A
other effect reported with the TRAINER System™ Appliances is transverse development of the dental arches. All the Frankel-like appliances, which have a buccal shield in their structure, move the cheeks away from the buccal aspect of the upper and lower posterior teeth. This action produces two effects on the craniomandibular system (CMS).

First, the presence of the buccal shields releases a force produced by the buccinators (muscles of the cheeks) on the buccal aspect of the posterior teeth, which normally is of about 2.7 g/cm², but can increase up to 20 g/cm² in patients with a digital sucking habit or tongue thrust. In the same way, these buccal shields in the appliance release excessive force (up to 80 g/cm²) that can be produced at the corner of the mouth on the cuspid teeth, which can be present in those patients with the same habits. Such a force tends to reduce the inter-canine distance, badly affecting the shape of the dental arches and crowding the dentition (Lindner and Hellsing 1991; Mew 2004).

Second, the presence of the buccal shields in the appliance stretches the buccinators and orbicularis oris (muscles of the lips), creating a tension zone at the area of insertion of those muscles.

As it has been extensively explained in the literature (most orthodontics and cranio-facial growth books), on the tension zone there is bone apposition (Frost 2004). Therefore, by creating a tension zone by stretching the muscles (buccinators and orbicularis) through the buccal shield in the appliance, there is an increase in bone apposition at the maxilla and mandible. The presence of the buccal shield at the anterior area of the mouth encourages the patient to produce a better lip seal, which will be explained later.

Be aware that this effect is higher in the MYOBRACE®. As explained in part two, one of the assets of the MYOBRACE is the inner-core embedded in the buccal shields. This inner-core provides more resistance to the appliance and counteracts the force released by the buccinators and orbicularis muscles when they are hyperactive.

The TRAINER System in the context of treating malocclusions

Fig. 4: Patient, age 7. In this case, there is also a mandibular advance and an improvement in the inclination of the upper incisors. Furthermore, a significant improvement in lip seal (right side) can be observed in this patient after treatment during 14 months with a TRAINER Appliance (FHS).

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“I have been in the practice of orthodontics since 1972, and have taken many of the post-graduate orthodontic courses offered in this country, including Ricketts, Roth-Williams, Sarver, and Hilgers. I can say without question that the McLaughlin Program was the finest course of its nature that I have ever taken.” Dr. Nile Scott, Pueblo, Colorado

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An additional effect to stimulate transverse development of the dental arches with the Trainers is changing the posture of the tongue. When relaxed, the tongue stays in a physiological position (Fig. 4), which is encouraged by the lingual tab located on the upper-lingual side of all the appliances of the TRAINER System, including the MYOBRACE.

It has been scientifically proven that the TRAINER System Appliances produce transverse development of the dental arches. A paper published in the Journal of Clinical Pediatric Dentistry (Ramirez-Yañez et al. 2007) shows the results of a study on the effect of the T4K on the dimensions of the dental arches of 60 children with Class II, Div 1. These results show that there is a significant increase in the inter-canine, inter-premolar and inter-molar distances when treatment was performed with the TRAINER Appliance.

This effect is produced by posturing the tongue in a more physiological position and by the buccal shields in the appliance releasing the force produced by the muscles of the cheeks and lips. In other words, the effect with the TRAINER is similar to that reported in patients treated with the function regulator appliance (Frankel R. 1977).

Vertical growth and development
Clinically, the TRAINER System Appliances produce an improvement in the vertical relationship between the upper and lower teeth (overbite) in patients that have either a deep or an open bite. This has been scientifically demonstrated in two studies (Usumez et al. 2004; Ramirez-Yañez et al. 2007) — one where it was reported that patients with deep bite have a significant increase in the vertical dimension (Fig. 5) and another where patients with open bite have a significant reduction in the negative overbite (Fig. 6).

To explain the effect of the TRAINER System Appliances on the vertical development, it is necessary to use concepts from the physiology of the CMS. Furthermore, it is necessary to explain separately how the Trainers work to correct each of these problems, as the same appliance works in a different way when there is a deep bite or an open bite.

Deep bite
When the mouth is closed, the masticatory muscles, particularly the masseters (deep masseter) and temporalis (posterior fibers), increase their activity when the first teeth contact occurs. This is a physiological response that permits a higher force to move the teeth closer and smash any piece of food that may be between them. Patients with a deep bite have stronger muscles closing the mouth (Farella et al. 2005), and some reports have shown that deep-bite patients have more type II fibers in the masseter muscle (Rowlerson et al. 2005), which has been associated with an increase in the average of bite force (Ringqvist 1973).

The presence of the TRAINER in the mouth does not permit tooth contact because of the silicon surface between the upper and lower components of the appliance, which avoids contact between the teeth. As there is no contact between the teeth and maximum intercuspation is not reached, the increase in muscular activity when closing the mouth does not occur, reducing the loading at the teeth and their dento-alveolar units at maximum intercuspation. As the loading at maximum intercuspation is reduced, the dento-alveolar units can develop and teeth can come to that plane given by the occlusal surfaces of the appliance. Thus, an occlusal plane (Spee curve), which is generally...
Open bite

On the other hand, open bite closes when treatment is performed with the appliances of the TRAINER System (Ramirez-Yañez et al. 2007). To understand how these appliances can produce a positive effect when treating open bites, it is necessary to understand the physiology of tongue posture.

