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Orthodontic treatment conceptions
according to McLaughlin-Bennet-Trevisi

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Note: The authors have financial interest in the products described in this article.

Historical Perspective

From standard Edgewise to pre-adjusted appliances.

Lawrence F. Andrews designed the first totally pre-adjusted appliance in the late sixties after studying 120 casts of nonorthodontic patients with normal occlusion. Andrews found that six common characteristics were always present.

Later he took the first order measurements (in/out), the tip, and the torque of the clinical crowns as a point of reference. He then made a bracket based on these values. After this first kind of appliance, many other changes were introduced into treatment mechanics depending on the necessities. Orthodontists have now used pre-adjusted brackets for over 25 years.

Since 1975 McLaughlin -Bennet-Trevisi have been working to improve treatment mechanics for the new generation of pre-adjusted brackets. While trying to devise an approach using lighter forces, they also worked on developing different types of tubes and brackets. The use of these different brackets and tube types in several clinical applications brought, as a result, the improvement

of full working appliances with the same mechanics as suggested by the authors.

The six keys to normal occlusion (Andrews, 1972)

1. Molar relation

2. Crown tip

3. Crown torque

4. Lack of rotations

5. Tight contacts

6. Occlusal plane

Key 1: Molar relationship

1- The mesiobuccal cusp of the upper fist permanent molar falls within the groove between the mesial and middle cusps of the lower first permanent molar.

2- The mesiolingual marginal ridge of the upper first permanent molar occludes with the marginal ridge of the lower permanent second molar.

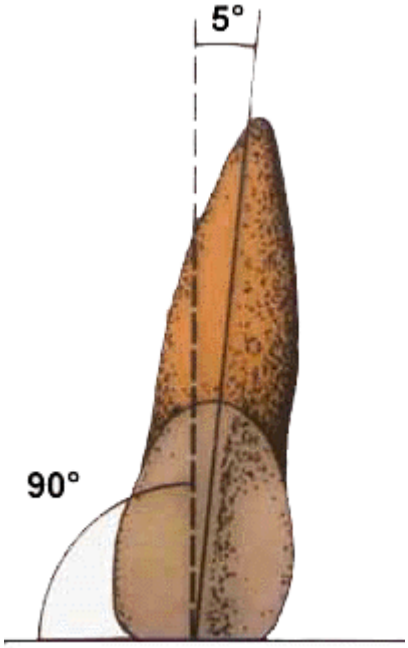
3- The mesiolingual cusp of the upper first permanent molar occludes with the central fossa of lower first permanent molar.

4- The buccal cusps of the upper bicuspids are in a cusp-embrasure relationship with the lower bicuspids.

5- The lingual cusps of the upper bicuspids are in a cusp-fossa relationship with the lower bicuspids.

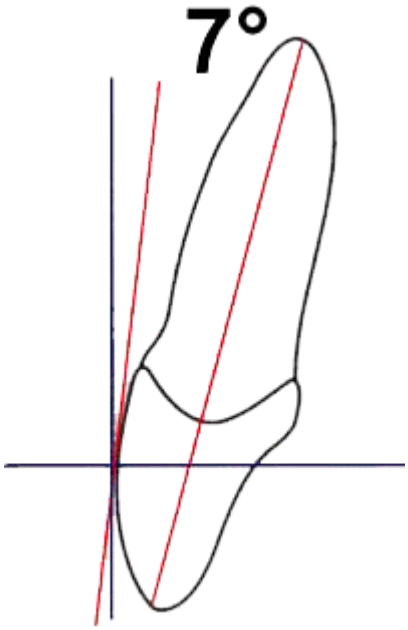
6- The upper cuspids are in a cusp-embrasure relationship with the lower cuspid and lower first bicuspid.

7- The upper and lower incisors contact and the midlines are coincident.



Key 2: Crown angulation, the mesiodistal "tip"

Crown tip or mesiodistal tip refers to angulation (or tip) of the long axis of the crown, not to angulation of the long axis of the entire tooth. In normal occlusion, the gingival portion of the long axis of each crown is distal to the incisal portion, varying with the individual tooth type. The degree of crown tip is the angle between the long axis of the crown (as viewed from the labial or buccal surface) and a line bearing 90 degrees from the occlusal plane.



