months (Fig. 2). Treatment was continued with maxillary lingual brackets, combined with an upper Nance button and transpalatal bar, and with lower labial brackets.

The maxillary archwire sequence was: .016" copper nickel titanium (adapted labial archwire), .016" Australian wire and coil spring for bicuspid distalization, .0175" × .0175" TMA, .0175" × .0175" with closing "I" loop, .016" TMA. Mandibular archwires were .016" copper nickel titanium and .017" × .017" TMA. Total treatment time was 24 months (Fig. 3).

Distalization with a Modified Pendulum

Normally, as in the case shown above, the first molars are distalized with the left and right TMA arms of the Pendulum. The same distal force that the arms exert against the molars is also exerted mesially against the Pendulum, which makes incisor protrusion likely. This protrusion can be increased further when the second bicuspid arms are cut to permit spontaneous distalization of those teeth.

Therefore, in cases of extreme overjet or where anchorage is critical, such as with reduced periodontal support or excessive lower facial height, we modify the M-Pendulum by using four removable arms, for both the first and second molars. The internal diameter of the four stainless steel tubes embedded in the acrylic corresponds to that of the removable TMA arms (Fig. 4).

The following case needed distalization only of the upper right first and second molars. The fixed left spring was made with stainless steel wire for anchorage. The two removable right springs were made with TMA wire. The bonding procedure is as follows:

1. Adjust and cement the molar bands using Blue Ultra Band Lock.
2. Etch the occlusal surfaces of the four upper bicuspids for 30 seconds with Onyx Etch.
3. Rinse the teeth for 10 seconds, and dry.
4. Place the Pendulum appliance in the proper position, and bond it with Light Bond (Fig. 5).
5. Light-cure the adhesive for 30 seconds.

6. Check the occlusion with articulating paper. The contact of the four upper bicuspids with their lower antagonists must be simultaneous. The surface of the adhesive should be flat and polished.
7. Insert the left stainless steel spring into the lingual sheath, and fix it in place with an elastomeric ligature. Insert the TMA spring of the upper right second molar into the corresponding tube of the Pendulum appliance and into the lingual sheath, where it is also tied with an elastomeric ligature for added security (Fig. 6). The pressure exerted by the Pendulum will be less, since the distalization force is used to move the second molars and first molars sequentially, rather than simultaneously.

Because they are removable, the arms can be adjusted more easily to control tooth inclination and intrusion and to compensate for molar extrusion. If vertical control is critical, the molar disclusion caused by bonding the Pendulum to the bicuspids can be counteracted with composite build-ups on the lower molars. The build-ups must have completely smooth occlusal surfaces.

Once the second molars have been distalized (Fig. 7), their arms are left passively in place for anchorage, and the first molar arms are activated for distalization and intrusion (Fig. 8). After the first molars have been distalized, the Pendulum is replaced with a Nance button (Fig. 9). A continuous .016" stainless steel archwire or a sectional .016" archwire can be used, with an omega bend mesial to the molars, to increase anchorage. A figure-8 ligature is added from the first to the second molar. The archwire will be passive in the anterior region, thus avoiding incisor protrusion. Elastic chain is used to distalize the second bicuspids and then the first bicuspids (Fig. 10).

If anterior anchorage is critical, we recommend that the palatal acrylic of the Pendulum be kept out of contact with the incisors. In addition, the second bicuspid arm should not be cut for spontaneous distalization, and the bicuspids should not be moved with springs that can protrude the incisors.

Finally, the cuspids are distalized with elastic chain (Fig. 11), and the incisors are leveled and aligned (Fig. 12).

Case 2

A 29-year-old female presented with a Class II malocclusion and crowding (Fig. 13). The maxillary molars were distalized in four months with the modified Pendulum (Fig. 14). Treatment was finished with a lingual multi-bracketed appliance.

