The Pendulum Appliance utilizes a large acrylic Nance Button in the palate for anchorage along with .032 pendulum springs which fit into .036 lingual sheaths in the maxillary first molars and delivers light continuous distalizing forces to the first molars.

Molar distalization for Class II malocclusions has been a topic which has been discussed for many years by orthodontic practitioners. If molar distalization is deemed to be the treatment of choice, I would recommend the “new” Pendulum Appliance which has been appropriately named the “compliance appliance”. This is primarily due to the fact that this appliance is fixed and takes the control out of the hands of the patient and transfers that control to the orthodontic clinician. The main purpose of this appliance is to distalize maxillary molars in a predictable, efficient manner without placing any strain on the lower arch. Clinicians can easily distalize maxillary molars 5 mm in 3 to 4 months with this appliance.

by Dr. Brock H. M. Rondeau
CASE REPORT #1
PENDULUM APPLIANCE

Female

Profile

12 years 8 months

Straight

TMJ History

Normal

TMJ Signs

Normal Range of Motion

No Clicking

No Pain

TMJ Symptoms

Not Significant

Functional Problems

None

Skeletal Problems

Class I Skeletal

Normal Maxilla

Normal Mandible

Normal Vertical

Dental Problems

Overjet 5 mm.

Overbite 0 mm.

Class II Molar

3 / 3 Blocked Out Labially

Severe Crowding Maxillary Arch

Treatment Plan

Phase 1 MX Pendulum Appliance

Extract Upper Second Molars

Phase 2 MX Transpalatal Arch–

Nance Button

Phase 3 Straight Wire

Occlusal View, Insert Pendulum, March 1993

Right Lateral View, Insert Pendulum, March 1993

Occlusal View, Molar Bands Inserted, March 1993

Occlusal View, Activation of Pendulum Springs, March 1993

Occlusal View, Distalized Upper Left, First Molar 6 mm., September 1993

Occlusal View, Distalized Upper Left, First Molar 6 mm., September 1993

Occlusal View, Molar Distalized July 1993

Occlusal View, Transpalatal Arch, Nance Button, September 1993
DESIGN OF PENDULUM APPLIANCE

1. Pendulum Springs .032 Wire
   The distalization of the maxillary molars occurs due to the Pendulum Springs which include the recurved molar insertion wire, a small horizontal adjustment loop, a closed helix loop, and a loop for retention in the palatal acrylic of the Nance Button.

2. Lingual Sheaths .036
   The recurved molar insertion wire fits into the .036 Lingual Sheaths which are soldered to the lingual of the maxillary first molar bands.

3. Nance Button
   The palatal acrylic helps provide anchorage as well as retention for the Pendulum Springs and must be made as large as possible to prevent any tissue impingement.

4. Maxillary First Molar Bands
   The .036 lingual sheaths are soldered to the lingual of the Maxillary First Molar Bands.

5. Maxillary First Bicuspid Bands
   The bands are attached by a retaining wire.

6. Midline Screw (Optional)
   Utilized when transverse development of maxillary arch is required.

7. Occlusal Rests
   Occlusal Rests were placed on the maxillary first and second bicuspid to help provide anterior anchorage in some earlier designs of the Pendulum Appliance. To maximize anterior anchorage, it is preferable to place bands on the maxillary first bicuspids instead of Occlusal Rests.

FUNCTIONS OF PENDULUM SPRINGS

The main function of the Pendulum Springs is to deliver a light, continuous distalizing force to the maxillary first molars. It is called a Pendulum Appliance due to the nature of the Pendulum Spring which produces a broad, swinging arc (Pendulum) of force from the palatal acrylic to the maxillary molars. Pendulum Springs can also be adjusted to expand and rotate the maxillary first molars.

a) Recurved Molar Insertion Wire
   The .032 Recurved Molar Insertion Wire fits into the .036 Lingual Sheath on the Maxillary First Molar Band. It is vital that this wire not be torqued during the adjustment and activation of the Helix Loop which could adversely affect the maxillary molars. The mesial end of the recurved loop is grasped with a Howe Plier or Weingart Plier, and the Pendulum Spring is seated in the Lingual Sheath.

