MBT™ Versatile+ Appliance System

– Efficient Methods
– Innovative Appliances
– Quality Results

Efficient Treatment Solutions for Clinical Excellence

MBT™
Versatile+ Appliance System

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The MBT™ Versatile+ Appliance System

Orthodontics, a science centered around managing and leveraging biological movement, is, in itself, a study in continuous movement. It is a discipline of continuous evolution, drawing from new technology and collective experience, to better meet the needs of the patient and the orthodontic practice. The ever-present challenge is coordinating different advancements to work together toward a better result.

The MBT™ Versatile+ Appliance System brings together current science and decades of orthodontic experience into one synchronized methodology. The core aspects of diagnosis and treatment planning, accurate bracket placement, effective movement and quality fixed appliances are all essential to consistently achieve a quality result. The MBT System brings together appliances and methods in these different areas into one technique. It provides a systemized approach to treatment, one that incorporates time-tested innovation and experience and the development of new methods and technologies.

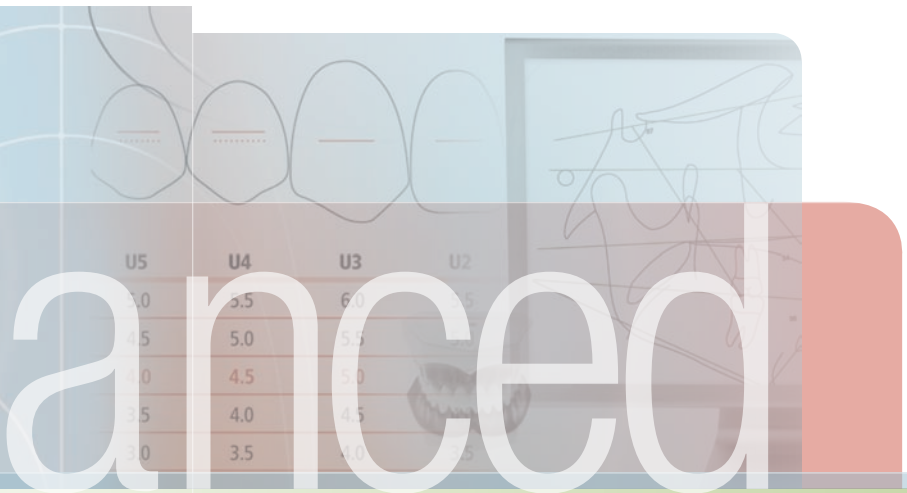
In the early 1990s, Drs. Richard McLaughlin, John Bennett and Hugo Trevisi collaborated with 3M Unitek to develop the MBT Versatile+ Appliance System. Combining the doctors' decades of clinical experience with 3M Unitek's legacy of quality and innovation, the result was a set of integrated tools and methods based on a set of fundamental concepts:

- **Improving the values of pre-adjusted appliances.** Over the previous two decades, pre-adjusted appliances had become widely accepted globally over standard edgewise brackets, yet all systems were based on the research and techniques available at the time that Dr. Lawrence Andrews published *The Six Keys to Normal Occlusion* in 1972. The MBT System updates the tip and torque values based on further research.

- **Customizing archwire selection to patient need.** The shape of the arch form, the material type and arch form size can be selected based on the treatment need for the patient. The MBT System equips doctors with tools and information on how to choose archwires that best meet the patient's situation at each stage of movement.
- **Assisting the accurate vertical placement of brackets.** The visual cues traditionally used to properly orient brackets are frequently deceptive. The MBT System provides a quantitative means to consistently arrive at a more effective vertical placement.
- **Using light-force, sliding mechanics.** Anchorage control can be achieved early in treatment, and does not have to be sacrificed to achieve other movement goals. The MBT System offers a number of techniques to achieve treatment goals effectively.

Moving forward, the structure of the MBT System is designed to continuously adapt and evolve as new information and innovation enters into orthodontics. To maintain this core focus, the MBT System's development is clinically driven by a board of experienced, internationally renowned orthodontists. As the MBT Clinical Development Council, these doctors continue to develop new education and advance the appliance system in the spirit of continuous improvement.

This handbook is designed to give a general overview of the elements of the MBT™ Versatile+ Appliance System, and to establish the basic principles within each element. Despite its nature of continuous movement, orthodontics offers the opportunity to achieve treatment goals consistently when these elements are approached in a systematic, coordinated method, as is offered in the MBT System.



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Pre-Adjusted Appliances

Tip Values

The original pre-adjusted appliances designed by Dr. Andrews did not draw their tip values directly from his research. The actual appliance tip values were increased in recognition of the assumed high forces that would be placed on the teeth by the archwire, the common treatment technique at the time. Current wire materials technology and sliding mechanics allow the MBT™ Versatile+ Appliance System to include tip values closer to the biological norms found in Andrews' study and others done since then. As the tip is therefore managed more effectively with current technology and innovative control methods in the MBT System, the amount of anchorage required to affect anterior tooth movement is reduced, facilitating overall anchorage management.

Figure 1

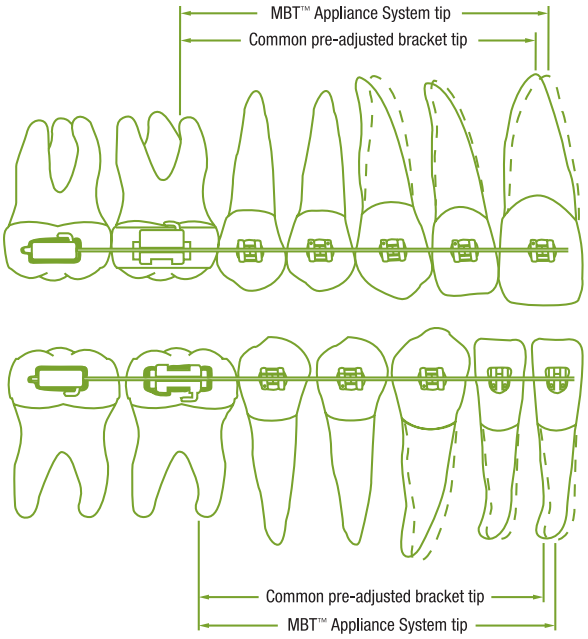


Figure 1: Reduced tip values upright the tooth roots.

Figure 2

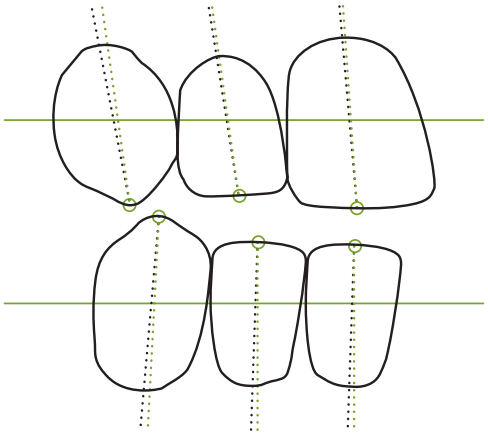


Figure 2: Comparison of Traditional Pre-Adjusted Appliance anterior tip values (black) and the MBT™ Versatile+ Appliance System (green). The reduced tip in the MBT System acknowledges a reduction in required anchorage when employing low-force mechanics.

In the molars, the angulation has been removed. Buccal tubes placed parallel to the buccal cusps will yield a 5° angulation in the upper tube and a 2° angulation in the lower tube, so the net result is a 5° and a 2° angulation in the buccal tubes.

Figure 3

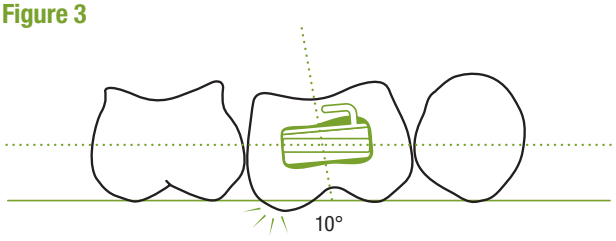


Figure 3A: When using a tube with 5° angulation, if it is placed parallel to the buccal cusps, it will effectively deliver a 10° tip to the first molar.

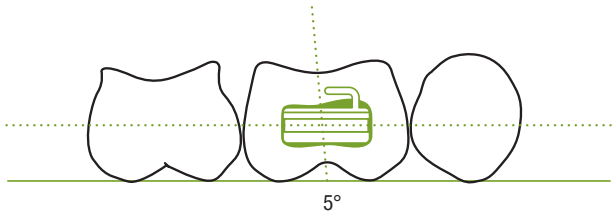


Figure 3B: Thus a 0° tip tube, seated parallel to the buccal cusps, delivers the ideal 5° of tip.

