**Space Closure Biomechanics Applied Using The MBT™ System Technique**

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With the evolution of orthodontic techniques, the sliding biomechanics has shown to be the most effective technique applied for closing spaces in extraction cases when the pre-adjusted appliance is used.

The sliding technique consists of the sliding of the rectangular archwires in the bracket slot of premolar teeth and in the buccal tube of molar teeth, allowing the remaining spaces of the extracted teeth to be closed.

The system to be presented in this article is based on the extensive clinical experience of the three MBT™ System advocates — McLaughlin, Bennett, Trevisi — who have applied this technique over a long period of time, achieving excellent force levels and resulting in tooth movement with excellent control of the biomechanics during the space closure of the extraction sites.

It is very important to emphasize that orthodontic appliances that produce tip overcorrection for anterior teeth (upper tipping using Andrews, Sabata and Watanabe figures) have caused single movement or group movement of teeth without the control of the professional during the aligning and the leveling stage of treatment (deep overbite of anterior teeth, intermediate open bite of premolar teeth, protrusion of anterior teeth). These matters require further anchorage during the space closure stage of treatment.

Because the MBT appliance system has less tipping for anterior, upper and lower teeth, the aligning and the leveling biomechanics are much more effective, as they avoid these problems. Furthermore, the sliding technique is much more sensitive when compared to appliances that have a very strong anterior tipping.

During the sliding biomechanics, the MBT system advocates recommend using a preadjusted appliance with a .022” x .028” slot, .019” x .025” rectangular steel archwires and .07mm or .08mm hooks welded or prewelded to the archwire to the mesial of the cuspid teeth (Fig. 5). In addition, .009” or .010” steel ligatures associated with AlastiK™ Modules should be used for the retraction system.

Therefore, three retraction systems will be presented in this article. These systems have been developed from the experience of the MBT system advocates who have over 25 years of experience with the preadjusted appliance and the sliding technique.

**Retraction System 1**

It consists of applying the AlastiK module to the hook of first molar teeth and steel ligatures laced to the hooks prewelded to the rectangular archwire to the mesial of cuspid teeth. This was the first retraction system proposed by the MBT system advocates (Figs. 1 and 2).

**Figure 1:** The AlastiK™ Module is applied to the hook of molars, and the steel ligature is laced to the prewelded hook to the archwire to the mesial of the cuspid teeth.

**Figure 2:** Resources of retraction system 1. In order to avoid the AlastiK™ Module to be in contact with the gum, it is recommended to involve the steel ligature on the AlastiK module of second premolar teeth.
Retraction System 2

It consists of lacing the steel ligature to the molars and applying the AlastiK™ Module to the hook prewelded to the archwire to the mesial of cuspid teeth. This was the second retraction system proposed by the MBT™ System advocates (Fig. 3).

Retraction System 3

It consists of lacing molar and premolar teeth with steel ligatures and applying the AlastiK module to the hook prewelded to the archwire to the mesial of cuspid teeth. This retraction system is similar to retraction system 2, and it has been developed to decrease friction caused by the sliding mechanics. In this system, it is not necessary to apply the AlastiK module to premolar teeth during the space closure stage of treatment (Fig. 4).

Prewelding to the Mesial of Cuspid Teeth

Professionals should precisely establish the contact point between cuspids and the lateral incisors and use .07mm brass wire when prewelding the hooks. The fixation of the wire to the rectangular archwire is performed using a Mathieu plier. This is a very comfortable system, allowing good prewelding and not distempering the rectangular steel archwire (Fig. 5). In the MBT system technique, rectangular archwires with prewelded hooks are available with three inter-cuspid distance.

Engagement of the Retraction Systems

Retraction System 1: Firstly, place the steel ligature to the AlastiK module (Fig. 6). Then, apply the AlastiK module to the hook of the first molar and the steel ligature to the mesial of the cuspid hook, applying the recommended activation (Fig. 7).

Retraction Systems 2 and 3: Firstly, place the steel ligature to the posterior teeth (Fig. 8). Then, apply the AlastiK module to the steel ligature, and place the AlastiK module to the mesial of the cuspid hook, applying the recommended activation (Fig. 9).
Figure 8: Engagement of retraction system 3 on posterior teeth. Engagement of the steel ligature to molar and premolar teeth.

Figure 9: Engagement of retraction system 3. AlastiK™ Module applied to the mesial of the cuspid hook and activation.

