Muscle exercises in Interceptive Orthodontics

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Abstract Normal primary dentition and a normal transition from the primary to the permanent dentition are necessary to establish a normal adult occlusion. It has been one of the major goals of modern orthodontics to understand this transition process well enough to prevent or intercept developing malocclusion caused by aberrations in the developmental process. preventive orthodontics can be defined conceptually as "prevention of potential interferences with occlusal development" while interceptive orthodontics is defined as "elimination of existing interferences with the key factors involved in the development of dentition" Any treatment procedures aimed at eliminating existing interferences with normal development like muscle exercises, Serial extraction, correction of developing crossbite, interception of skeletal malrelation (Class II & Class III), space regaining, control of abnormal habits would fall under interceptive orthodontics.

Keywords- *Interceptive orthodontics, Muscle exercises, Myofunctional therapy*

I. INTRODUCTION

It is accepted as a premise that a normal primary dentition and a normal transition from the primary to the permanent dentition are necessary to establish a normal adult occlusion. It has been one of the major goals of modern orthodontics to understand this transition process well enough to prevent or intercept developing malocclusion caused by aberrations in the developmental process. Presumably, if man were not diphyodont (if there were not two dentitions) there would be no need for preventive or interceptive orthodontics.

There are a number of procedures that can be undertaken by the Orthodontist, like:-

- Preventive orthodontics,
- Interceptive orthodontics,
- Corrective orthodontics, and
- Surgical orthodontics.

Any treatment procedures aimed at eliminating existing interferences with normal development like[1]

- muscle exercises
- Serial extraction,
- correction of developing crossbite,
- interception of skeletal malrelation (Class II & Class III),
- space regaining,
- control of abnormal habits

would fall under interceptive orthodontics.

II. MUSCLE **EXERCISES**

Introduction and Historical Review

According to the definition of functional therapy, there can be an instrumental therapy that utilizes devices, primarily intraoral, and a therapy that simply utilizes gymnastic exercises or exercises for neuromuscular reeducation.

Myofunctional therapy was presented to the American Society of Orthodontists in 1918 by Canadian **Alfred Paul Rogers**[2] a student of Angle who tried to apply the modeling effect of functional stimuli to orthodontics, as had been done in surgery and general orthopedics.

His intention was to treat dental maxillofacial dysmorphosis, reestablishing altered muscle balance through training and partly renouncing the use of orthodontic appliances. He believed that the postural and functional anomalies of orofacial musculature were important etiologic factors in malocclusions.
Rogers[2] stated that, before anything else, the correct shape and intercuspation of the dental arches had to be reached by means of mechanical orthodontic forces, to eliminate any interference with normal muscle functioning, and, second, a muscular balance had to be achieved to stabilize or improve the results attained with the preliminary orthodontic treatment: "The orthodontist's mission is not just to straighten teeth. He also has to develop bone tissue. . . and reinforce all the tissues directly or indirectly involved with the face."

Roger[2]formulated some principles that even today are fundaments of myofunctional therapy: "Before undertaking malocclusion therapy one should check the patient's habits while eating, sleeping, playing and in his social relations. A careful investigation could reveal certain interferences or etiological factors that need to be eliminated for the treatment to be a success."

Moreover, **Roger**[2] stated: "The mechanical shifting of teeth and their retention are by themselves not enough to guarantee malocclusion correction. In fact, the face muscles have to be taken into careful consideration and re-educated so they can function normally.

"In the past the orthodontist was tied down, trying to reach the goal solely with his own efforts…. ignoring the physiological forces and functional activity of the various organs, which are essential to complete success.

"Muscles are living orthodontic appliances**.**[3] Correcting malocclusions with the aid of myofunctional therapy does not necessitate retention....

"Myofunctional therapy should not be seen as a substitute for therapy with orthodontic devices but rather as an accessory indispensable in creating the elements needed for normal growth and development. And so nutritional factors such as vitamins and mineral salts, endocrine functioning and correcting bad habits should be given due consideration."