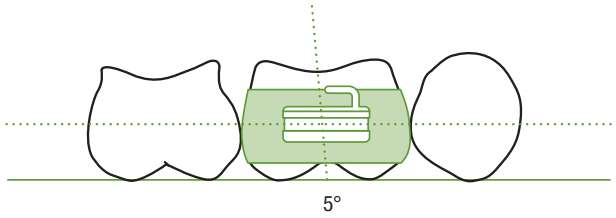


Figure 3C: When tubes are welded to bands, the same difficulty exists when there is a 5° tip. If band edges are parallel to the buccal cusps, the effective tip is 10°. A tube with 0° tip on a band provides an effective 5° when the band is seated parallel to the buccal cusps.

Table 1: Tip Values

Tooth	Andrews' Norms	Traditional Pre-Adjusted Appliance	MBT™ Versatile+ Appliance System
Upper Central	3.59°	5°	4°
Upper Lateral	8.04°	9°	8°
Upper Cuspid	8.4°	11°	8°
Upper 1st Bicuspid	2.7°	2°	0°
Upper 2nd Bicuspid	2.8°	2°	0°
Upper 1st Molar	5.7°	5°	0°
Upper 2nd Molar	0.4°	5°	0°
Lower Central	0.53°	2°	0°
Lower Lateral	0.38°	2°	0°
Lower Cuspid	2.5°	5°	3°
Lower 1st Bicuspid	1.3°	2°	2°
Lower 2nd Bicuspid	1.54°	2°	2°
Lower 1st Molar	2.0°	2°	0°
Lower 2nd Molar	2.9°	2°	0°

Torque Values

Torque movement is an extremely challenging aspect of orthodontic treatment, one that requires significant movement through bone with less than 1 mm of contact between the archwire and the bracket to do so. In addition, traditional pre-adjusted appliances designed from Andrews' research and other studies did not consider the extent of torque loss that results from the fact that even a full-sized archwire does not completely fill the slot and therefore cannot completely express the torque built into the bracket. So as difficult as it is to achieve desired torque, the factor of torque loss increases that difficulty.

Figure 4

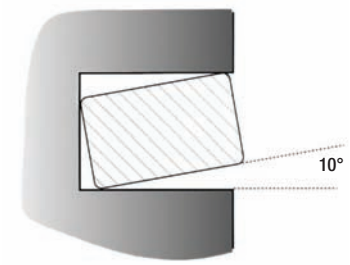


Figure 4: A rectangular .019 × .025 stainless steel wire in an .022 slot can yield approximately 10° of torque loss. The actual amount depends on variability in both wire and slot, but the true torque achieved is less than the value built into the slot.

Anterior Torque

Inadequate torque expressed in the anterior teeth can result in torque loss in the upper incisors during overjet reduction or space closure and proclination of the lower incisors when leveling the Curve of Spee or treating for crowding in the lower arch. The MBT™ Versatile+ Appliance System offers greater palatal root torque in the upper incisor area and greater labial root torque in the lower incisors. For increased versatility, two options are available for the upper central incisors: +17° or +22°, depending on the clinical need.

Figure 5

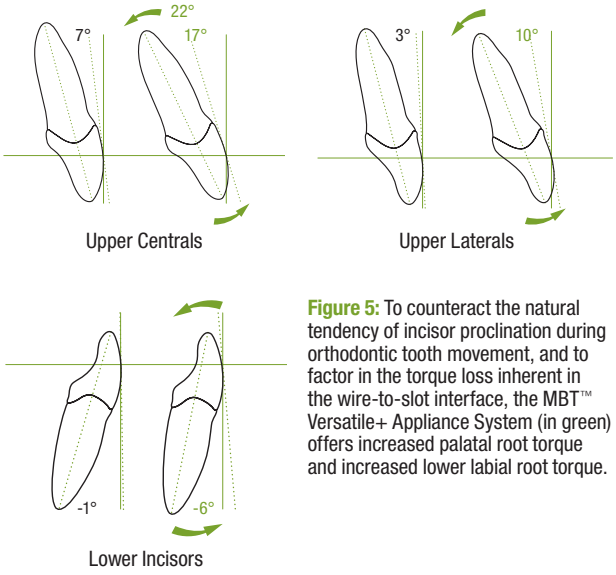


Figure 5: To counteract the natural tendency of incisor proclination during orthodontic tooth movement, and to factor in the torque loss inherent in the wire-to-slot interface, the MBT™ Versatile+ Appliance System (in green) offers increased palatal root torque and increased lower labial root torque.

Posterior Torque

Because of their position on the curve of the arch, and because of their root anatomy, proper torque expression of cuspids is especially challenging and is influenced by each patient's natural arch form and treatment needs. The MBT™ Versatile+ Appliance System provides three torque options for upper cuspids — -7°, 0°, +7° — and three options for lower cuspids: -6°, 0°, and +6°. This allows the practitioner to match the torque amount that will best achieve a secure root torque and intercuspidation.

Insufficient torque expression in the upper molars is commonly manifested by "hanging" palatal cusps, creating centric interferences and requiring further correction. The MBT System increases the buccal root torque to help counteract this tendency.

Figure 6

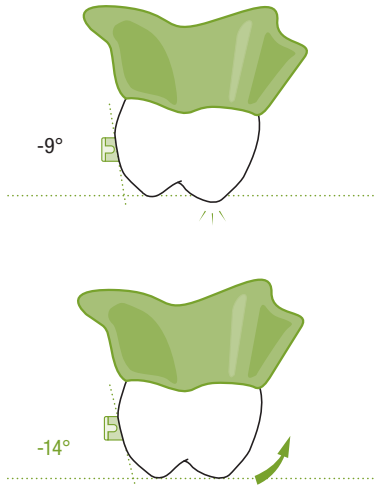


Figure 6: The MBT™ Versatile+ Appliance System increases the buccal root torque (in green) of the upper molars, reducing the possibility of palatal cusp interferences.

Relative to Andrews' original research, the MBT System reduces lingual crown torque in the lower posterior area for three reasons:

- In cases of cuspid and bicuspid gingival recession, the teeth may benefit from having the roots moved closer to the center of the alveolar process.
- In cases that show narrowing of the maxillary arch with lower posterior segments that are inclined lingually, buccal uprighting for the posterior area is a favorable step for both arches.
- Lower 2nd molars tend to torque lingually over the course of treatment, especially when there is a high degree of buccal root torque in the buccal tube.

Therefore, reduced torque values can more consistently assist the effort to keep the posterior segment centered and uprighted.

Figure 7

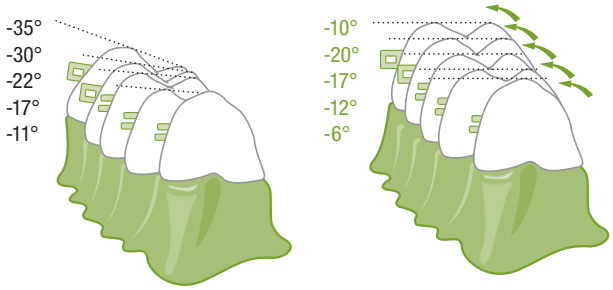


Figure 7: Excessive torque in the posterior segments influences the teeth to roll lingually. The MBT™ Versatile+ Appliance System provides reduced torque values in this area (in green), allowing uprighting of the teeth.

Table 2: Torque Values

Tooth	Andrews' Norms	Traditional Pre-Adjusted Appliance	MBT™ Versatile+ Appliance System
Upper Central	6.11°	7°	17° 22°
Upper Lateral	4.42°	3°	10°
Upper Cuspid	-7.3°	-7°	-7° 0° 7°
Upper 1st Bicuspid	-8.5°	-7°	-7°
Upper 2nd Bicuspid	-8.9°	-7°	-7°
Upper 1st Molar	-11.5°	-9°	-14°
Upper 2nd Molar	-8.1°	-9°	-14°
Lower Central	-1.71°	-1°	-6°
Lower Lateral	-3.24°	-1°	-6°
Lower Cuspid	-12.7°	-11°	-6° 0° 6°
Lower 1st Bicuspid	-19.0°	-17°	-12°
Lower 2nd Bicuspid	-23.6°	-22°	-17°
Lower 1st Molar	-30.7°	-30°	-20°
Lower 2nd Molar	-36.0°	-35°	-10°

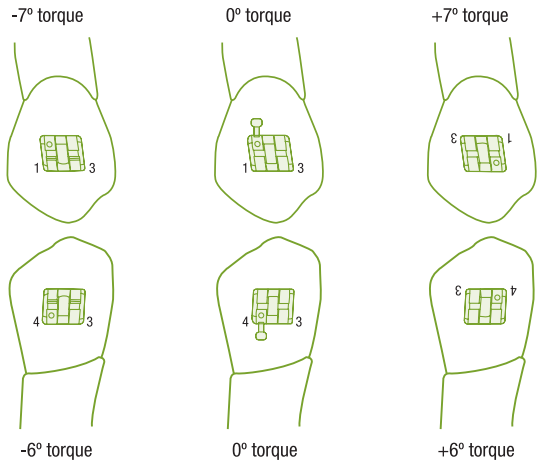
Key Examples of Versatility

Integral in the MBT™ Versatile+ Appliance System is the element of customization to meet specific patient treatment needs. It offers a balance between systematic structure in treatment methods and individualistic versatility.