The maxillary archwire sequence was: .016" stainless steel sectional archwires for bicuspid distalization, .016" stainless steel continuous archwire for cuspid distalization, .017" × .017" copper nickel titanium, .016" × .022" stainless steel, .016" stainless steel. Mandibular archwires were .017" × .017" copper nickel titanium, .016" × .022" stainless steel, and .016" stainless steel. Total treatment time was 16 months (Fig. 15).

Discussion

If an increase in overjet is seen after Pendulum therapy, it may not be caused by anterior anchorage loss, but by any of the following factors3-16:

1. Improper diagnosis of an occlusal-musculoskeletal disharmony. If centric occlusion is produced in an advanced position with respect to maximal muscoloskeletal harmony, the mandible may reposition after leveling and alignment, and the consequent increase in overjet could be interpreted as anterior anchorage loss.

2. Inadequate vertical control of the molars during treatment. This can lead to undesirable molar extrusion and thus to a backward rotation of the mandible and increased overjet. We recommend minimizing the use of intermaxillary elastics with light archwires, and using closing archwires with a built-in upper curve of Spee and reverse lower curve.

3. Molar distalization. As Ricketts established, for each 3mm of molar distalization, the mandible rotates 1° backward.17 The rotation can be greater if the molars are mesially inclined initially, so that distal uprighting causes an increase in the vertical dimension. It can also be exacerbated in patients with weak facial patterns.

4. Arch expansion. If a molar that is to be moved distally is also in a crossbite position, we can simultaneously expand the maxillary arch by activating the central Pendulum screw or the TMA arms. During the crossbite correction, the molars pass through a stage of edge-to-edge occlusal contact, and the mandible rotates 1.5-2° backward. From this position to normal occlusion, the mandible rotates only .75-1° forward. Thus, a 1° backward rotation will remain when expansion is finished. Slower expansion can result in as much as a 2° backward rotation, and if the molar torque is simultaneously increased, the rotation can be even greater.

We have used the modified M-Pendulum appliance presented here in both labial and lingual treatment with excellent results and without losing anterior anchorage. •

FIGURES

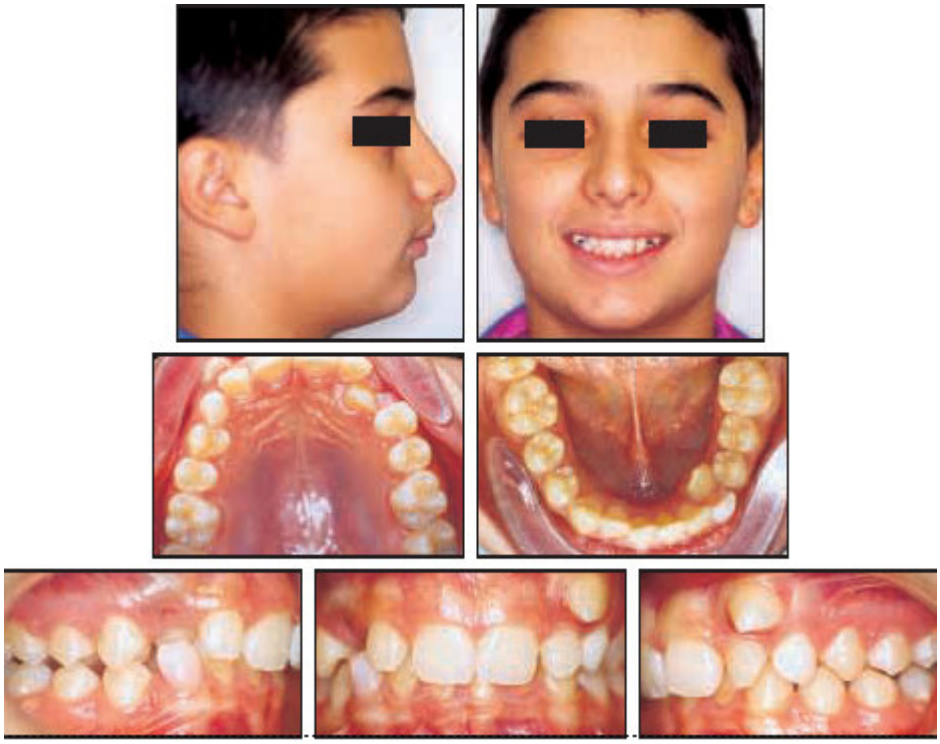

Fig. 1 Case 1. 15-year-old male patient with Class II, division 2 right malocclusion and midline deviation before treatment.

