Treatment Philosophy of the MBT™ Appliance System

The MBT Appliance System philosophy of orthodontic treatment has been developed over a twenty year period of time and has involved the combined efforts of its three principle clinicians, along with the help of numerous other clinician colleagues. Their philosophy places emphasis on four critical areas of orthodontic treatment: 1. Treatment mechanics, 2. The pre-adjusted appliance, 3. Bracket placement technique, and 4. Arch form and archwire sequencing.

The MBT System philosophy is supported not only by a custom designed appliance, but also by worldwide continuing educational opportunities as well as a long awaited textbook.

1. Treatment Mechanics

Emphasis on dento-alveolar change

The major effect of orthodontic treatment is on the dento-alveolar structures. Thus the term “growth modification” in growing patients consists primarily in the modification of the growth and development of the dento-alveolar processes. While other “orthopedic” changes may be occurring in some patients, the majority of change is dento-alveolar, and, therefore, emphasis is placed on the management of these structures.

Use of Light, Continuous Forces

Intermittent forces have proven to be relatively ineffective in bringing about dental tooth movement; on the other hand, continuous forces are most effective in moving dental structures. Heavy forces have been shown to have a detrimental effect on the root structure while lighter forces have been shown to maximize biologic response and efficacy in tooth movement. Therefore, treatment planning is directed at providing light continuous forces on the teeth that need to be moved at any given time during orthodontic treatment.

Anchorage Control

A combination of extra-oral (facebows and “J” hooks) and intra-oral (palatal bars, lingual arches, Class II elastics, Class III elastics, Nance arches, Utility arches, etc.) methods of anchorage control are utilized in the MBT system.

Leveling and Aligning

The leveling and aligning stage of treatment consists of the following techniques:

- Use of NiTi Heat-Activated nickel titanium wires during the aligning process
- The use of canine lace backs for cuspid control and retraction
- The use of bend backs to control forward movement of incisors
- The use of open coil springs to create space for blocked out teeth
- Early establishment and maintenance of arch form, followed by bringing malposed teeth into the primary arch form without arch form distortion

Overbite Control

Overbite control is best accomplished by using the following principles:

- Differentially controlling the eruption/extrusion (intrusive and extrusive forces) of the anterior and posterior segments
- Including second molars early in treatment for the opening of most deep bite cases
- Being aware that in most cases leveling and bite opening are not complete until rectangular wires have been in for one or two months
- Avoiding leveling of the posterior portion of the Curve of Spee in open bite cases

Space Closure

Space closure control is best accomplished by using the following principles:

- A .019 x .025” rectangular wire in the .022 bracket slot is preferred for effective sliding mechanics without major archwire deflection
- Sliding mechanics is accomplished with elastic module tie backs
- Incisor torque control is accomplished through bracket design and archwire bending

Overjet (Class II-Class III) Correction

Class II and Class III correction is accomplished by using a combination of headgear, Class II and Class III elastics, and functional appliances. These appliances are used in combinations that bring about the best opportunity for continuous forces on the dento-alveolar processes.
Finishing
Finishing involves three main processes:

- The correction of mistakes made earlier in treatment (bracket positioning, torque control, anchorage control etc.)
- Over-correction as needed (periodontal, alveolar-sutural, muscular, and growth)
- Settling of cases in light wires for approximately six weeks (minimum) prior to debanding

Retention
Retention is accomplished using a combination of bonded retainers for the lower anterior segment, wrap around upper retainers to allow for continued arch settling, and some positioners as well as some clear acrylic full coverage retainers.

2. MBT™ Appliance Bracket System
Victory Series™ Brackets – Figures 1, 2, 3 show a good candidate for this small steel bracket, as evidenced by the patient’s short clinical crowns.

Full Size Twin Brackets – Figures 7, 8, 9 show a patient with large teeth, a difficult malocclusion and poor hygiene. The larger bracket will maximize base surface area and increase control.

Clarity™ Brackets – Figures 4, 5, 6 show Clarity metal-reinforced ceramic brackets on her upper teeth, aesthetic brackets for an aesthetic appearance during treatment.