Cuspids

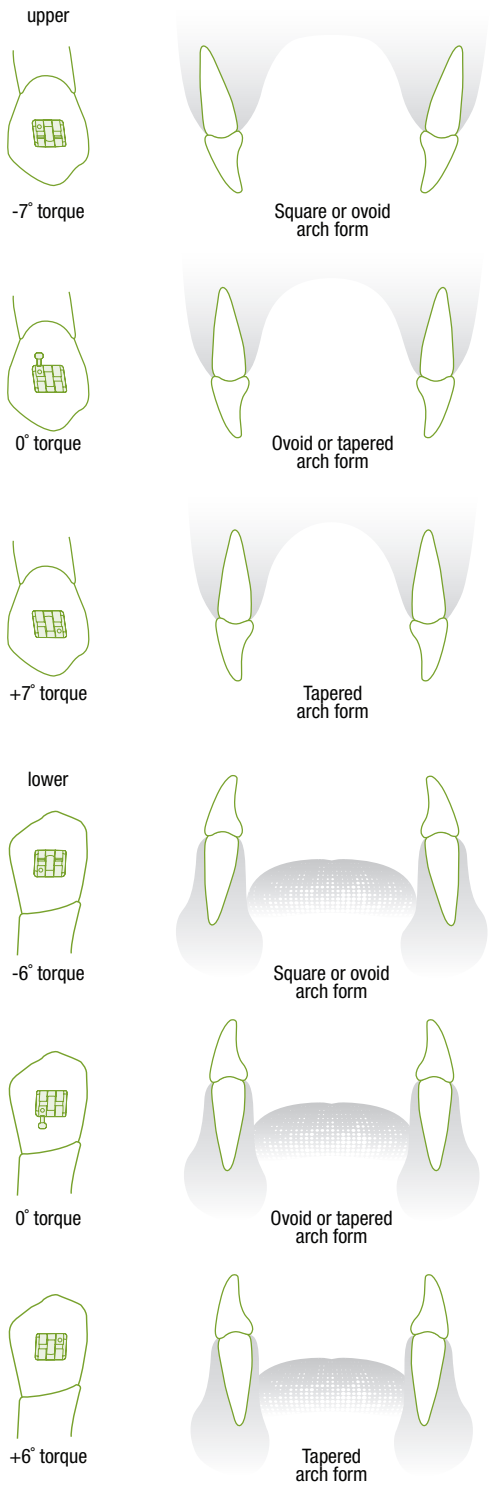
One example of this is the set of options in cuspid brackets. Variability in the tooth itself (i.e. its prominence), in the arch, and in the inter-relationship between arches can influence the best cuspid torque value. For upper cuspids, the -7° torque bracket is designed to be functional when turned 180° degrees as a +7° torque bracket, and the same is true for the lower -6° bracket. Thus the MBT System offers new options with consideration toward inventory control as well. The 0° torque option is especially helpful in extraction cases to help maintain the cuspid roots centered in the alveolar process.

Figure 8



For vertical, transverse or sagittal movement, consider the optimal cuspid torque value for each patient's treatment need. In addition, consider the patient's natural arch form.

Figure 9



Molars

There are certain treatment instances, such as when finishing with the molars in a Class II relationship, where less distal offset is preferred in order to allow the upper molars to rotate mesio-palatally. The MBT™ Versatile+ System lower 2nd molar buccal tubes may be used contralaterally during the finishing stages to achieve this objective, because they have no distal offset. The tip can be modified manually as well, resulting in a 0° tip instead of the normal 5° tip on the upper first molars and a 0° distal offset instead of 10°.

Upper Incisors

- There is a choice of upper central brackets of either +17° or +22° torque, depending on the extent of torque needs of the patient.
- The upper lateral bracket may be inverted 180° to provide -10° of torque. This is especially useful when laterals are palatally displaced. The inverted value helps bring the root forward with the crown.

Figure 10A

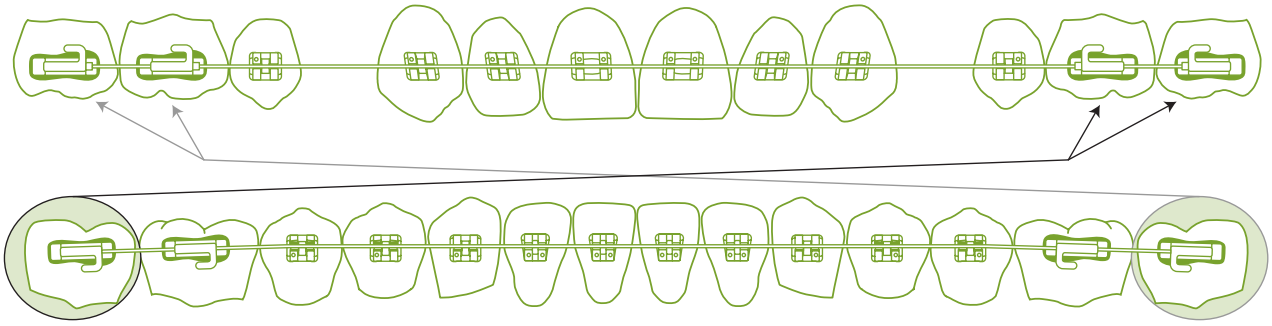


Figure 10A: Especially in cases with upper premolar extraction and whenever extra torque control is needed, finish treatment using the higher-torque and zero-offset lower 2nd molars contralaterally on the upper first and second molars.

Figure 10B

Figure 10B: An example of versatility in the MBT™ Versatile+ Appliance System. With upper premolar extractions and no extractions in the lower arch, treatment is completed in Class II with lower 2nd molar tubes on upper 1st molars. The upper 1st molars display rotation, occupying more space in the mesio-palatal direction.

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Key Examples of Versatility (continued)

Second Bicuspids

Two In-Out Options: Even in systems where there are multiple tip or torque options for an individual tooth, traditional straight-wire appliances have offered only one in-out measurement. These in-out values have, after decades of clinical use, shown to be adequate to achieve proper alignment, requiring special wire bends only in exceptional cases. The MBT™ Versatile+ Appliance System does, however, offer two in-out options for the upper second bicuspid.

Upper first and second bicuspids can vary in relative size to each other, where the second bicuspid is frequently smaller. When the upper first and second bicuspids are generally equal in size, an upper first bicuspid bracket may be used on both teeth. In cases where the upper second bicuspid is smaller, the system offers an upper second bicuspid bracket with an additional 0.5 mm thickness in in-out compensation. This allows for better alignment of central fossae in the upper arch and will also provide for increased mesio-buccal rotation of the upper first molar (Figure 11).

Figure 11

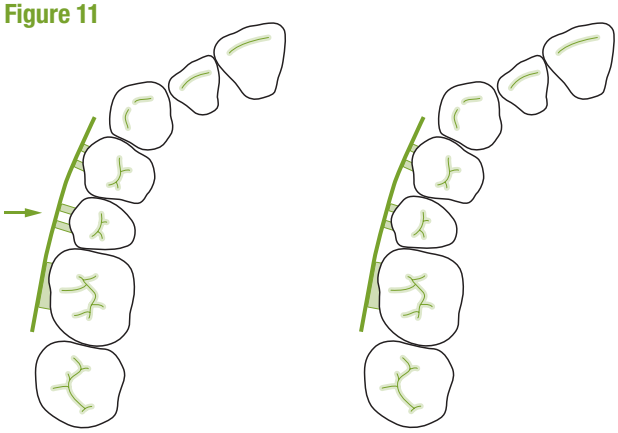


Figure 11: The MBT™ Versatile+ Appliance System offers the option of a bicuspid bracket that has an increased 0.5 mm in/out value for the cases where upper second bicuspids are smaller than upper first bicuspids.