Fig. 2 Case 1. Distalization with M-Pendulum appliance.

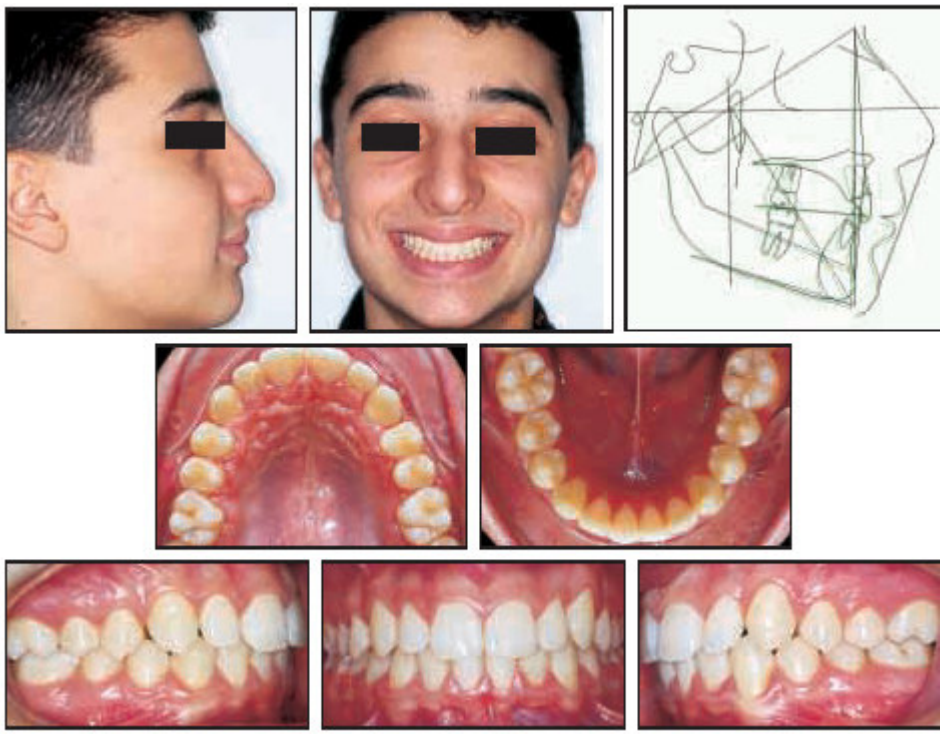

Fig. 3 Case 1. Patient after 24 months of treatment.

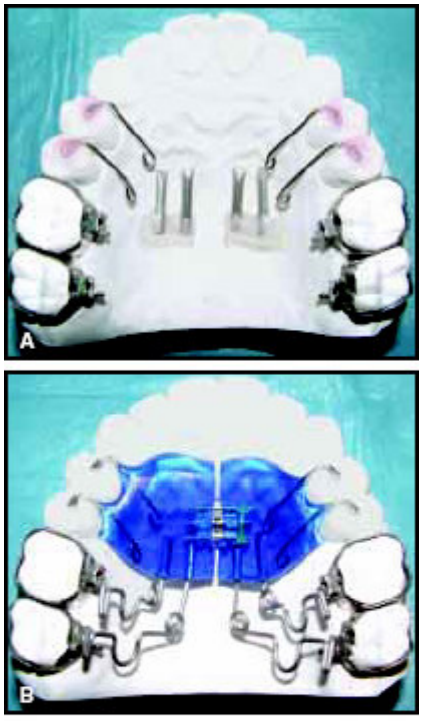

Fig. 4 Fabrication of four-arm Pendulum. A. Stainless steel tubes in palatal area. B. Removable TMA arms inserted into stainless steel tubes.

Fig. 5 Pendulum appliance bonded in position.