APC™ System
In addition to the MBT Versatile+ appliance types available, our offices also appreciate the option of APC adhesive coating on our brackets. The efficiency and simplified inventory management has been most beneficial for staff and patients.
MBT™ Appliance Features

Reduced Upper and Lower Anterior Tip

<table>
<thead>
<tr>
<th>Upper Anterior Tip</th>
<th>Lower Anterior Tip</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Lateral Cusp</td>
<td>Central Lateral Cusp</td>
</tr>
<tr>
<td>Andrews’ norms 3.59° 8.04° 8.4° 0.53° 0.38° 2.5°</td>
<td></td>
</tr>
<tr>
<td>Sebata’s data 4.25° 7.74° 7.7° -0.48° -1.2° 1.5°</td>
<td></td>
</tr>
<tr>
<td>Watanabe’s data 3.11° 3.99° 7.7° 1.96° 2.28° 5.4°</td>
<td></td>
</tr>
<tr>
<td>MBT™ Appliance 4.0° 8.0° 8.0° 0° 0° 3.0°</td>
<td></td>
</tr>
<tr>
<td>Original SWA 5.0° 9.0° 11.0° 2.0° 2.0° 5.0°</td>
<td></td>
</tr>
<tr>
<td>Roth SWA 5.0° 9.0° 13.0° 2.0° 2.0° 7.0°</td>
<td></td>
</tr>
</tbody>
</table>

Table 1 shows anterior tip measurements: Andrews’ non-orthodontic normal study, two Japanese studies, the MBT Versatile+ Appliance, the Original Straight-Wire Appliance™ and the Roth Appliance.

The anterior tip measurements for the original Straight-Wire Appliance are all greater than those found in Andrews’ research. This was presumably done to control what Andrews referred to as the ‘wagon wheel’ effect that torque places on anterior crown tip. This is somewhat similar to the compensating anti-tip, anti-rotation and power arms built into the extraction brackets for the treatment of bicuspid extraction cases.

*As palatal root torque is added to the anterior segment, mesial crown tip is reduced*

It has been observed by the authors that with light continuous force mechanics, tip is well controlled by the pre-adjusted appliance. Using “lacebacks” and “bendbacks” during leveling and aligning, and elastic module “tie-backs” during space closure, very little adverse tipping occurs during these stages of treatment. By the finishing stage of treatment, completely levelled upper and lower rectangular wires are normally in place, indicating that full expression of both anterior and posterior crown tip has occurred. Thus, additional tip is not seen to be necessary in the anterior segments.

Also, additional anterior tip creates a significant drain on molar anchorage, Figure 10, 11. If the original research values for tip are used, a total of 10° less distal root tip in the upper anterior segment and 12° less distal root tip in the lower anterior segment is needed (compared against the Original Straight-Wire Appliance).

- Figures 10 and 11 show the difference in root positions with MBT Versatile+ Appliance and two SWA.

- Figure 12. The MBT Appliance provides anterior tip measurements that correspond to Andrews’ norms. This reduced tip provides a significant reduction in anchorage needs.

- Figure 13: This X-ray shows a case treated with a bracket with excessive cuspid tip. This is what the MBT Versatile+ bracket was designed against.

Thus reduced tip significantly reduces the need for anchorage control, which normally translates into a reduced need for patient cooperation. Since the MBT Versatile+ measurements are identical to Andrews’ original research figures, there is no compromise in ideal static occlusion. And if the condyles are in centric relation, there is no compromise in ideal functional occlusion as described by Roth.

---

Table 1 Anterior Tip

<table>
<thead>
<tr>
<th>Total Arch Length Change</th>
<th>Cusp Tip</th>
<th>Lateral Tip</th>
<th>Central Tip</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBT™ System</td>
<td>0.0mm</td>
<td>8°</td>
<td>8°</td>
</tr>
<tr>
<td>Andrews</td>
<td>1.7mm</td>
<td>11°</td>
<td>9°</td>
</tr>
<tr>
<td>Roth</td>
<td>2.4mm</td>
<td>13°</td>
<td>9°</td>
</tr>
</tbody>
</table>

Fig. 10 Upper Arch Length

Fig. 11 Lower Arch Length
**Upper Posterior Tip**

Table 2 shows posterior tip measurements for the upper bicuspids and molars: Andrews’ non-orthodontic normal study, two Japanese studies, the MBT Versatile+ Appliance, the Original Straight-Wire Appliance™ and the Roth Appliance.