Victory Series™ Lower Second Bicuspid Tubes: Appliances placed on lower second bicuspids frequently encounter occlusal interference during the early stages of treatment. Included in the MBT™ Versatile+ Appliance System is the Victory Series™ Lower Second Bicuspid Tube. As a tube, there are no tie-wings because ligation is not necessary, reducing the profile of the appliance on the tooth (Figure 12).

Figure 12

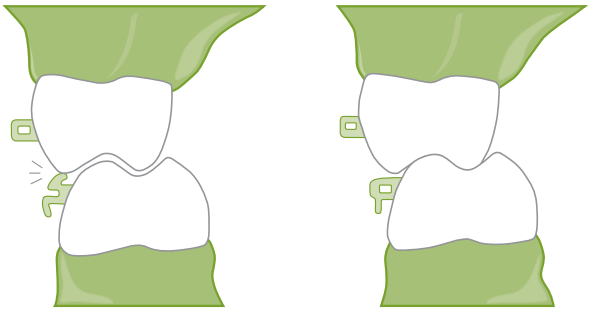


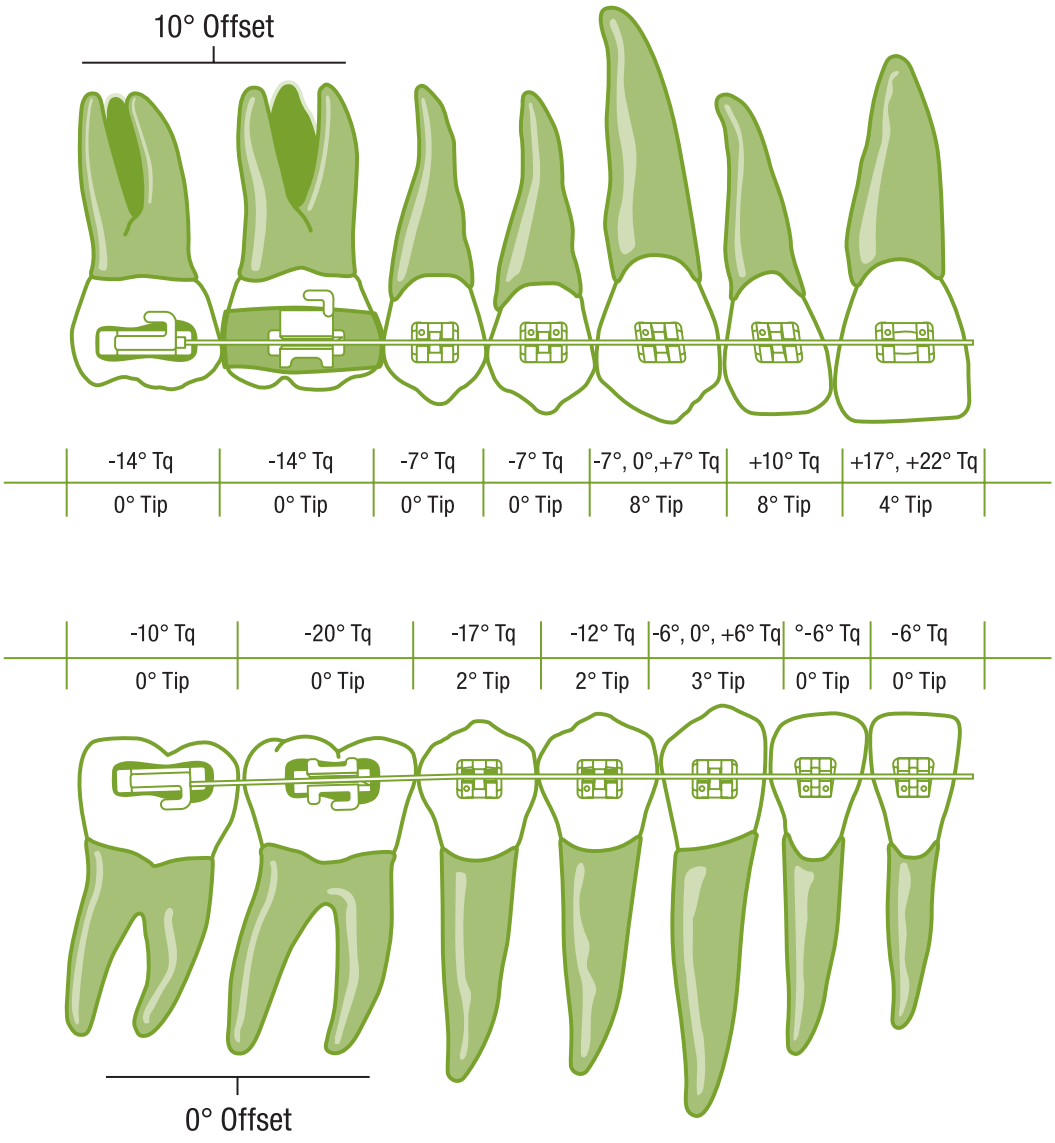
Figure 12: There is less chance of occlusal interference from tubes.

Victory Series™ Lower Second Biscuspid Tube

Pre-Adjusted Appliances

Summary of Values

MBT™ Versatile+ Appliance System



MBT™ Versatile+ Appliance System
Brackets and Archwires

Ligated Appliances

Victory Series™ Brackets: This mid-sized bracket provides an excellent combination of comfort, control and aesthetics. It is most beneficial in cases with smaller teeth and minimal-to-moderate degrees of difficulty.

Victory Series™ Low Profile Brackets: The Victory Series™ Low Profile Bracket is popular worldwide, featuring reduced bracket height for reduced occlusal interference. Features include torque-in-base and tie-wing undercut areas deep enough for double ligation.

Clarity™ Metal-Reinforced Ceramic Brackets: Clarity™ Metal-Reinforced Ceramic brackets blend nicely with the tooth surface and provide excellent aesthetics. They feature a metal slot which minimizes breakage and allows for metal-bracket-like sliding mechanics. Most importantly, the brackets have a stress concentrator in the base for ease of removal.

Clarity™ ADVANCED Ceramic Brackets: Clarity™ ADVANCED Ceramic Brackets deliver brilliant aesthetics, predictable debonding and enhanced patient comfort. They are produced using a fine-grained ceramic material and an injection-molding process, resulting in trusted strength in a small bracket size and profile.

Self-Ligating Appliances

SmartClip™ Self-Ligating Brackets: For doctors who seek the features of a self-ligating appliance with the advantages of a true-twin bracket design, SmartClip™ Self-Ligating Brackets are the ideal choice. Their application to MBT™ Versatile+ Appliance System mechanics is thoroughly detailed in Dr. Hugo Trevisi's textbook *SmartClip™ Self-Ligating Appliance System – Concept and Biomechanics* (REF. 014-508).

Clarity™ SL Self-Ligating Brackets: To combine self-ligation and aesthetic treatment, Clarity™ SL Self-Ligating brackets integrate the innovative self-ligating design of the SmartClip bracket with the translucence of ceramic. Their application to MBT System mechanics is detailed in Dr. Hugo Trevisi's textbook *State-of-the-Art Orthodontics* (REF. 014-534).

Archwires

The three archforms advocated in the MBT™ Versatile+ Appliance System are available in a large range of dimensions and material types. 3M Unitek originally pioneered the use of nickel-titanium orthodontic wire, and today offers a range of nickel-titanium options to address different clinical needs, including Nitinol Classic, Nitinol Heat-Activated, and Nitinol SuperElastic Wire. In addition, stainless steel wire and Beta III – a happy medium between nickel-titanium and stainless steel – complete the wire portfolio.

nitinol™ SuperElastic

Posted archwires, designed expressly for use in MBT System low-force sliding mechanics, are offered in a wide range of sizes and all three arch forms as well.

Buccal Tubes, Auxiliaries, and Textbooks

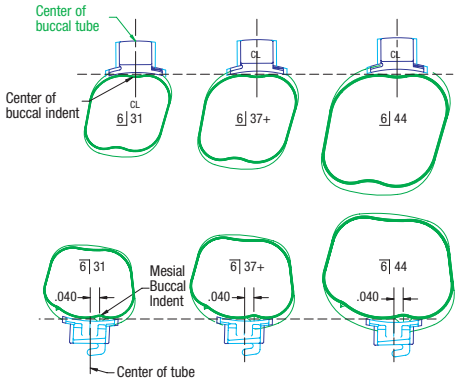
Victory Series™ Buccal Tubes

Buccal Tubes – Metal-injection molded for dimension consistency and rounded surfaces, Victory Series Buccal Tubes have a contoured shape and hook designed for both practicality and comfort. The MBT System prescription is available in multiple buccal tube designs, with distal notches and under tie-wing space suitable for MBT System retraction mechanics.