First, it is important to remember the tongue, the mandible and the hyoid bone are linked through a muscular system and work as a team.

When the tongue is relaxed, its tip positions on the incisal papilla at the anterior part of the palate, which is its natural position when relaxed. With the tip of the tongue in this position, the dorsum of the tongue runs at the cervical third of the crowns and roots of the upper premolars. The base of the tongue goes downward at the molars, leading to insert at the hyoid bone.

When the tongue is relaxed, the hyoid bone, where the anterior digastric muscle inserts, is positioned approximately between the third and fourth cervical vertebrae, and antero-posteriorly, about the middle of the body of the mandible (Rocabado 1983; Tallgren and Solow 1987). The anterior digastric muscle, which is located between the mandibular symphysis and the hyoid bone, plays an important role in the growth and orientation of the mandible (Spyropoulos et al. 2002), as it loads the anterior area of the mandible.

In patients with tongue thrust, the tongue is protruded. Therefore, the tip of the tongue is positioned forward and downward (the dorsum of the tongue comes downward and the base of the tongue moves forward). This causes the hyoid bone to move backward and upward (Ono et al. 1996; Haralabakis 1995), which stretches and increases the muscular activity of the anterior digastric muscle.

Increasing the muscular activity of the anterior digastrics increases the pulling produced by that muscle on the anterior area of the mandible, pulling the mandibular symphysis backward and downward, stimulating a clockwise rotation of the mandible aggravating the open bite.

In this context, the hyoid bone locates in a better position, decreasing the activity in the anterior digastric muscle. Reducing the pulling at the anterior area of the mandible by the anterior digastric muscle, the mandible is not stimulated to rotate backward and downward anymore, and the muscles elevating the mandible may stimulate a counter-clockwise rotation, which help to close the open bite (Fig. 6).

These significant results when treating open bite patients with the TRAINER System Appliances were explained by Usumez and colleagues (Usumez et al. 2004). They found a significant reduction in the angles MP-FH (frankfort/mandibular plane) and SN-GoGn (sella-nasion/gonion-gnathion), which means the Trainers produce in some way a counter-clockwise rotation of the mandible.

Another effect contributing to the closure of open bites with the Trainers is that the appliance does not allow the tongue to position between the incisors teeth. This allows the teeth that are under-erupted to re-erupt (secondary eruption process) with development of their dento-alveolar units at the anterior area of the mouth. Thus, the angular pattern of the TRAINER System helps to treat an open bite by re-educating the tongue to position in a more physiological pattern, therefore permitting a counter-clockwise rotation of the mandible as well as stimulating or permitting development at the dento-alveolar units at the incisors.

Lip seal

One of the problems associated with mouth breathing and teeth crowding is unsealed lips. This is caused by a low muscular activity in the lip muscles (orbicularis).

There is an antagonism between the orbicularis and the mentalis muscles; when the lip muscles reduce their activity, the mentalis muscles increase their activity and vice versa (Tosello et al. 1999; Lowe and Takada 1984). In patients who do not maintain a correct lip seal, the mentalis muscles maintain higher activity. So, the muscular activity at the orbicularis is very low or even non-existent. Lip seal is reached through increasing the activity at the mentalis muscles, which pushes the lower lip up to reach the upper lip, which is generally short because of a lack in development of the upper orbicularis muscle.

The TRAINER System Appliances have some elements on the anterio-inferior area of the buccal shield that touch the internal mucosa of the lower lip when the lip is being raised by the anterior digastric muscle (Fig. 8). When the mucosa of the lower lip is stimulated by any element, the activity in the mentalis muscles is inhibited (Stavvidi et al. 1992).

Reducing the activity of the mentalis muscles increases the activity of the orbicularis due to the antagonism explained previously (Tosello et al. 1999). This way, development of the lip muscular is stimulated to produce a better and permanent lip seal through the activity of the lip muscles rather than the activity of the mentalis muscles (Fig. 4).

Conclusions

The various appliances of the TRAINER System work similarly, improving the muscular activity of the masticatory and facial muscles as well as re-educating the tongue to sit in a more physiological position when relaxed. By maintaining the mandible in a forward position during a period of approximately 10 hours per day, there is a change in the mandibular posture, which improves the sagittal aspects in those patients with a disto-occlusion.

Through their action on the muscles of the cheeks and lips, the TRAINER System Appliances produce transverse development of the dental arches. Finally, through their action on the muscles closing the mouth and the tongue, the position of the tongue, as they improve the vertical aspect in those patients with either deep or open bites.

Thus, it can be concluded that the appliances of the TRAINER System (including the MYOBRACE) are a valid alternative to treat malocclusion, as they improve the sagittal and transverse development of the maxilla and mandible as demonstrated by scientific research. These appliances also improve the muscular activity of the masticatory and facial muscles, as well as the posture of the tongue, as it has been shown in successful cases treated with the Trainers as well as published in the literature.

There is ongoing research with the appliances of the TRAINER System to evaluate their action on the muscular activity of the muscles in the CMS, an action that has already demonstrated with other functional maxillary orthopedics (FMO) appliances (Stavvidi et al. 1992; Sessle et al. 1996).

All changes produced in the mouth and the CMS by the Trainers permit the teeth to have more space and position better in the dental arches, which have better tooth alignment. The MYO-