Analyzing the *modus operandi* of the TRAINER System Appliances

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Part 2 of three

As suggested by the name, the appliances of the TRAINER System™ just train or exercise the muscles at the craniomandibular system (CMS) to physiologically load the bones, stimulating growth and development in the structure composing the CMS. Through development of the maxilla, the mandible and the dental arches, as well as by re-educating tongue posture, the teeth tend to position better and align correctly.

The effects produced by the trainers on the maxilla and mandible have been demonstrated through scientific studies (Usumez et al. 2004; Ramirez-Yañez et al. 2007), as well as through clinical cases successfully treated with these appliances and reported in the literature (Ramirez-Yañez GO and Faria P. 2008; Kanao et al. 2009).

Currently, there is ongoing research with the TRAINER System Appliances focusing on understanding their effect on the muscular activity of the masticatory and facial muscles, as well as further investigation of the positive effect the appliances can have in mouth-breathing patients and on some altered oral functions, such as swallowing.

In the following sections, the *modus operandi* of the TRAINER System Appliances are explained, considering separately their effect on the three dimensions of the mouth: sagittal, transverse and vertical. Scientific literature supporting the physiological concepts involved in the effects produced by the trainers is presented to further support the concept that the TRAINER System Appliances (including the MYOBRACE®) are a viable alternative in treating malocclusion.

Sagittal growth and development (antero-posterior)

The effect produced by the TRAINER System Appliances is in part similar to those functional appliances designed to stimulate mandibular growth and development by bringing the mandible forward into an edge-to-edge position (bionator, monoblock, twin-block, etc). By placing the mandible in such a position, the muscles protruding the mandible are stretched (masseter, medial pterygoid and lateral pterygoid muscles).

The TRAINER Appliances are recommended to be worn one to two hours during the day and 10 to 12 hours at night while sleeping. It was explained by Van der Linden and colleagues (Van der Linden, Frans & Proffit 2004) that all action maintained for more than six continuous hours produces an effect on the CMS.

The trainers maintain the mandible in a forward position for 10 to 12 hours during the night, keeping the muscles protruding the mandible stretched.

This makes the blood vessels in the muscle decrease their diameter, which hinders sufficient blood flow, therefore decreasing the gas and substance exchange in the muscle through the blood. This situation produces muscular tiredness due to an accumulation of lactic acid in the muscle.

A similar physiological process occurs in our body when people initiate an exercise routine at the gym, and muscles that had not been used for a certain period are activated. This is the reason a patient wearing any of the trainers complains of muscular soreness on the face and mouth during the first couple weeks of treatment.

When the appliance is taken out of the mouth, the muscles protruding the mandible fall into hyper-contractibility (involuntary and repeated contractions of the muscles), which moves the mandible forward and backward. This explains why at the beginning of treatment (about three to four weeks), patients report that in the morning when they remove the TRAINER (or MYOBRACE) from the mouth, they...
This muscular hyper-contractility produces higher blood flow in the muscles protruding the mandible, and thus the excess of lactic acid accumulated during the period the trainer was in the mouth is removed from the muscles. This increase in blood flow brings to the muscles more undifferentiated cells, which have the ability of differentiating into myoblasts that can produce new muscular fibers in those muscles.

One of the muscles playing an important role in stimulating mandibular growth and development when these kind of functional appliances are used is the lateral pterygoid muscle. This muscle inserts on the mandibular condyle and is in charge of moving the mandibular condyle forward, together with the articular capsule and the interarticular disc at the temporo-mandibular joint, when the mandible protrudes or performs lateral excursions.

As previously explained, there are small movements of the condyle within the glenoid fossa at the temporo-mandibular joint that are interpreted by the patient as discomfort in the morning. It is nothing more than the movement of the mandibular condyle, produced by the hyper-contractibility of the lateral pterygoid muscle raising after the appliance is removed from the mouth.

These forward and backward movements of the mandibular condyle within the glenoid fossa stretch the retro-discal pad (also known as Zenckel’s zone) where the blood vessels release nutrients and growth factors that reach the mandibular condyle, stimulating mandibular growth and development through endochondral ossification.

This was reported by Prof. Alexandre Petrovic, who showed through his studies (Petrovic et al., 1991; Stutzmann and Petrovic 1990) how these FMO appliances maintain the mandible over a certain period of time in an edge-to-edge position and how mandibular growth is stimulated by this action. (It is...
important to remember the mandibular condylar cartilage, as all cartilages, does not contain blood vessels and receives its nutrients and growth factors through its surrounding structures.)

This repetitive stimulation every night, maintaining the mandible in an edge-to-edge position, induces new muscular fiber formation in the muscles protruding the mandible and improves the activity in those muscles. This allows the mandible to be kept in a forward position without muscular tiredness due to lactic acid accumulation. In other words, the mandible is now in a forward position held by the muscles.

On the other hand, this muscular hyper-contractibility, occurring in the muscles protruding the mandible the moment the appliance is removed from the mouth, stimulates endochondral ossification, which leads to more mandibular development. These effects together bring the mandible forward through an increase in the performance of the muscles protruding the mandible and endochondral ossification.

This explains the significant clinical results presented in Figure 3, and those reported in the literature where a significant improvement in the relationship between the maxilla and the mandible was observed in patients Class II, division 1 and 2 when treatment was performed with the TRAINER System Appliances (Quadrelli, et al. 2002; Usumez et al. 2004; Ramirez-Yañez and Faria 2008).

Look for Part 3 of this article in the November issue of Ortho Tribune. References will appear at the end of Part 3.

EasyFit Jumper

FORESTADENT introduces a fixed functional orthodontic appliance for the protrusive movement of the mandible with its new EasyFit™ Jumper. This modified Herbst appliance is attached in the maxilla within the molar area (between teeth #4 and #5) and in the mandibular within the pre-molar area (teeth #5 and #7), similar to the well-known mandibular protrusion hinge by Prof. Dr. Herbst. The EasyFit Jumper is not attached to bands or splints but placed directly on the archwire of the multibracket appliance. It is fixed in position using special nuts with integrated rectangular tubes that are simply slipped onto the archwire to be fitted, adjusted and clamped using pliers.

The majority of Class II appliances have to be disassembled several times due to the use of spacers, but this is not necessary with the Easy-Fit Jumper, which operates without spacers. Instead, the thread construction in the guide tube ensures smooth adjustment of mandibular advancement.

The key supplied is simply inserted into the hole of the sleeve on the guide tube and turned in the required direction until the planned protrusion is reached. There is no longer the need for time-consuming laboratory procedures or several appointments for individual adjustments of the appliance. All working stages can now be performed directly at chairside in one appointment. The appliance can also be easily reactivated introrally.

The dorsal angulation bar of the Class II device automatically produces a horizontal movement, which is parallel to the occlusal plane. Applied forces can therefore be channelled to a favorable direction on the square archwire and multibracket appliance.

The intelligent design of the EasyFit Jumper also enables left-handed or right-handed activation without having to alter the position of the patient. Furthermore, the unique construction eliminates the risk of accidental aspiration of loose parts.

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