Key 3: Crown angulation, labiolingual or buccolingual inclination ("torque")

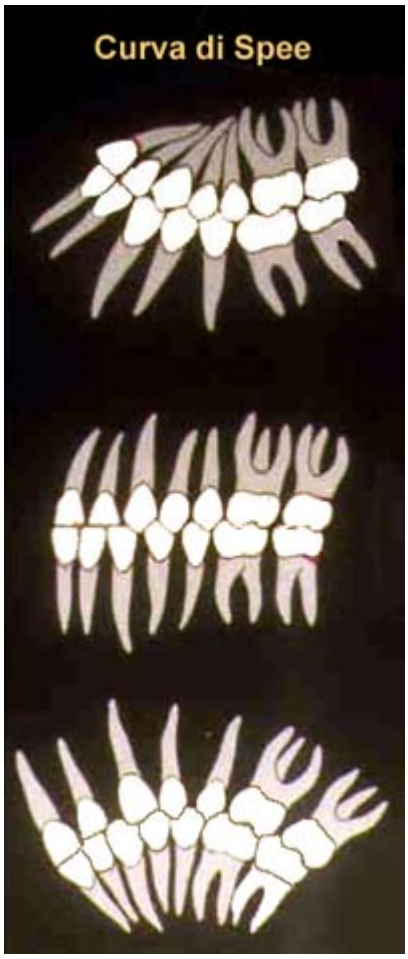
Torque is expressed in plus or minus degrees, representing the angle formed by a line which bears 90 degrees to the occlusal plane and a line that is tangent to the middle of the labial or buccal long axis of the clinical crown. A plus reading is given if the gingival portion of the tangent line is lingual to the incisal portion. A minus reading is recorded when the gingival portion of the tangent line is labial to the incisal portion.

Key 4: Rotations

The teeth should be free of undesirable rotations. For example, rotated molars occupy more space than normal, creating a situation unreceptive to normal occlusion.

Key 5: Tight contacts

The contact points should be tight (no spaces).



Key 6: Occlusal Plane

According to Andrews, a flat plane should be a treatment goal as a form of overtreatment. A deep curve of Spee results in a more contained area for the upper teeth, making normal occlusion impossible. A reverse curve of Spee is an extreme form of overtreatment, allowing excessive space for each tooth to be intercuspally placed.

According to Roth, the goals of a functional occlusion are as below:

1- Centric occlusion is coincident with centric relation

2- Class I relationship or cusp to marginal ridge relationship

3- Even force distribution in the posterior

4- In protrusive excursion, eight lower anterior teeth should be in contact with six upper anterior teeth.

5- Lowest anterior slot - 1mm back disclosure.

6- Lateral cuspid slot with the lowest back disclosure.

MBT appliance characteristics

1- Tip in the slot

2- Torque at the base

3- In/out at the base

4- Round base

5- Specific modelling of brackets

6- I.D. System.

The torque and the In/out that are incorporated in the bracket base are the most important characteristic of the pre-adjusted appliance. They allow the proper force application through the centre of the slot and the base

being coincident. As a result of this detail, it is possible to align the slots on the Andrews' plane and consequently on the arch with a straight wire. The appliance having the torque on the slot will never be able to accomplish this. The brackets used in the original techniques are twin or Siamese brackets with the 0.022x0.028 slot assuring a strict relation between the archwire and the slots thus allowing good working mechanics.

Anterior bracket tips

Tip measurements for anterior teeth in the MBT appliance are according to Andrews' original research where the static ideal and the functional ideal occlusion described by Roth are respected.

The only differences are the upper anteriors (10° less distal crown tip) and the lower anteriors (12° less). According to the authors, these changes allow better anchorage control and when using light forces there is no opposite tip effect caused by torque, the phenomenon Andrews referred to as the "Wagon wheel effect".