Direct Bond Tubes – The micro-etched 80 gauge mesh, along with the buccal indent and the correct anatomical fit, are designed for increased bond strength. The buccal indent assists in more accurate tube positioning. Select direct bond tubes offer a Jumbo Base option, with 30% more bonding surface, and all offer the efficient option of APC™ Adhesive on the base.

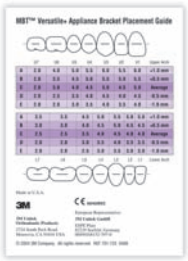
Prewelded Tubes – The process to weld tubes to bands uses the latest technology to ensure accurate, consistent welds. MBT System Weld Positioning acknowledges that bands placed parallel to the molar's buccal cusps will put the tube at a 5° angle, and thus removes this angulation from the placement. In addition, the positioning is designed for the center of the tube to be in a relatively consistent position across all sizes and tube lengths, for a more uniform approach to treatment (Figure 13).

Figure 13



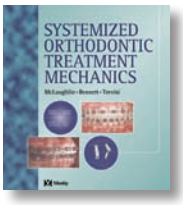
Auxiliaries

To help address the myriad challenges that each treatment poses, 3M Unitek offers tools designed for use in the MBT System to help with case planning, chairside application, and clinical treatment.



Textbooks

For more thorough information on all aspects of the MBT System, three textbooks provide insight, explanation, and many clinical examples of techniques and applications. See page 26 for a more complete description.



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Archwires

Archwire Form and Force

The primary constraint to any orthodontic treatment is the patient's biological limitations. Acting as the unifying element for effecting movement and aligning the teeth, the archwire will be most effective if it works within the range of those biological limitations. The extent that an archwire's shape and force level can correspond to both the treatment goals and the patient's anatomy is a critical factor in orthodontic treatment, but it is difficult to work through that level of variability. The MBT™ Versatile+ Appliance System offers tools and guidance to assist in this regard.

Archwire Form

The challenge of orthodontic treatment is to arrive at alignment in an arch form that is aesthetic, healthy, coordinated between arches, and stable. Researchers have repeatedly found less relapse tendency if the patient's original arch form serves as the objective throughout treatment. Studies have shown that the treatment difficulty lies in the finding that natural arch forms vary among patients. As is true in the area of pre-adjusted appliances, the orthodontist is therefore challenged to find a balance between a standardized system for efficiency with the ability to individualize for effectiveness.

Some research in this area has arrived at the observation that the archform that comes closest to a common ideal arch is in the shape of a catenary curve, which is formed when a chain is suspended from two points of varying width. But further research has shown that it is not the best form for a significant population of patients seeking orthodontic treatment. Among the different areas of the arch, many have observed the inter-cuspid width dimension to be the most critical and the area of the most significant relapse if it is changed.

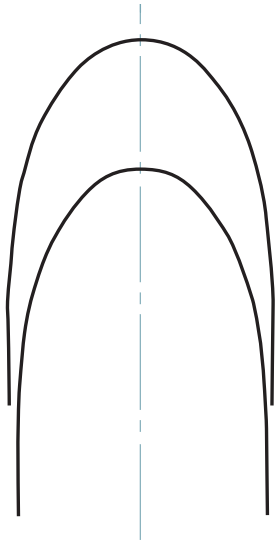
Drawing from decades of scientific research and clinical experience, the MBT System includes three arch form shapes. The three shapes offer the necessary balance between a mode of treatment more stable than treating all patients to one arch form, and a mode of treatment more efficient than customized arch form shaping for each patient at every stage of treatment. The arch forms start from the catenary curve concept, and the greatest difference among the three is in the inter-cuspid width. For each patient, one arch form is the basis for the majority of treatment, with the versatility to allow some individualization in the later stages of treatment if deemed beneficial for that patient.

Tapered Arch Form: Among the three, this arch form offers the narrowest inter-cuspid width. This form is especially ideal for patients with narrow arch forms and gingival recession in the area of the cuspids and bicuspids (most frequently found among adults). Another useful application of this arch form is in cases of partial treatment of only one arch, as it will help reduce the occurrence of expansion in the treated arch.

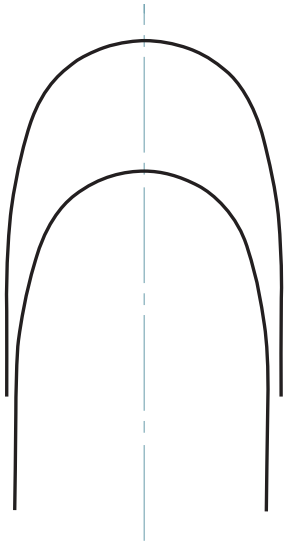
Square Arch Form: This arch form is especially practical for patients with broad natural arch forms. It can also be applied early in treatment in cases that require buccal uprooting of the lower posterior segments and upper arch expansion. If over-expansion occurs, it is possible to change to the Ovoid arch forms later in treatment.

Ovoid Arch Form: With an inter-cuspid width between the other two forms, this form is intended, when employed with the retention and settling steps mentioned above, to maintain a stable arch form post-treatment.

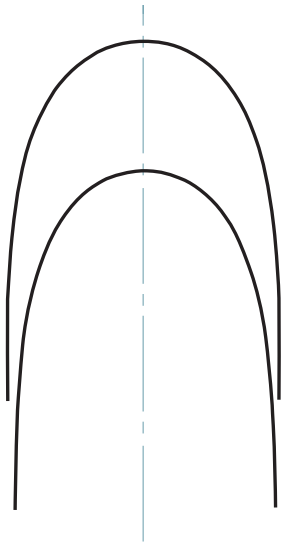
Figure 14



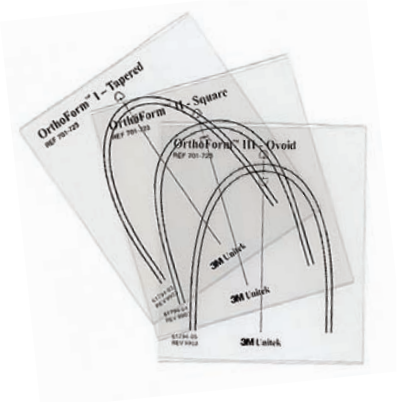
Tapered Arch Form – OrthoForm™ I Modified



Square Arch Form – OrthoForm™ II



Ovoid Arch Form – OrthoForm™ III



Diagnosis OrthoForm™ Arch Form Templates
Clear templates for overlay on patient model.
REF. 701-723 (3) in package

Operatory OrthoForm Arch Form Templates
White templates for chairside use.
REF. 701-724 (3) in package

3M Unitek

Archwires

Archwire Form and Force (continued)

Archwire Force

The correct size and force of archwire to use depends in large part on the treatment tasks for each stage of treatment.

In the initial aligning and leveling stages of treatment, it is especially important to minimize binding friction and avoid an unphysiologic level of force on the teeth. Nickel-titanium wires are optimal at this stage, offering the capability of expressing light but effective forces on wires small enough to minimize friction in the slot.

In the working and finishing stages, the importance of wire elasticity is gradually replaced by the importance for stiffness to help secure alignment and avoid undesired side effects. Stainless steel wires have long been shown to be effective at this point, having minimal friction, good torque control, and general alignment.

Table 3 illustrates the archwire options that have been found to exhibit the best characteristics relevant to each stage of treatment, including versatility options as required in different treatment situations that may arise. Stainless steel wires have long been shown to be effective at this point, having minimal friction, good torque control, and general alignment.

Figure 15

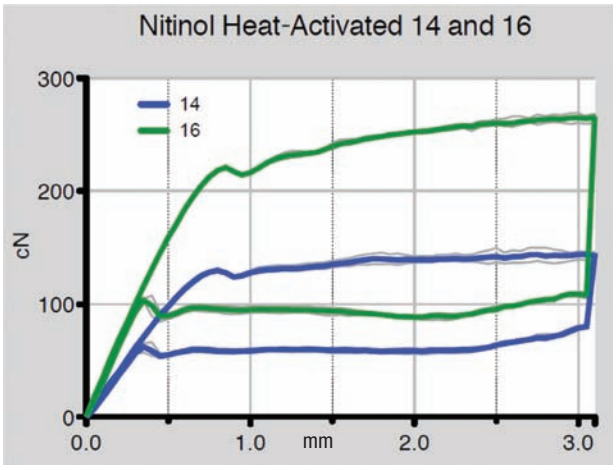


Figure 15: Comparative force levels expressed by Nitinol Heat-Activated archwires of two different sizes when deflected 3 mm.