<table>
<thead>
<tr>
<th>Upper Posterior Tip</th>
<th>1st Bl</th>
<th>2nd Bl</th>
<th>1st Molar</th>
<th>2nd Molar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrews’ norms</td>
<td>2.7°</td>
<td>2.8°</td>
<td>5.7°</td>
<td>0.4°</td>
</tr>
<tr>
<td>Sebata’s data</td>
<td>3.5°</td>
<td>6.2°</td>
<td>5.2°</td>
<td>-0.3°</td>
</tr>
<tr>
<td>Watanabe’s data</td>
<td>4.7°</td>
<td>5.2°</td>
<td>4.9°</td>
<td>4.1°</td>
</tr>
<tr>
<td>MBT™ Appliance</td>
<td>0°</td>
<td>0°</td>
<td>0°</td>
<td>0°</td>
</tr>
<tr>
<td>Original SWA</td>
<td>2.0°</td>
<td>2.0°</td>
<td>5.0°</td>
<td>5.0°</td>
</tr>
<tr>
<td>Roth SWA</td>
<td>0°</td>
<td>0°</td>
<td>0°</td>
<td>0°</td>
</tr>
</tbody>
</table>

Table 2  Upper Posterior Tip  * Effective tip is 5°

For the MBT Versatile+ Appliance, 0° of tip, as opposed to 2° of tip, was selected for all upper bicuspids brackets to place the crowns in a slightly more upright position, (in a Class I direction). It also provides for slightly reduced anchorage needs for the upper arch.

The buccal groove is the reference for crown tip in the upper molars. This buccal groove shows a 5° angulation to a line drawn perpendicular to the occlusal plane. There are two methods of achieving 5° of effective tip in the upper first and second molars.

If a 5° bracket is used, the band must be seated more gingivally at the mesial aspect to position bracket wings parallel to buccal groove. (Fig 14a). This makes band positioning more difficult. When using these 5° brackets, it is frequently necessary to trim band material from the distal of the band. If the 5° bracket is used and the band is placed parallel to the occlusal plane, it provides an excessive 10° of actual tip to the upper first and second molars (Fig 14b).

Alternatively, the authors prefer to use a 0° crown tip bracket with the band and bracket slots placed parallel to the occlusal plane. This introduces the correct 5° of tip in the upper molars, as measured from the buccal groove (Fig 14c) and is easier to seat. The new Unitek™

**Lower Posterior Tip**

Table 3 shows tip measurements for the lower bicuspids and lower molars: Andrews’ non-orthodontic normal study, two Japanese studies, the MBT Versatile+ Appliance, the Original Straight-Wire Appliance and the Roth Appliance.

The authors observed that torque is rather poorly controlled with the pre-adjusted appliance system. This is due to the fact that the torque movement is a difficult one since less than 1mm of contact between the bracket and the archwire must be achieved. In general, however, lies the greatest challenge to bracket design in the pre-adjusted appliance. In the majority of orthodontic cases, because of this lack of torque control, torque tends to be lost in the upper incisors during overjet reduction and space closure. The lower incisors frequently tend to procline forward during Curve of Spee leveling and when eliminating lower incisor crowding. This incisor torque factor, along with the tip and tooth size factors, frequently prevents posterior teeth from fitting into a Class I relationship.
Because of these factors there is generally a need for greater palatal root torque of the upper incisors and labial root torque for more uprighting of the lower incisors (Figure 15). For all these reasons, the authors recommend +17° of torque for the upper central incisors, +10° of torque for the upper lateral incisors, and -6° of torque for the lower incisors.

**Upper Cuspid, Bicuspid and Molar Torque**

Table 5 shows upper cuspid, bicuspid and molar torque values: Andrews’ non-orthodontic normal study, two Japanese studies, the MBT Versatile+ Appliance, the Original Straight-Wire Appliance™ and the Roth Appliance.

In Figure 16 the MBT™ Versatile+ Appliance provides increased palatal root torque for the upper incisors (a, b) and increased labial root torque for the lower incisors (c), the most common requirements in orthodontic cases.