Upper posterior bracket tips

The MBT appliance provides 0° tip in upper bicuspid brackets to keep them in a more vertical position conducive to Class I occlusion. Upper molar tubes also have 0° tip. Since the point of reference for those teeth is the vestibular slot, having a 5° tip with respect to a perpendicular line to the occlusal plane will give the upper first and second molars 5° tip with respect to the buccal slot.

Lower posterior teeth

2° tip is provided in the lower bicuspid brackets. This is also true for the upper bicuspids. It is possible to get 2° of tip placing the bands with 0° tip tubes parallel to the occlusal plane as for those teeth where the vestibular slot is tipped 2° with respect to a perpendicular line to the occlusal plane.

Torque measurements

Incisors

Generally in the pre-adjusted appliances there is poor control of torque during tooth movement. Upper incisors become detorqued during space closure and overjet reduction. Lower incisors tend to tip forward during Curve

of Spee leveling and alignment. This is why the authors thought of increasing the lingual root torque of the upper incisors to +17° for the central incisors and +10° for the lateral incisors and -6° for buccal root torque of the lower incisors.

Cuspids, bicuspids and upper molars

Torque measurements for these teeth are all negative. For cuspids and upper bicuspids this value is -7°, which is derived from the original Straight Wire appliance. The molar values have been changed from -9° to -14° in order to eliminate occlusal interference of the palatal cusps which occurs when these teeth have excess buccal crown torque.

Cuspids, bicuspids and lower molars

The authors decided to reduce lingual crown torque for the following three reasons:

1- Lower cuspids and sometimes bicuspids have little alveolar bone with gingival recession and can become worse if the crowns are moved more to the centre of the alveolar protuberance.

2- After maxillary expansion it is necessary to coordinate arches with the lingual crown tip of the lower postieriors.

3- Lower second molars with 35° torque show continuous lingual tipping.

In/Out measurements

The authors used the same In/Out measurements as the original Straight Wire appliance after considering them thoroughly. The only change regards the upper second bicuspid which suddenly looks smaller than the first one. For this reason the upper second bicuspid bracket has 0.5 mm more In/Out. In cases where the upper second bicuspids are the same size as the first bicuspids, it is possible to use the same bracket for the first and second bicuspids.

Types of MBT brackets.

There are three different types of brackets to allow the patient a choice and to give the orthodontist good control during treatment.

Victory series of brackets™

This is a small-medium size bracket appropriate for small teeth and for medium difficult cases.

Full size brackets™

They allow the best control and therefore are prescribed for those patients who have large teeth and have severe malocclusions where control is of the utmost importance.

Clarity brackets™

These aesthetic brackets are ceramic with a metallic slot resulting in good sliding mechanics and the lowest risk of breakage. Furthermore they show a stress concentration at the base ensuring easy removal at the end of treatment.

Arch form

Several papers throughout the years have attempted to identify the ideal arch form. Research shows a wide variability in arch forms, thus making it impossible to identify one ideal arch form. Therefore, we cannot conceive a single arch for all patients. In addition we must consider that when a patient's arch form has been modified, there is a higher tendency to relapse after the removal of the appliance. However since the use of preformed arches is an obvious advantage for orthodontists, practical solutions have been developed for the purpose of retention after orthodontic treatment and three arch forms are available: Narrow arch, Square arch, and Ovoid arch.