b) Horizontal Adjustment Loop
   Due to the nature of the Pendulum Springs which are a constant length, the maxillary molars have a tendency to go lingually when distalized. To compensate for this shortcoming, it is prudent to open the Horizontal Adjustment Loop, utilizing the #139 Bird Beak Plier, which lengthens the Pendulum Spring and helps prevent the unwanted lingual movement. This Horizontal Adjustment Loop adds some flexibility to the wire which also facilitates the insertion of the Pendulum Spring into the Lingual Sheath.

c) Helix Loop
   When the small, powerful Helix Loop is activated, it delivers the distalizing force to the maxillary molars.

d) Retention Loop
   This loop allows for retention of the Pendulum Spring into the palatal acrylic. The springs are extended as close to the midline of the palate as possible to maximize their range of motion and to allow for easier insertion into the Lingual Sheaths. Tongue irritation during swallowing is reduced by extending the springs distal to the button.

INDICATIONS FOR PENDULUM APPLIANCE

The Pendulum Appliance should be used primarily in the following clinical situation: Class I skeletal, straight profile, normal skeletal vertical, normal transverse development, where the main problem is an arch length deficiency due to a Class II molar relationship. Prior to the distalization of the maxillary molars, clinicians must confirm that the patient has no significant signs or symptoms of TMI. All patients must be thoroughly screened, utilizing a TMJ health questionnaire and thoroughly examined with regard to range of motion as well as palpation of the muscles of the head and neck. If the TMJ health questionnaire, range of motion, muscle palpation all indicate a normal, healthy TMJ, then the clinician can assume that the condyles are in a downward and forward position in the fossa and there exists a normal relationship between the maxilla and the mandible. Correct condylar position may also be confirmed radiographically with transcranial radiographs and/or tomograms. The use of the Pendulum Appliance is therefore indicated. It must be noted that if there are significant signs and symptoms of TMI, the use of the Pendulum Appli-
# CASE REPORT #2

## PENDULUM APPLIANCE

<table>
<thead>
<tr>
<th>Male</th>
<th>15 years 5 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profile</td>
<td>Straight</td>
</tr>
<tr>
<td>TMJ History</td>
<td>Normal</td>
</tr>
<tr>
<td>TMJ Signs</td>
<td>Normal Range of Motion</td>
</tr>
<tr>
<td>TMJ Symptoms</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Functional Problems</td>
<td>None</td>
</tr>
<tr>
<td>Skeletal Problems</td>
<td>Class I Skeletal</td>
</tr>
<tr>
<td></td>
<td>Normal Maxilla</td>
</tr>
<tr>
<td></td>
<td>Normal Mandible</td>
</tr>
<tr>
<td></td>
<td>Normal Vertical</td>
</tr>
<tr>
<td>Dental Problems</td>
<td>Overjet 9 mm.</td>
</tr>
<tr>
<td></td>
<td>Overbite 3 mm.</td>
</tr>
<tr>
<td></td>
<td>Class II Molar</td>
</tr>
<tr>
<td></td>
<td>7/ Protrusive</td>
</tr>
</tbody>
</table>

**Treatment Plan**

- **Phase 1**
  - MX Pendulum Appliance
  - Extract Upper Right Second Molar
- **Phase 2**
  - MX Transpalatal Arch—Nance Button
- **Phase 3**
  - Straight Wire

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![Right Lateral View Insert Pendulum, March 1993](image1)

![Occlusal View Insert Pendulum, March 1993](image2)

![Occlusal View Right Molar Distalized 4 mm., Left Molar Distalized 2 mm., July 1993](image3)

![Occlusal View Right Molar Distalized 5 mm., August 1993](image4)

![Occlusal View Right Molar Distalized 5 mm., August 1992](image5)
ance is contra-indicated. If there is any chance of the condyles being displaced distally, then any retractive orthodontic technique such as the Wilson Distalizing Arch, Cervical Facebow Headgear, maxillary bicuspid extractions, Posterior Sagittal or the Pendulum Appliance is contra-indicated.