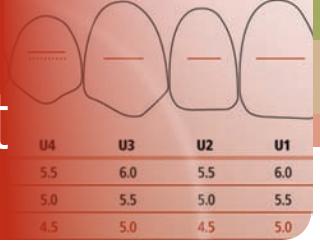
Summary Selection Table

Table 3: MBT™ Versatile+ Appliance System Treatment Phases and Wire Requirements

Treatment Stage	Recommended Wire Products and Variations			
	MBT™ System Brackets 18 Slot		MBT™ System Brackets 22 Slot	
Aligning Stage Tasks: • Activating cellular reaction • Initial slot alignment • Initial de-rotation Requirements for Wire: • Low forces, especially with large irregularities • Force limitation desirable (force limitation by superelastic plateau) • Avoid binding • Torque effect initially usually not desirable	**14 HANT**	*Variations:* 14 NCL with push coil and not all teeth ligated	**14 HANT** *then for self-ligating only:* **14+16 HANT Tandem**	*Variations:* 14 NCL with push coil and not all teeth ligated
Leveling Stage Tasks: • Final de-rotation/ re-establishing correct contact points • Establishing torque • Correcting angulations • Leveling Curve of Spee Requirements for Wire: • Not too high forces • Elasticity to correct angulations/tip • Good rotational control • Dimension needs to fill slot height for torque effect • Stiffness to level Curve of Spee	*Self-Ligating:* **14×25 HANT** or **14+14 HANT Tandem** *Non-Self-Ligating:* **16 Australian** then **16×25 Beta III Titanium**	*Variations:* If torque matters • 16×25 NCL For additional vertical leveling: • 18 SS • 16×22 NSE reversed curve	*Self-Ligating + Non-Self-Ligating:* **19×25 HANT**	*Variations:* If torque matters • 19×25 NCL instead of 19×25 HANT For additional vertical leveling: • 18 SS • 20 SS • 19×25 NSE reversed curve • 19×25 Beta III Titanium
Working Stage Tasks: • Closing of extraction spaces • Closing of other spaces • Retracting anterior teeth with torque control Requirements for Wire: • Enough stiffness to avoid vertical and horizontal bowing • Dimension needs to fill slot height for torque effect • Good rotational control • Low friction	**16×25 SS** or **17×25 SS Hybrid** (with crimp hooks)	*Variations:* If no space closure required: • 16×25 Beta III Titanium	**19×25 SS** (with crimp hooks)	*Variations:* Optional: 21×25 hybrid If no space closure required: • 19×25 Beta III Titanium
Finishing Stage Tasks: • Correct midlines • Root alignment • Overbite/overjet • Functional occlusion Requirements for Wire: • Corrective bends possible without too high forces • Good rotational control • Dimension needs to fill slot height for torque effect • Enough stiffness to hold or fine-tune arch form and overbite	**16×25 Beta III Titanium**	*Variations:* If already in place: • 17×25 SS hybrid • 16×25 SS	**19×25 Beta III Titanium**	*Variations:* If already in place: • 19×25 SS
Settling Stage Tasks: • Maximizing intercuspidation Requirements for Wire: • Allows minor tooth movement by occlusion and elastic traction	**16×22 Braided**	Alternative would be using a positioner	**19×25 Braided**	Alternative would be using a positioner

Table 3: Recommended wires by treatment phase, MBT™ Versatile+ Appliance System. **Note:** Wire selection should be made on a case-by-case basis. NCL: Nitinol Classic; NSE: Nitinol Super-Elastic; HANT: Nitinol HA; SS: Stainless Steel.

This table, and associated research on wire forces and material properties, was authored by Prof. Dietmar Segner, Hamburg, Germany.



Vertical and Axial Positioning

Of the many different factors that can influence the efficiency and quality of tooth movement, bracket placement accuracy is perhaps the most important. The performance of the other factors – tip, torque, bracket dimensions, archwire selection, base fit, etc, are all very significantly influenced by the location of the bracket on the tooth. It is commonly accepted that optimal precision and efficiency is achieved by indirect bonding, but in addition a systemized technique that allows for consistent, accurate bracket placement can have a significant impact on individual cases and on the orthodontic practice as a whole.

The Challenge of Accurate Vertical Positioning

A common method of bracket placement is to visually align the center of the bracket with the vertical long axis of the clinical crown and center the slot along the center of the clinical crown. The ultimate efficiency of this method is dependent on the accuracy that visual estimation affords. While the use of the mesial and distal edges of the tooth are reasonably accurate indicators of a bracket's proper horizontal and axial positioning, there are a number of factors that can make vertical positioning inaccurate, which can lead to unwanted torque, intrusion, or extrusion and hence necessary repositioning.

Partially Erupted Teeth: The true center of a clinical crown is difficult to identify when the tooth hasn't yet fully erupted. The likely result is a placement that is too occlusal relative to the true center, especially with bicuspids and lower second molars.

Figure 16

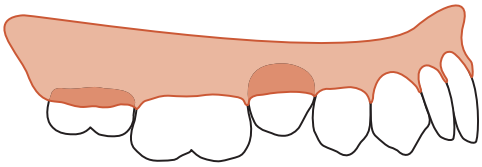


Figure 16: The center of the clinical crown is more difficult to visualize in partially erupted teeth in young patients.

Inflamed Gingiva: Gingival inflammation reduces the visible portion of the clinical crown, resulting in an incomplete view of the actual clinical crown, and therefore an inaccurate center.

Figure 17

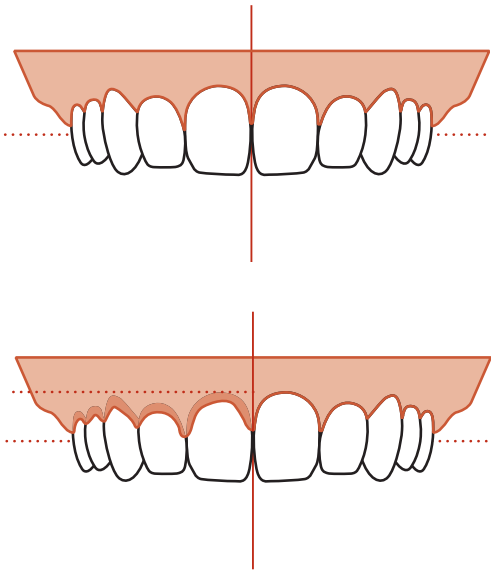


Figure 17: Inflamed gingival causes foreshortening, which can effectively reduce the length of the clinical crowns, making the center difficult to ascertain. The bottom image is the same case as the top image, but with gingival inflammation in the upper right quadrant.

Displaced Roots: Teeth with palatally or lingually displaced roots have more gingival tissue covering the clinical crown so that less of the total crown is visible potentially leading to a placement too occlusally, compared to the true center of the tooth. Facially displaced roots, often in the cuspid area, result in the opposite difficulty: more of the tooth is exposed because of the root's orientation, potentially leading to a placement more gingivally to the tooth than the vertical center.

Figure 18

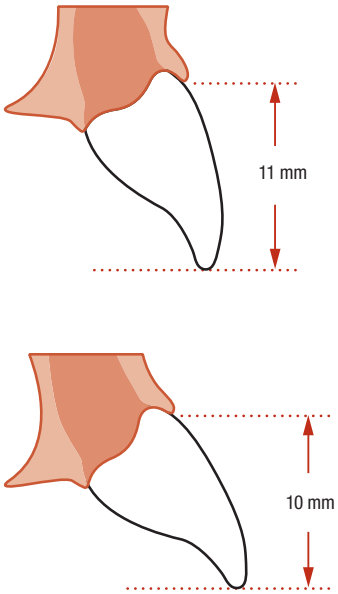


Figure 18: Teeth with roots that are lingually displaced can reveal shorter clinical crowns.

Figure 19

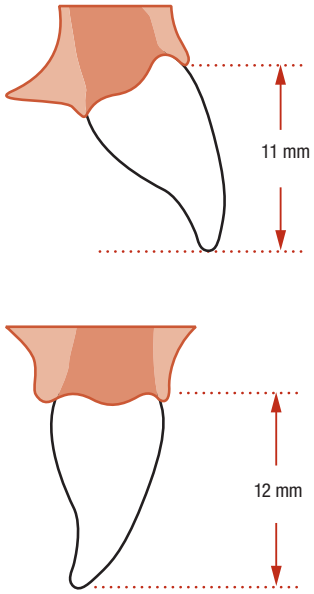


Figure 19: Teeth with roots that are facially displaced can reveal longer clinical crowns.

Fractures or Tooth Wear: Because the clinical crown in these cases is shortened from the occlusal edge, it may be difficult to determine the true center of the crown.