Fig. 6 TMA spring of upper right second molar inserted into corresponding tube in Pendulum appliance and into lingual sheath, where it is tied with elastomeric ligature.

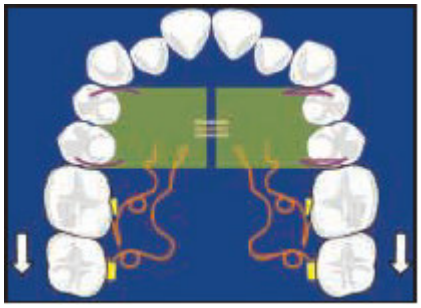

Fig. 7 Distalization of second molars with removable arms.

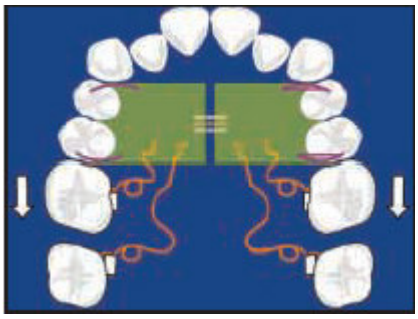

Fig. 8 Distalization of first molars with removable arms, keeping second molar arms passively in place for anchorage.

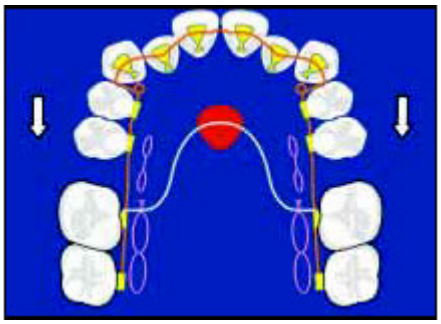

Fig. 9 Pendulum replaced with Nance button, and second bicuspids distalized with elastic chain.

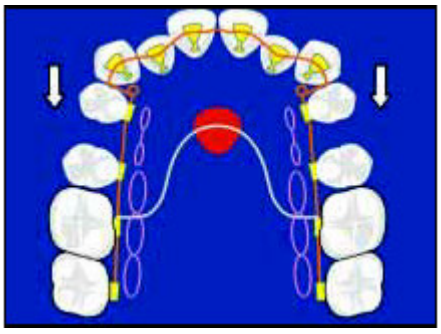

Fig. 10 First bicuspids distalized with elastic chain.

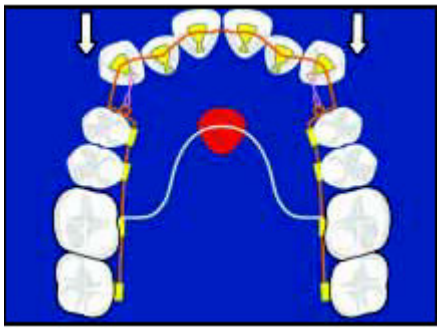

Fig. 11 Cuspids distalized with elastic chain.

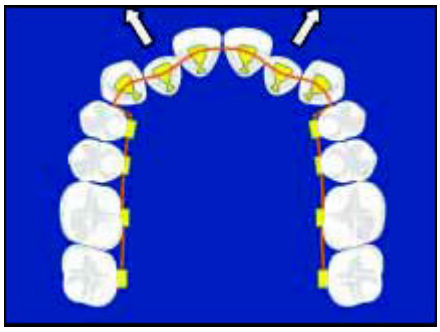

Fig. 12 Leveling and alignment of incisors.