1. **Profile**
   - Straigh profile
   - Adequate maxillary lip support

2. **Functional**
   - Normal, healthy TMJ
   - Correct condyle-fossa relationship
   - Correct mandible to maxilla relationship

3. **Skeletal**
   - Class I skeletal
     - Normal Maxilla
     - Normal Mandible
     - Normal skeletal vertical
   - Skeletal closed
   - Normal, short lower face height
   - Maxilla normal transverse width
   - Brachycephalic growth pattern

4. **Dental**
   - Class II molar relationship
   - Deep overbite
   - Permanent dentition
   - Maxillary first molar mesially inclined
   - Preferably prior to eruption maxillary second molars
   - Maxillary cusps labially displaced
   - Loss of arch length due to premature loss of second deciduous molars
   - Cases where extrusion of maxillary molars will not adversely affect the patient

5. **Cooperation**
   - Utilized in cases where you anticipate there may be a problem with patient compliance regarding the wearing of orthodontic appliances

**METHOD OF INSERTION OF PENDULUM APPLIANCE**

1. Insert Pendulum Appliance as one unit by applying wax to the buccal tubes and lingual sheaths of the molar bands and then cementing the Maxillary First Molar Bands.

2. The Pendulum Springs are not activated prior to cementing the Maxillary First Molar Bands.

3. The Maxillary First Bicuspid Bands are not cemented initially.

4. Remove the Pendulum Appliance (except for the first molars) including the Pendulum Springs, Nance Button, and the First Bicuspid Bands.

5. Activate Helix Loop of Pendulum Spring. (The amount of activation and the method of activation will be discussed later.)

6. Insert recurved molar insertion wire of the Pendulum Spring into the Lingual Sheath and cement Maxillary First Bicuspid Bands.

   After one month, repeat steps #4, 5 and 6 to activate and reinsert the Pendulum Appliance by removing the First Bicuspid Bands and then recementing them.

**ADVANTAGES OF PENDULUM APPLIANCE**

1. **Comfort**—The Pendulum Appliance encourages patient cooperation since it is so comfortable.

2. **No Acrylic Between Teeth**—The fact that there is no acrylic between the teeth, as is the case with the posterior sagittal appliance, results in a high rate of patient acceptance.

3. **Speech**—Patients have no problem speaking with this appliance.

4. **Eating**—Patients have no problem eating with this appliance.

5. **Worn 24 Hours**—since the Pendulum is a fixed appliance, it is guaranteed to be worn 24 hours per day and therefore is quite effective in distalizing the maxillary molars in a short period of time.

**DISADVANTAGES OF PENDULUM APPLIANCE**

1. **Torquing or Rotation of Molars**
   - If the Helix Loop is not adjusted correctly, the Pendulum Spring can be distorted and torqued and when inserted in the Lingual Sheath of the maxillary molars, can result in undesirable rotation or torquing of the molars.

2. **Tissue Irritation**
   - a) Food and plaque can accumulate under the palatal acrylic and cause tissue irritation. When the appliance is removed every month for re-activation, this problem can be observed. The slight amount of tissue irritation is rarely serious enough to discontinue treatment.
   - b) When the Helix Loop of the Pendulum Springs are activated, this results in anterior reciprocal forces being generated against the palatal acrylic and the palate. The larger the palatal acrylic, the more the forces will be generated over a wider area and therefore less palatal irritation will be evident.

**CONTRA-INDICATIONS FOR PENDULUM APPLIANCE**

1. **Profile**
   - Retrogнатhic profile
   - Inadequate maxillary lip support

2. **Functional**
   - Numerous signs and symptoms of TMJ
   - Posteriorly or superiorly displaced condyles

3. **Skeletal**
   - Class II skeletal
     - Normal maxilla
     - Retrogнатhic mandible
   - Skeletal open
   - Excess lower face height

**THE FUNCTIONAL ORTHODONTIST**

30° Activation 10° Lost 20° Net Activation
45° Activation 15° Lost 30° Net Activation
60° Activation 20° Lost 40° Net Activation

Initial Activation Maxillary First Molar 45°
If you have to distalize the first and second maxillary molars simultaneously, you will require more activation.