Figure 20

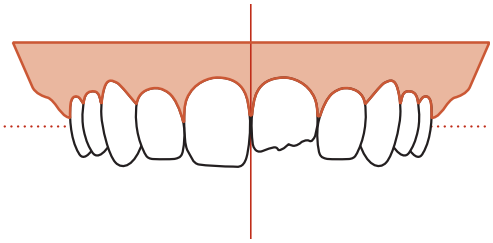


Figure 20: Incisors with fractures or tooth wear make it more challenging to determine the center of the clinical crown.

Long Tapered Buccal Cusps: Tooth shape is variable, and it is possible for cuspids or bicuspids to have long and tapered buccal cusps, giving an inaccurate sense of the true size of the clinical crown to find its center.

Long Clinical Crowns: When certain clinical crowns are proportionately longer than the average length for that individual (such as with upper incisors), placement of a bracket at the center of the clinical crown may result in aesthetic and occlusal difficulties. If placed at the center, these teeth will look too long and interfere with the opposing dentition.

Short Clinical Crowns: The opposite difficulty may occur in the circumstance where certain teeth are proportionately shorter than the average length for that individual. If the bracket is placed at the center of the clinical crown, aesthetically the tooth will look too short and functionally the tooth will not be in appropriate contact with the opposing dentition.

Appliance Placement

Bracket Placement

Visual estimation of proper vertical positioning risks inaccuracy due to a number of the variables previously mentioned. The MBT™ Versatile+ Appliance System includes a standardized method for accurate vertical bracket placement that is independent of these factors. This method efficiently assists the means to find the proper height relative to the other teeth on the arch instead of determining the correct position for each individual tooth. The eventual goal, it should be noted, is tooth alignment relative to the other teeth, so the additional analysis early in treatment may result in a more efficient process throughout.

The MBT™ Versatile+ Appliance System Bracket Placement Chart

The Bracket Placement Chart seen in Table 4 is the result of research of published studies, thorough analysis of treated cases, and years of clinical experience to determine the vertical placement norms. Potential errors made because of the location of the gingiva are eliminated because all measurements are made from the occlusal edge of the teeth. This chart also allows for the complexity that can arise due to proportionally long or short teeth. This chart does not allow for measuring teeth with occlusal wear, or crowns with long, tapered cusps, but it can be used as a starting point, after which an appropriate millimeter adjustment is made, as appropriate for the case. In general, this chart is to be viewed as a guide, but adjustments may be made from the initial reference points, as determined necessary by the practitioner for situations specific to each patient.

Use of the MBT System Bracket Placement Chart is done by following these steps:

1. Use dividers and a millimeter ruler to measure the clinical crown heights on the fully erupted teeth in the patient's study model.
2. Record these measurements, divide them in half and round to the nearest 0.5 mm. This will provide the distance from the occlusal surface to the vertical center of the clinical crown.
3. Review the MBT System Bracket Placement Chart. Select the row that has the greatest number of the recorded measurements from cuspid to cuspid. Use the Chart as a reference point: in cases of occlusal wear or disproportionately-sized teeth, make the appropriate millimeter adjustments from the Chart's reference value as necessary.
4. Using the row on the Bracket Placement Chart selected, choose the value for the 1st Molar slot height and draw a line on the buccal edge of the tooth that reflects that value from the occlusal edge. Then measure the difference between the marginal ridge line and the Chart's measurement line.
5. Apply the same difference measured on the molar to the marginal ridge lines of the 1st and 2nd Bicuspid teeth to find the optimal vertical placement for those teeth.
6. Place the brackets while visualizing the vertical long axis of the clinical crowns for a vertical reference and the perceived center of the clinical crown as a horizontal reference.
7. Use a bracket placement gauge to confirm the vertical height of the appliances based on the values selected on the Bracket Placement Chart. Adjust as necessary.
8. Ensure that the malocclusion does not create conflict between maxillary teeth and mandibular appliances, and if there is conflict, remove the appliance or adjust the treatment plan accordingly.

Table 4: MBT™ Versatile+ Appliance System Bracket Placement Chart

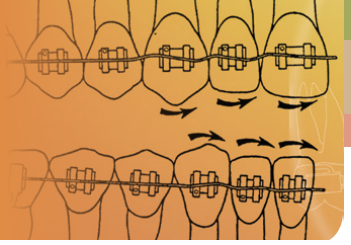
U7	U6	U5	U4	U3	U2	U1	
2.0	4.0			6.0	5.5	6.0	+1.0 mm
2.0	3.5			5.5	5.0	5.5	+0.5 mm
2.0	3.0			5.0	4.5	5.0	Average
2.0	2.5			4.5	4.0	4.5	-0.5 mm
2.0	2.0			4.0	3.5	4.0	-1.0 mm

L7	L6	L5	L4	L3	L2	L1	
3.5	3.5			5.5	5.0	5.0	+1.0 mm
3.0	3.0			5.0	4.5	4.5	+0.5 mm
2.5	2.5			4.5	4.0	4.0	Average
2.0	2.0			4.0	3.5	3.5	-0.5 mm
2.0	2.0			3.5	3.0	3.0	-1.0 mm

Variations

- In cases of deep bites or open bites, consider selecting a row for the posterior teeth that is adjacent to the row selected for the anterior teeth, to achieve the desired intrusion or extrusion while maintaining relative vertical alignment.
- In extraction cases, to avoid a vertical step in the teeth adjacent to the extraction, consider selecting a row for the posterior teeth different from the row chosen for the anterior teeth to arrive at proper cuspid height relative to the rest of the new arch.

Direct visualization for bracket placement has proven to be reasonably accurate, and it is an efficient technique for direct or indirect bonding methods. The vertical dimension, however, poses a number of variables that can challenge the accuracy of bracket placement. The MBT™ Versatile+ Appliance System provides, through the use of the Bracket Placement Chart and the Positioning Instruments, helpful tools that reduce the potential for placement error and provide a means of greater consistency and accuracy. Incorporation of these tools into the practice's placement methods involves relatively few new process steps, but can contribute to the overall success of a patient's treatment as a result.



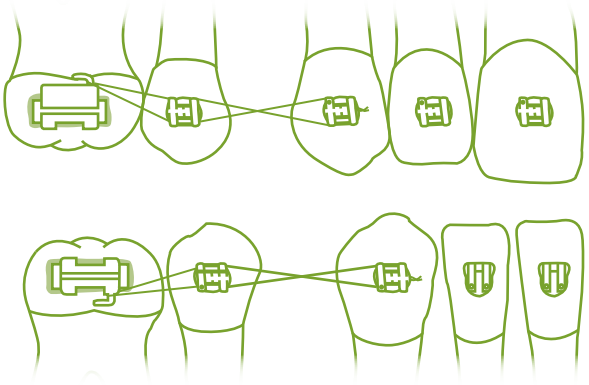
Mechanics

Light Force Mechanics and Anchorage Control

The process of orthodontic treatment can yield reciprocal tooth movement that is not part of the treatment plan. This kind of movement is most often seen in the posterior, where molar alignment is affected in response to high forces placed on them in their role as anchor. The MBT™ Versatile+ Appliance System incorporates tools and treatment methods to achieve desired movement using light forces, thereby minimizing unwanted movement and anchorage loss. In this way, the path to finishing can begin with the first appointment, as no preparation of the molars to withstand high forces is required. As an integrated system, the reduced prescription tip in the brackets and the lower forces in the wires, compared to earlier orthodontic techniques, are enhanced by these methods.

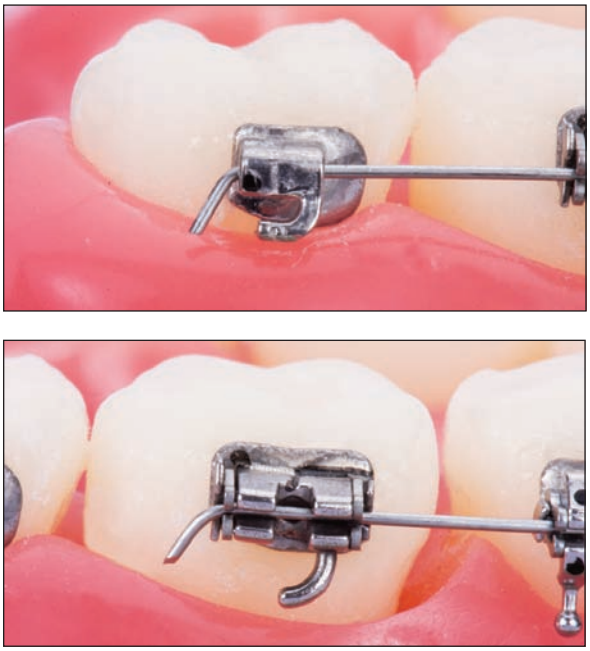
Lacebacks are a technique to prevent incisor proclination during the leveling and aligning phase.