In 1930s, he designed an exercise still used today for treating hypertonicity in orofacial musculature: the salted hot water exercise, dilating the blood vessels; furthermore, relaxing the facial muscles improved appearance.

Special consideration should be given to the historical development of myofunctional therapy aided by nonorthodontic devices. The equipment and apparatuses used to increase muscle work had been in use for quite some time. From old-fashioned means (batons, circles, little clubs, ropes, etc), modern muscle-training machines had developed.

Myofunctional therapy was aided by the use of tools that were not strictly orthodontic, which could be called exercisers**.** Some are still used today: the retrolabial button, the plastic disks to keep between the lips, and the rubber tubes to grip between the teeth for the isometric exercising of the masticatory muscles.

The following is a list of the most commonly used exercisers:-[3]

1. Friel's disk: This was a metal disk 30 mm in diameter and 2 mm thick, supported horizontally solely by the force of the lips. Set on the disk in an eccentric, vertical position was a little box that kept the patient from putting the disk too far back in the oral cavity, so that it had to be supported by the lips. The exercise had to be done two or three times a day, gradually increasing exercise time from 1 to 2 minutes to a maximum of 10 minutes.

2. Hoey's balancer: Structurally similar to Friel's disk, it consisted of a metal disk with a vertical box in an eccentric position. It also had a horizontal rod with a sliding counterweight allowing for a gradual increase in the resistance that had to be overcome with lip contraction.

3. Rogers' exerciser: This was a tool to widen the labial rim in a way similar to the traction exerted by two hooked fingers placed inside the mouth. It consisted of two metal branches rotating on an axis. The two far ends were placed in the corners of the mouth while a rubber ring was attached to the opposite ones.(Figure 1) The patient had to contract the orbicular muscle intermittently to overcome the resistance of the ring, which tended to transversally widen the lips (predominantly transversal exercise). Rogers recommended a minimum of 50 contractions to be divided up during the day.

Fig: 1. Rogers' Exerciser.

4. Ferris' dumbbell: This was a small rubber cylinder with a ball-shaped grip. Gripping this hilt with the hand, the patient had to bite the cylinder 10 times per session, putting the elastic extremity first between the molars and then between the canines and incisors. This was used to strengthen the elevator muscles of the mandible, and its use is still recommended today, for the same purpose but in other configurations: rubber tube, silicon tubes, and occlusal plates made from elastomers.

5. Chenet's exerciser: It was a common clothespin modified to facilitate a grip on the teeth. It can be considered a functional precursor of Sanders' condyle distractor, used in orthodontics, and the appliance of Rocabado, devices used in treating painful dysfunction of the temporomandibular articulation.
The patient had to place the open end of the pincers between the teeth and repeatedly shut it, activating the spring.

6. Rogers' rubber tape: This was a rubber strip with a loop on one end to slip a finger through and a little shield on the other to place behind the anterior teeth(Figure 2). The patient gripped this end with the teeth and exerted resistance to the traction, keeping the mandible in a normal mesiodistal relation.
The purpose of the exercise was to reinforce the masticatory and neck muscles and was preferably done in a supine position. It was obviously not advisable when the maxillary and/or mandibular incisors were excessively vestibularized, although this restriction does not appear in Rogers' writings. The very well known button exercise, destined to strengthen the orbicular muscle because the button is held solely with the force of the lips, probably derived from a modification of the exercise done with Rogers' tape.

Fig: 2.Rogers' Rubber Tape.

7. Wind instruments: In treating dysmorphosis characterized by a short or retruding mandible, wind instruments with a mouthpiece like that of a trumpet, comet, or horn have been recommended for many years. In using these instruments, the musician must bring the mandible forward, with the teeth in a head-to-head position, while to make the sound the lips have to be forcibly contracted, thus exercising the orbicular muscle.
In Class III malocclusions characterized by hypotrophy of the premaxilla or by a receding maxilla it is advisable to use simple reed instruments, such as the clarinet or saxophone**.** These have a wedge-shaped mouthpiece similar to the inclined plane which, placedp obliquely between the dental arches and folded lips, pushes the maxillary incisors forward.