Initial Activation Maxillary First and Second Molars 60°

METHODS OF RETENTION AFTER PENDULUM APPLIANCE

1. Modified Pendulum Appliance
The Pendulum Appliance could be modified as a fixed retainer. The palatal acrylic could be made smaller similar to a Nance Button, the first bicuspid bands cut off the appliance, and the Pendulum Springs deactivated.

2. Utility Arch
A holding Utility Arch (.016 x .016 S.S.) could be utilized to hold the molars distally. The Utility Arch involves four incisors and two first molars, anterior bends 5 mm. high, 2 mm. distal to the lateral brackets and posterior bends 2.5 mm. high and butted right up against the mesial of the gingival tube. (The gingival tube is recommended for Utility Arches since it has no torque and no angulation.) The disadvantage of using the Utility Arch is that the four incisors must be aligned with straight wire (.018 NiTi, Ormco) prior to the placement of .016 x .016 Utility Arch. This usually takes several months; therefore, if this method of retention is desirable, straight wire brackets should be placed to align the incisors at the same time as the Pendulum is inserted. The advantage of using the Utility Arch is that this is an ideal archwire to correct the molars if they are mesially rotated. A toe-in bend (distal offset) may be placed which will facilitate the distal rotation of the molar which will help achieve a Class I molar relationship as well as increase the arch length by 1–2 mm. per side.

3. Transpalatal Arch—Nance Button
The Transpalatal Arch preserves the transverse dimension and the Nance Button helps hold the molars distally. A lingual hook may be placed on the molar band which will assist with the distalization of the cuspsids and bicuspsids. A distalizing force from the lingual may be applied by attaching power chain from lingual buttons on the lingual of the cuspsids and bicuspsids to the lingual hook on the first molars, distalizing force from the buccal may be applied by attaching power chain from the brackets on the cuspsids and bicuspsids to the buccal hook on the first molars.

4. Rick-A-Nator
The Rick-A-Nator Appliance consists of two molar bands on the maxillary first molars attached via two .040 connector wires to an anterior biteplate. The Rick-A-Nator is very effective in preventing the molars from relapsing mesially. It is the retention appliance of choice in the following clinical situations:

a) Deep Overbite—The anterior biteplate opens the bite and allows the placement of the brackets on the lower anterior.

b) Vertical Maxillary Incisors—The Rick-A-Nator touches the lingual of the maxillary incisors and can help vertical maxillary incisors achieve the desired labial crown torque.

Lingual hooks may also be soldered to the lingual of the first molar bands which will facilitate the distalization of the cuspsids and bicuspsids.

The bottom line is that the clinician must employ some type of fixed retainer after the Pendulum Appliance or the molars will relapse mesially. It is recommended that the Pendulum Appliance be utilized for 3 to 4 months depending on the amount of distalization and then removed primarily due to the minor tissue irritation that occurs under the palatal acrylic of this fixed appliance. Once the molars have been distalized, a smaller, more hygienic lingual retainer such as a Transpalatal Arch or Rick-A-Nator can be placed.

DEGREE OF MOLAR DISTALIZATION
All molar distalization appliances, including the Pendulum Appliance, results in distal tipping of the first molars. The crown tips distally and the root remains more mesial. When the Pendulum and subsequent retention appliances are removed, the crowns will try to upright over their roots. It is recommended that when distalizing the first molar, it be overcorrected to Class III molar relationship and then when the retention appliances are removed and the straight wire appliances placed, the first molars may be corrected to Class I.

If there is no vertical problem, the first and second molars can be distalized 3 to 4 mm. very efficiently. If there is a vertical problem and you need to distalize the maxillary first molars, the treatment of choice would be to extract the second molars. Further, if your intention is to distalize the first molars 6 to 8 mm., for the purpose of retention and future stability, the second molars should be extracted (assuming the third molars are present). This prevents the impaction of the third molars.