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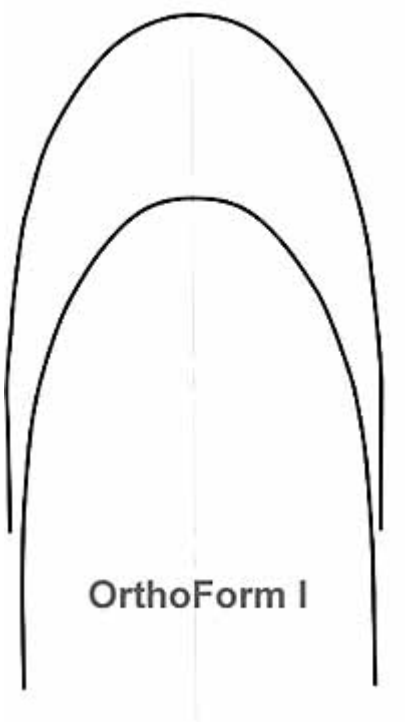
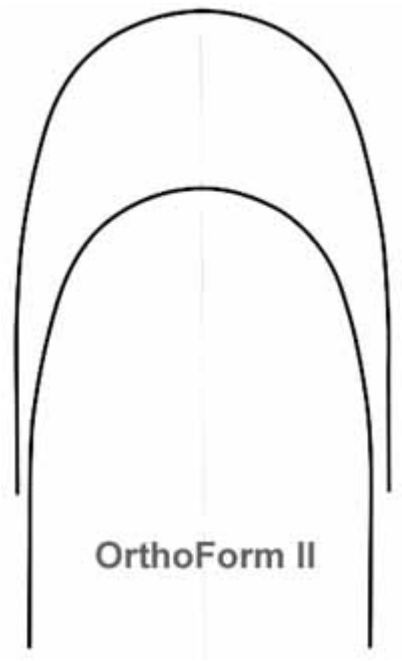
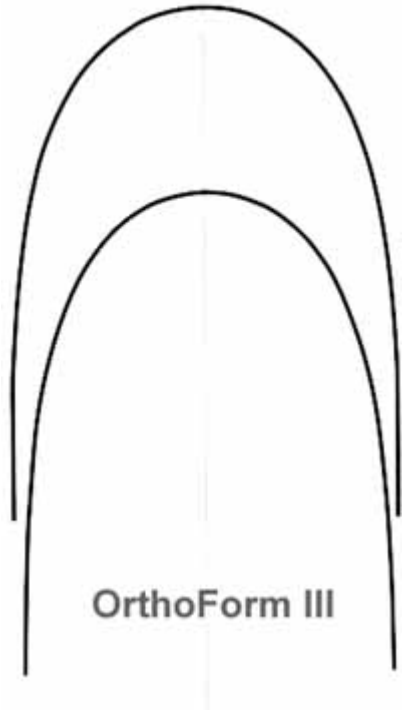


Stabilization techniques

1. Proceeding rectangular wires to lighter wires (0.014 NiTi in the lower arch and sectional wires 2 x 2 0.014 stainless steel in the upper arch) for 6 weeks before debonding to permit vertical and inter-arch settling. It also allows for settling of the arch form to a more physiologic position for the patient, based on the tongue and perioral musculature. Eventually we can stabilize the extraction sites with metal ligatures, using mobile contention plates to maintain the transverse superior dimension, making tip back bends in the arch wire to avoid incisor relapse in Class II division 1 cases.
2. The use of a lower lingual fixed retainer in the anterior allows for some settling of inter-cuspid width without movement in the incisor area.





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The three arch forms

These have been conceived based on four basic aspects of arch form:

1)Anterior curvature

2)Inter-cuspid width: Inter-cuspid width is the most critical aspect of arch form selection.

3)Inter-molar width: This dimension is more stable. Therefore, one can standardize the pre-formed wire and customize to the patient.

4)Posterior curvature.

These are the guidelines for choosing the correct arch form:

Narrow arch form

Orthoform™ I (3M Unitek) has a smaller cuspid width and is indicated for patients with narrow arches and cases with gingival recession on cuspids and bicuspids to avoid expansion of the upper arch. The posterior portion of the wire can easily be modified to achieve a good intermolar width.

Square arch form

Available as Orthoform™ II (3M Unitek) is indicated for patients with broad arches and also in the first phase of treatment requiring posterior uprighting and upper expansion.

Ovoid arch form

Orthoform™ III (3M Unitek) is the most commonly used arch form by the authors. It seems to result in less post-treatment relapse. Since it is not practical to maintain a large inventory of arch forms the authors prefer using ovoid forms when they use twisted wires, round 0.014-0.016 SS wires and all thermoactive NiTi wires. When they use round 0.018, 0.020 stainless steel wires or rectangular wires that can significantly influence the arch form, they choose one of the three forms.

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