**Table 5 Upper Posterior Torque**

<table>
<thead>
<tr>
<th>Cuspid</th>
<th>1st Bi</th>
<th>2nd Bl</th>
<th>1st Molar</th>
<th>2nd Molar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrews’ norms</td>
<td>-7.3°</td>
<td>-8.5°</td>
<td>-8.9°</td>
<td>-11.5°</td>
</tr>
<tr>
<td>Sebata’s data</td>
<td>0.7°</td>
<td>-6.5°</td>
<td>-6.5°</td>
<td>-1.7°</td>
</tr>
<tr>
<td>Watanabe’s data</td>
<td>-5.3°</td>
<td>-6.0°</td>
<td>-7.2°</td>
<td>-9.8°</td>
</tr>
<tr>
<td>MBT™ Appliance</td>
<td>-7.0°</td>
<td>-7.0°</td>
<td>-7.0°</td>
<td>-14.0°</td>
</tr>
<tr>
<td>Original SWA</td>
<td>-7.0°</td>
<td>-7.0°</td>
<td>-7.0°</td>
<td>-9.0°</td>
</tr>
<tr>
<td>Roth SWA</td>
<td>-2.0°</td>
<td>-7.0°</td>
<td>-7.0°</td>
<td>-14.0°</td>
</tr>
</tbody>
</table>

The upper cuspid and bicuspid torque values of -7° have proven to be satisfactory in most cases, and have therefore been selected for the MBT Versatile+ Appliance. The upper molars, on the other hand, frequently show excessive buccal crown torque with palatal cusps “hanging down” which creates centric, balancing side and working side interferences. For this reason the authors prefer -14° of buccal root torque in these teeth, as opposed to only -9° of buccal root torque (Fig. 17a, b, c).

**Lower Cuspid, Bicuspid and Molar Torque**

Table 6 shows torque values for lower cusps, bicuspids and molars from Andrews’ non-orthodontic normal study, two Japanese studies, the MBT Versatile+ Appliance, the Original Straight-Wire Appliance™ and the Roth Appliance.

There are three reasons for reducing the amount of lingual crown torque in the lower cuspid, bicuspid and molar areas: 1) Since lower cusps and sometimes bicuspids often show gingival recession, they benefit from the roots being moved closer to the center of the alveolar process; 2) many orthodontic cases demonstrate narrowing in the maxillary arch with lower posterior segments that are compensated toward the lingual. These cases benefit from buccal uprighting of the lower posterior segment. 3) It has been consistently observed that lower second molars with -35° of torque consistently “roll in” lingually. Therefore, the authors have chosen to reduce the lingual crown torque, by 5° in the lower cusps and bicuspids, by 10° in the lower first molars, and by 25° in the lower second molars (Fig. 18a, b and 19a, b, c).
**In-out Modifications of the MBT™ Versatile+ Appliance**

It has been observed by the authors that the in-out measurements (including molar rotation) for the original Straight-Wire Appliance™ have, for the most part, proven to be quite satisfactory. With the exception of severe rotations at the initiation of treatment (best handled by space opening in combination with facial and lingual rotation elastics) minimal modifications in archwires need to be made until the finishing stage of treatment. At that time some teeth may need to be over-rotated for stability (using rotation wedges) and first molars may need archwire offsets to complete their rotation.

One important in-out feature that has been added to the MBT Versatile+ appliance is because upper second bicuspids are frequently smaller in size than upper first bicuspids. For this reason, an upper second bicuspid bracket has been provided with an additional 0.5mm of in-out compensation. This will allow for better alignment of central fossae in the upper arch and will also provide for relatively increased mesio-buccal rotation of the upper first molar. When upper second bicuspids are similar in size to the upper first bicuspids, an upper first bicuspid bracket can be used on the upper second bicuspids.

**MBT Appliance Versatility**

- **Inversion of upper lateral incisor brackets** (Fig. 23, 24, 25). This is beneficial in cases with palatally displaced laterals requiring labial root torque for proper stability.

- **Same tip and torque in lower incisor brackets.** With the same lower incisor brackets, inventory is simplified and the possibility of confusion during bracket placement is minimized.

**Figure 19a, b, c** Progressive buccal crown torque in the lower posterior segments (cuspids through molars) provides uprighting of these areas, which are frequently inclined lingually.

**Figure 20** A patient in need of posterior buccal crown torque.

**Figure 21** An upper second bicuspid bracket with an additional 0.5 mm of in-out compensation is provided for the common situation in which upper second bicuspids are smaller than upper first bicuspids.
• Inversion of cuspid brackets with prominent cuspid roots. (Figure 26, 27). This adjustment allows for movement of the cuspid roots away from the cortical plate and into the center of the alveolar process.

• 0° cuspid brackets with hook for extraction cases. (Figure 28). Many orthodontists prefer to have a hook on their cuspid bracket, and the zero degree torque value also allows the cuspid to move away from the cortical plate for easier retraction.