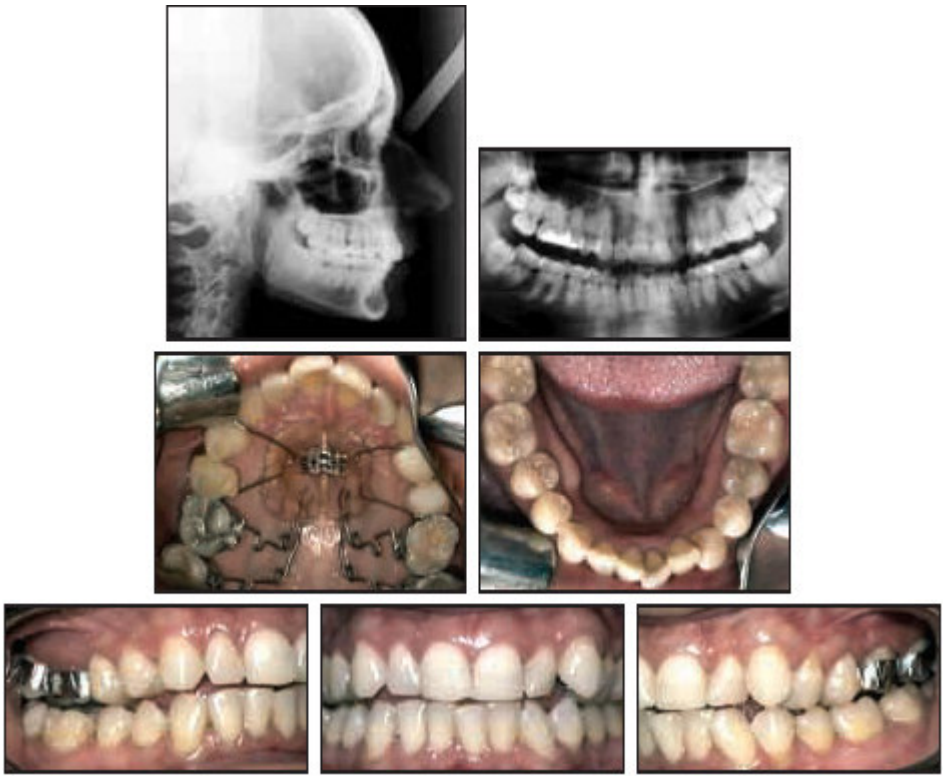

Fig. 13 Case 2. 29-year-old female patient with Class II malocclusion and crowding at beginning of treatment.

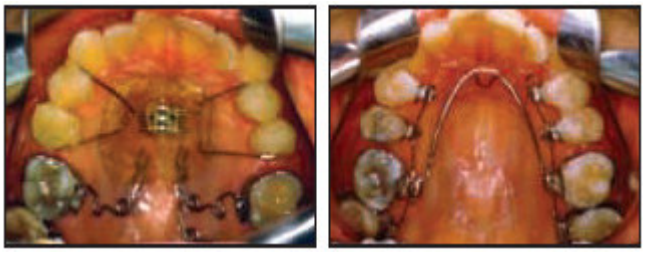

Fig. 14 Case 2. Molar distalization with four-arm Pendulum appliance.

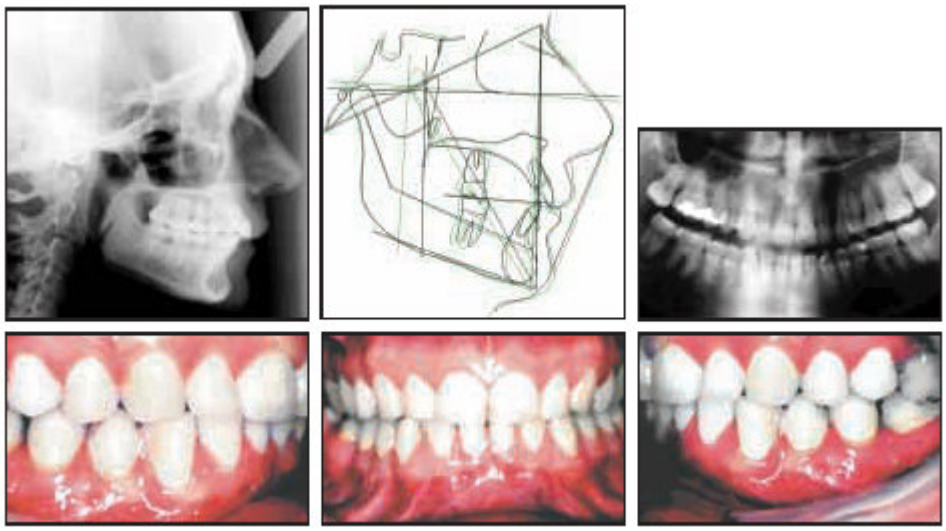

Fig. 15 Case 2. Patient after 16 months of treatment.