Figure 21



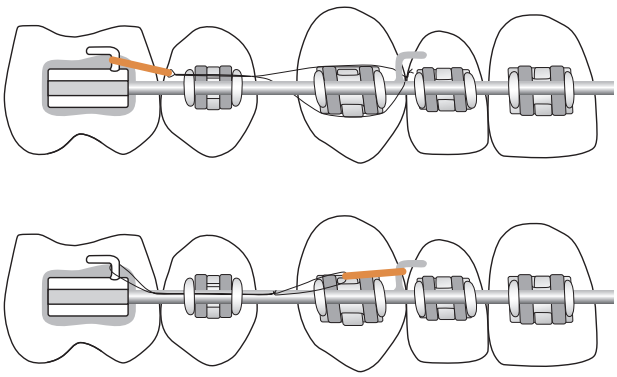
Bendbacks address the common occurrence of labial movement in the anterior teeth. Bending the archwire back distal to the terminal buccal tube helps to unify the arch, and it also helps address patient comfort distal to the molars (Figure 22).

Figure 22

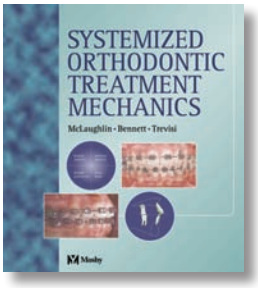


Tiebacks are the preferred method for space closure, providing a means to keep the involved teeth upright and aligned through movement. They are achieved through the combination of ligature tie wire, forming a laceback among the teeth to assist uprighting, and an elastomeric module, to provide force (Figure 23).

Figure 23



"Systemized Orthodontic Treatment Mechanics"

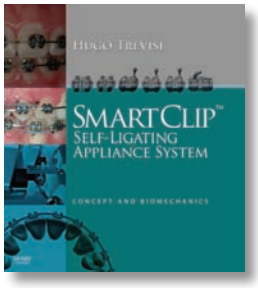


Systemized Orthodontic Treatment Mechanics from Doctors Richard McLaughlin, John Bennett and Hugo Trevisi will be of great interest to orthodontists worldwide, and in particular, to MBT™ Versatile+ Appliance System users.

Written by orthodontists, for orthodontists, this book provides the clinical orthodontist with an accessible and practical guide to the MBT System treatment philosophy. It brings together the four components which make up modern treatment mechanics: Bracket Design, Bracket Positioning, Archwire Selection and Force Levels.

014-436 (English)
014-450 (Spanish)

Orthodontic Textbook on SmartClip™ Appliances



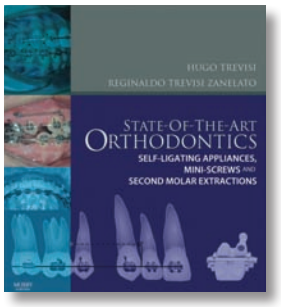
A comprehensive text has been written by Dr. Hugo Trevisi entitled *SmartClip™ Self-Ligating Appliance System – Concept and Biomechanics.* In a Foreword to the book, Dr. Richard McLaughlin states: "This impressive text is a comprehensive presentation of his [Dr. Trevisi's] work and his successful integration of the MBT [Versatile+ Appliance] System approach with self-ligating mechanics. The results are excellent."

Extensively illustrated including case presentations, the more than 250 page text includes an historical overview of orthodontic fixed appliances, discussion of the integration of the SmartClip Appliance System and the MBT Versatile+ Appliance System, Customized Bracket Positioning, Sliding Mechanics and Occlusion in Orthodontics.

014-508 (English)

State-Of-The-Art Orthodontics: Self-Ligating Appliances, Mini-Screws and Second Molar Extractions

Dr. Hugo Trevisi and Dr. Reginaldo Trevisi Zanelato



Current technological advances have had a major impact on contemporary orthodontics, allowing the clinician to provide quality treatment with favorable aesthetic results in a shorter time period. This book presents a treatment philosophy based on use of aesthetic self-ligating appliances and orthodontic miniscrews for anchorage, and treatment with second molar extraction.

The use of aesthetic, low-friction orthodontic appliances and orthodontic miniscrews allows faster and more efficient treatment with a reduced risk of the side effects of conventional orthodontic mechanics and tissue damage caused by the orthodontic tooth movement.

These appliances also address the issue of lack of cooperation on the part of patients with regard to use of headgear and other traditional intraoral anchorage devices, when treating Class II and Class III malocclusions or severe crowding. Both adolescent and adult patients often refuse to wear these appliances as they are not considered aesthetic.

This book emphasizes the importance of facial aesthetics during orthodontic treatment by describing intraoral anchorage systems that help eliminate the requirement for headgear and also diagnosis, treatment planning and orthodontic biomechanics with second molar extractions.

014-574 (English)

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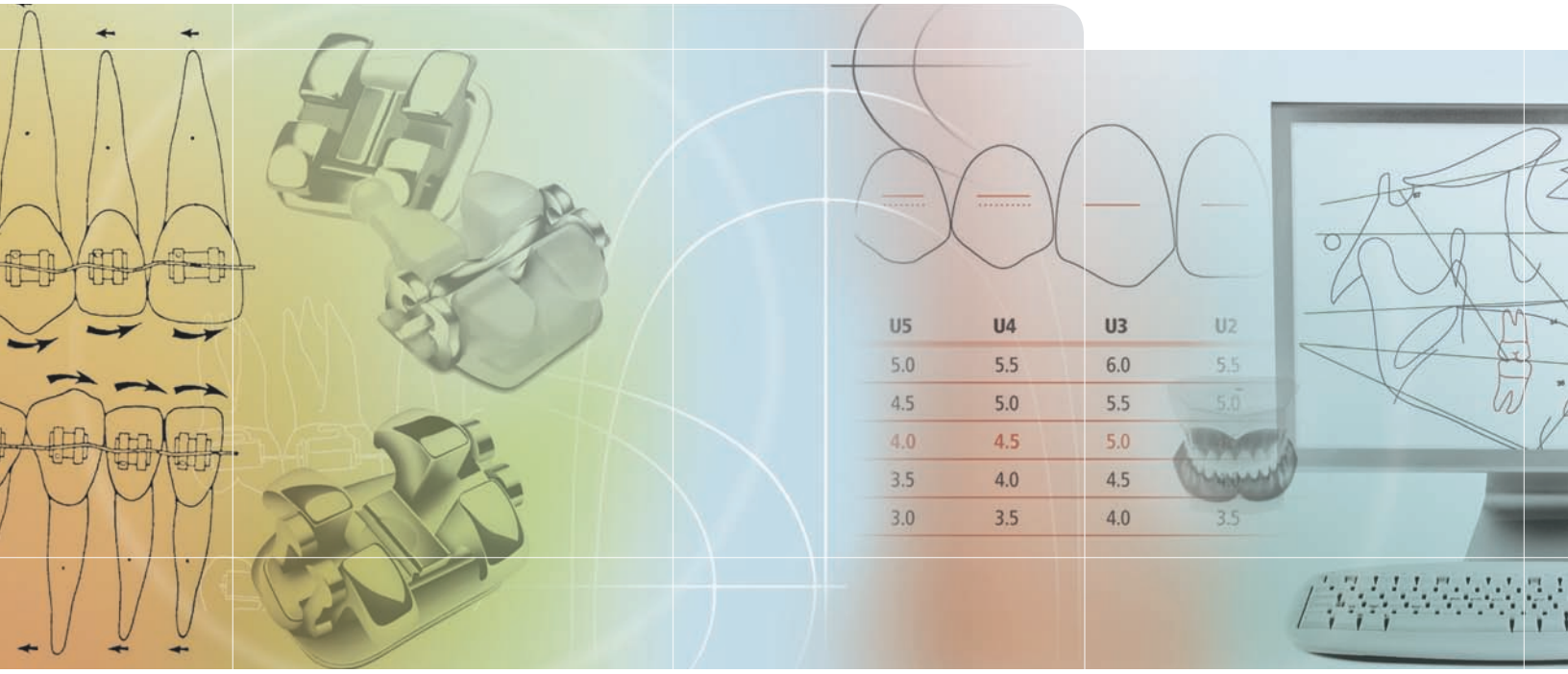
Efficient Treatment Solutions for Clinical Excellence



MBT™
Versatile+ Appliance System

For more information

about the application of MBT™ Versatile+ Appliance System mechanics, methods, or tools, contact your 3M Unitek Representative, who can provide more information and consult on the textbooks, literature, and educational seminars available.

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