• Inversion of upper cuspid brackets when cusps are in the lateral position. (Figure 29, 30, 31). This adjustment allows the cuspid root to move palatally and assume a position and appearance that more closely resembles the lateral incisor.

• Same tip and torque in upper bicuspid brackets. Thus, in most situations, one bracket is used for all four upper bicuspids. This simplifies inventory and provides for less confusion during placement.

• Additional 0.5mm of in-out in upper second bicuspid brackets. (Figure 32). Approximately 30% of upper second bicuspids are smaller than upper first bicuspids. This bracket is most beneficial in this situation. If all four bicuspids are the same size, then first bicuspid brackets can be placed on both first and second bicuspids.

• Upper second molar bands and brackets on upper first molars in non-headgear cases. (Figure 33). This adjustment provides greater comfort for the patient, as opposed to the placement of an unnecessary headgear tube.

• Lower second molar bands and brackets on lower first molars. When the buccal cusps of upper first molars impinge on the bracket of the lower first molar, the use of the lower second molar band with a much lower occlusal profile bracket often eliminates this problem.

• Lower second molar brackets on upper first and second molars when finishing in a Class II molar relationship. (Figure 34, 35). The lower second molar bracket has zero rotation and 10° of torque which places the Class II upper first molar in a correct relationship with the lower first molar.

• Inventory identification. This is vastly simplified by the pre-labeled individual blister packs of the APC™ Adhesive Coated brackets used in the operatory.
3. Bracket Placement

Prior to the development of the pre-adjusted appliance, edgewise brackets were placed using gauges which set the bracket a specific number of millimeters from the incisal or occlusal tooth surface. When the pre-adjusted appliance was developed, the center of the clinical crown became the vertical reference for bracket placement, and most orthodontists discontinued the use of gauges. The brackets were therefore placed by visually selecting the center of the clinical crown. Unfortunately, this method resulted in significant errors relative to vertical placement. For example:

- Gingival variations, such as partially erupted teeth, labially and lingually (palatally) displaced roots, and gingival inflammation led to placement errors.
- Large teeth (upper central incisors) and small teeth (upper lateral incisors) within the same patient led to obvious errors when brackets were placed in the center of the clinical crown.
- Incisal or occlusal fractures and wear, as well as teeth with extremely tapered and pointed cusps, led to bracket placement errors. (Figure 36)

“In the past, the best results were achieved by the orthodontists who were the best wire benders. In the future, the best results will come from those orthodontists who are the best bracket positioners.”

The use of a bracket placement chart (developed in 1994), as well as pre-adjusted Dougherty gauges, Figures 37 and 38, dramatically reduces bracket placement errors in the vertical dimension. Figures 39 though 44 show placement technique. We have experienced approximately a 50 – 60% reduction in the need to reposition brackets during treatment using this very simple but effective system.

Figure 39, 40, 41 illustrate measuring on the occlusal plane, burnishing the band, and then light curing the band and tube in position.

Figure 42, 43 and 44 show checking bracket height and tip, then curing.
**4. Arch Form and Wire Sequencing**

*Interview with Dr. Richard P. McLaughlin*

**Editor:** Arch form and archwire sequencing are a very important part of the McLaughlin-Bennett-Trevisi philosophy of orthodontic treatment. Can you comment in general on this importance?

**Dr. McLaughlin:** The proper selection of an arch form for each patient as well as the development of a general archwire sequencing system in the orthodontic practice can greatly increase treatment efficiency and also provide greater stability in completed cases.

**Editor:** Can you offer an historical perspective on the subject of arch form?

**Dr. McLaughlin:** A review of the orthodontic literature on the subject of arch form reveals that there are three main themes that run throughout this information. The first is the search for the ideal arch form (Bonwill-Hawley, catenary curve, Brader arch form, etc.). Second is the conflicting view that there is a great deal of variation in human arch form. The third is that when arch form is significantly changed in the patient, there is a great tendency toward orthodontic relapse.

**Editor:** How should this information affect the choices an orthodontist must make when selecting an arch form for each patient?

**Dr. McLaughlin:** This information, as well as treating patients over a 20 year time period, indicates that the use of a single arch form in all patients is an unsatisfactory method of treatment. Some method of individualization must be carried out.

---

Adapted from *Orthodontic Perspectives* Vol. IV No. 2. © 1997, 3M. All rights reserved.