REFERENCES

1 Scuzzo, G.; Pisani, F.; and Takemoto, K.: Maxillary molar distalization with a modified Pendulum appliance, J. Clin. Orthod. 33:645-650, 1999.

2 Scuzzo, G.; Takemoto, K.; Pisani, F.; and Della Vecchia, S.: The modified Pendulum appliance with removable arms, J. Clin. Orthod. 34:244-246, 2000.

3 Byloff, F.K.; Darendeliler, M.A.; Clar, E.; and Darendeliler, A.: Distal molar movement using the Pendulum appliance, Part 2: The effects of maxillary molar root uprighting bends, Angle Orthod. 67:261-270, 1997.

4 Cetlin, N.M. and Ten Hoeve, A.: Nonextraction treatment, J. Clin. Orthod. 17:396-413, 1983.

5 Echarri, P.: Ortodoncia lingual, VI-A parte: Tratamiento sin extracciones, Ortod. Clin. 3:86-93, 2000.

6 Echarri, P.: Sagittal and vertical control in lingual orthodontics, J. Ling. Orthod. 2:48-56, 2002.

7 Ghosh, J. and Nanda, R.S.: Evaluation of an intraoral maxillary molar distalization technique, Am. J. Orthod. 110:639-646, 1996.

8 Gianelly, A.A.; Vaitas, A.S.; Thomas, W.M.; and Berger, D.G.: Distalization of molars with repelling magnets: Case report, J. Clin. Orthod. 22:40-44, 1988.

9 Hilgers, J.J.: A palatal expansion appliance for non-compliance therapy, J. Clin. Orthod. 25:491-497, 1991.

10 Hilgers, J.J.: The Non-Compliance Bible: A Current Primer on Non-Extraction Therapy in the Eight Classical Types of Class II Malocclusion, Specialty Appliances, Cumming, GA, 1996.

11 Hilgers, J.J.: The Pendulum appliance for Class II non-compliance therapy, J. Clin. Orthod. 26:706-714, 1992.

12 Hilgers, J.J.: The Pendulum appliance: An update, Clin. Impress. 2:15-17, 1993.

13 Hilgers, J.J. and Bennett, R.K.: The Pendulum appliance: Creating the gain, Clin. Impress. 3:14-18, 1994.

14 Hilgers, J.J. and Bennett, R.K.: The Pendulum appliance, Part II: Maintaining the gain, Clin. Impress. 3:6-9, 14-23, 1994.

15 Jeckel, N. and Rakosi, T.: Molar distalization by intraoral force application, Eur. J. Orthod. 13:43-46, 1991.

16 Jones, R.D. and White, J.M.: Rapid Class II molar correction with an open-coil jig, J. Clin. Orthod. 26:661-664, 1992.

17 Ricketts, R.M.; Roth, R.H.; Chaconas, S.J.; Schulhof, R.J.; and Engel, G.A.: Orthodontic Diagnosis and Planning: Their Roles in Preventive and Rehabilitative Dentistry, vols. 1 and 2, Rocky Mountain Data Systems, Denver, 1982.

FOOTNOTES

1 Hilgers Pendulum: Ormco/"A" Company, 1717 W. Collins Ave., Orange, CA 92867.

2 TMA: Registered trademark of Ormco/"A" Company, 1717 W. Collins Ave., Orange, CA 92867.

3 Stainless steel tubes: Dentaurum, Inc., 10 Pheasant Run, Newtown, PA 18940.

4 Blue Ultra Band Lok, Light Bond: Reliance Orthodontic Products, P.O. Box 678, Itasca, IL 60143.

5 Onyx Etch: Centrix Dental, 770 River Road, Shelton, CT 06484.