<table>
<thead>
<tr>
<th>COMPARISON BETWEEN PENDULUM AND WILSON DISTALIZING ARCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wilson Distalizing Arch</td>
</tr>
<tr>
<td>Pendulum Fixed Yes</td>
</tr>
<tr>
<td>Patient Cooperation No Elastics</td>
</tr>
<tr>
<td>Lower Arch No Effect</td>
</tr>
<tr>
<td>Upper Incisors No Effect</td>
</tr>
<tr>
<td>Wilson Class II elastics</td>
</tr>
<tr>
<td>Posterior teeth move mesially</td>
</tr>
<tr>
<td>Loss of anchor-age lower arch</td>
</tr>
<tr>
<td>Flared incisors</td>
</tr>
<tr>
<td>If patient forgets to wear</td>
</tr>
<tr>
<td>Class II elastics</td>
</tr>
<tr>
<td>Flared incisors</td>
</tr>
</tbody>
</table>
and the patient is spared a difficult extraction procedure. The third molar replaces the second molar and this culminates in an excellent clinical result.

### COMPARISON BETWEEN PENDULUM AND WILSON DISTALIZING ARCH

The Pendulum Appliance only attaches to and affects the maxillary arch. Conversely, the Wilson Distalizing Arch generates forces between the maxillary and mandibular arches. Larry Andrews, in his original articles on the Straight Wire Appliance, discussed the harmful effects on the mandibular arch with long term Class II elastic wear. There is a loss of anchorage due to the mesial component of force which is placed on the lower first molars. This causes the mandibular posterior teeth to skid along the alveolar bone and in some cases results in undesirable flaring of the incisors. If the patient forgets to wear the Class II elastics, this can also cause a severe and undesirable flaring of the maxillary incisors. For these reasons, it is recommended that if a fixed appliance is required for the distalization of molars, the “new” Pendulum Appliance is the appliance of choice.

### COMPARISON BETWEEN PENDULUM AND POSTERIOR SAGITTAL

The Pendulum Appliance is superior to the Posterior Sagittal Appliance because it is fixed and there is no acrylic between the teeth which makes it much easier for the patient to talk and to eat. The patient acceptance rate is high and the success rate is almost 95% since it is worn 24 hours per day. If you are interested in distalizing molars in the permanent dentition, the appliance of choice is the Pendulum Appliance.

### CONCLUSION

The “new” Pendulum Appliance is one of the most effective molar distalizing appliances available today. It must be utilized in the correct clinical case and, as always in orthodontics, proper diagnosis is the key to successful treatment. It should be noted that this appliance must not be used in the majority of Class II malocclusions. Two prominent orthodontists from Michigan, Dr. James McNamara and Dr. Robert Moyers, have both stated that 80% of Class II malocclusions are Skeletal Class II problems with normal maxillas and retrognathic mandibles. These malocclusions frequently require maxillary arch development and mandibular repositioning and advancement with functional jaw orthopedic appliances. The appliance of choice in cases with large overjets would be the Twin Block Appliance (Dr. William Clark, Orthodontist, Fife, Scotland). The functional appliance of choice for slight overjets (less than 4 mm.) and deep overbites would be the Rick-A-Nator Appliance. For more information on the Rick-A-Nator, please refer to a previous article written by this author in the July-August 1990 issue of The Functional Orthodontist.

When dealing with a problem of dental crowding on the upper arch, there are three steps which should be followed:

1. Develop maxillary arch transversely.
2. Obtain correct torque for maxillary incisors. (Cephalometrically correct position.)
3. Distalize maxillary molars.

The distalization of maxillary molars utilizing the Pendulum Appliance should only be attempted in Class I Skeletal, normal or short lower face height, normal transverse development, healthy TMJ, mesially inclined molars, deep overbite, where the main problem is an arch length deficiency due to a Class II molar relationship in permanent dentition in patients with a straight profile.

The Pendulum Appliance can be an excellent appliance in cases where all of the above criteria have been met and you have Class I molar on one side and Class II molar on the other side.

The fact that this “new” Pendulum Appliance can distalize maxillary molars 3 mm. in 3 to 4 months and the appliance is fixed guarantees patient cooperation and ensures that this will be a valuable adjunct with other functional appliances such as the Rick-A-Nator and Twin Block Appliances in the correction of Class II malocclusions.

### BIBLIOGRAPHY