**Activation and Force Level**

For the three systems, the MBT™ System advocates recommend activating the module to twice the size of the AlastiK™ Module (Figs. 1, 3 and 4), leaving it on the patient for twenty-one days. The force level achieved in each quadrant is approximately 150g. After twenty-one days, the system can be redone or reactivated (Fig. 10).

Figure 10: Retraction system 3 during the second activation after twenty one days (note that the AlastiK™ Module is twice the size of its original size).

The second activation should be twice the size of the AlastiK module or, it should be carried out until the professional feels some resistance during the activation. The system should remain set on the patient for another 21 days.

It is recommended using retraction system 3 when the force level needs to be increased, mainly when the second molar is part of the space closure biomechanics (Fig. 11).

**When to apply the sliding mechanics**

In order to achieve perfect performance of the sliding biomechanics, the professional should follow some recommendations given by the MBT system advocates:

- Using .022” x .028” slot with .019” x .025” steel archwires.
- Leveling should be well performed. The slot plane should be well leveled, mainly in deep overbite cases.
- Using passive steel ligatures at least for 30 days in order to allow torque settlement during the initial use of .019” x .025” rectangular archwire. Then, progress to the sliding mechanics.
- Checking if there is a damaged bracket, as it causes friction during biomechanics.
- Checking if the archwire end (1mm) is at the distal of first or second molar teeth. If it does not occur, the archwire won’t slide in the bracket slot.

**MBT System Innovations:**

**Second premolar tubes and the MBT System technique**

The use of second premolar tubes has been incorporated into the MBT system technique, and it serves to improve the resources used in orthodontic treatment. The use of these tubes brings advantages to both the professional and the patient.

Expected advantages presented by the use of second premolar tubes:

- Decreased occlusal interference of the opposing teeth, mainly in overbite and Class II cases.
- More comfort to the patient.
- Decreased bracket failure.
- Decreased friction during the sliding mechanics.

Second premolar tubes result in excellent performance during the sliding mechanics for closing remaining spaces in first premolar extraction cases and in non-extraction cases. There is no need to use AlastiK modules. Tubes are expected to decrease friction between the wire and the bracket slot and allow the spaces to be closed quickly.
Lower second premolar brackets present debonding failure because they are set in a very difficult area, in which the incidence of masticatory forces, deep overbite and Class II malocclusion are high (Figs. 12A and 12B). Then, lower second premolar tubes have been designed in order to overcome this matter. These tubes have a larger base, enhancing bonding strength, and a 1.0mm debasing. They also have a special design, allowing the biomechanics to be performed during the aligning, leveling and space closure stage of treatment.

**Lower Second Molar Mini Tubes**

For the great majority of patients, there has always been a difficulty in including lower second molars in the orthodontic treatment. The interocclusal space and the gingival tissue do not allow setting a band with a tube or a bonded tube of regular size on teeth. The biomechanics resources are favored when it becomes possible to include these teeth in the orthodontic treatment, mainly in deep overbite cases.

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**Figure 12A:** Occlusal interference of upper premolar with a lower second premolar bracket.

**Figure 12B:** Tube replacing a second premolar bracket.

**Figure 13A:** Second premolar tube replacing a bracket due to bonding failure.

**Figure 13B:** Occlusal view. .014” Nitinol archwire during re-leveling.

**Figure 13C:** Maximum intercuspation. The patient presents overbite and a slight Class II malocclusion.

**Figure 14A, 14B, 14C:** Space closure stage of treatment applying the sliding biomechanics and using a bonded lower second premolar tube with .019” x .025” steel archwire.

**Figure 15:** Occlusal view of a lower second premolar tube and .019” x .025” steel archwire during the finishing stage of space closure.
For extraction or non-extraction treatments presenting space matters, second molar impaction is a barrier to the whole course of treatment. Therefore, it is necessary to have an appliance with a design that allows the inclusion of second molars in the treatment.

Lower second molar mini tubes have been developed, aiming at providing a good bonding strength to second molar devices, placing second molars to the level of the occlusal plane of first molar teeth. Its base has been designed to be well adapted to the contour of second molar mesial cusp. And, its design has a good debase, allowing it to be set in deep overbite cases (Figs. 16A and 16B).

**Figure 16A:** Mini tubes bonded on lower second molars. In this case, it would be difficult to use a regular tube.

**Figure 16B:** Engagement of the initial aligning and leveling archwire.

**Figure 17:** Lower second molar mini tube bonded to the distal on an impacted lower second molar.

**REFERENCES**

6. Ouchi, K et al. The effects of retraction forces applied to the anterior segment on orthodontic archwire: changes in the wire deflection with the wire size. California: Edward H. Angle Society, 2001