In 1939, in his Handbook of Dentistry, **Gustav Korkhaus**[4] reviewed the methods of exercising the face and massaging soft tissues formulated by numerous authors, categorizing the exercises on the basis of the muscles involved. In the same text he gave an overall negative appraisal of myofunctional therapy as the sole method for treating anomalies in the permanent dentition. According to **Korkhaus**[4] the reason for its lack of success lay, on the one hand, in the difficulty of getting patients to exercise constantly and for a long period and, on the other, in the fact the exercises had little effect on more serious types of occlusal anomalies. He also warned against the probable negative effects of the mandibular advancement exercises, which could lead to a dual bite, from an orthognathodontic standpoint even harder to treat than a simple distal positioning of the mandible, Instead, he attributed great worth to the lip exercises, with which normal labial competence could be achieved.
In 1946 **R. E. Rix**[5] published the first in a series of articles describing a type of deglutition with separated dental arches, which was then presented as, "deglutition with the tongue between the teeth and against the perioral musculature in a contracted state." He thought that this anomaly in deglutition was attributable to continuing to swallow like an infant, to hypertrophic tonsils, and to infections of the upper respiratory system.

R. E. Moyers[6] also made an in-depth study of the role of orofacial musculature both in diagnostics and in therapy, examining the different functions of the stomatognathic apparatus and deglutition and its anomalies in particular. In his writings he suggested different therapies to eliminate bad habits and other imbalances in orofacial musculature, while he criticized myofunctional therapy (even if only partially applied) because he thought its daily practice too difficult, if not impossible. Moyers believed that completely mobile functional appliances were more effective than the exercises themselves.

J. A.Salzmann[7] was one of the first to divulge the importance of myofunctional therapy in his Principles of Orthodontics, published in 1943. In fact, he included a chapter on this discipline, written together with his friend **Rogers,** which described the fundamentals of myofunctional therapy and many exercises, along with illustrations.

In 1963 **W. L. Kidd**[8] and colleagues published a fundamental study on the physiopathology of the orofacial musculature, in which the role muscles played in relapses began to be seen as important. Studying lip and tongue pressure in open bite patients who had relapsed into malocclusion, they discovered that their tongue pressure was double that of the control group's, while lip pressure was almost half.

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Exercises for Orbicularis oris and Circumoral muscles:[3]-

1. Upper lip should be stretched over the lower lip in an attempt to touch the chin.

2. Pump hot salt water back and forth behind the lips 4 to 5 times and spit it out and repeat it. Use half a glass of water at a time. This exercise has salubrious effect on hypertonicity.

3. The above exercise can be done using breath, instead of water. Force air behind the lips as forcibly as you can, hold it for a moment and then release it.

4. **Button tug of war:** Two 1½ inch flat buttons are taken, thick thread is passed between them. One button is held by the patient and the other by another person. The button should be held in position by the lip pressure. Gently, the pressure can be increased. The patient should not tilt or do abrupt movements, as it can hurt them.

5. **Button pull exercise:** It is similar to the tug of war exercise except that instead of two buttons, there is only one button threaded; the patient himself/herself pulls the thread and at the same time holds the button with the lip pressure.

6. **Holding cotton rolls:** The cotton rolls are used to form as a lip bumper behind the offending lip. This is indicated for grossly everted lips, over developed mentalis and in cases of short and retruded upper lip that does not respond to other exercises.

7. **Oral screen:** It is a myofunctional appliance used as a muscle exerciser(Figure.3).

Figure 3. Oral Screen.

Exercise for Masseter muscle:-

Masseter count to ten exercise: Ask the patient to clench the teeth, then count from 1 to 10 and relax. Repeat it again.

Exercises for Tongue:[3] -

a. The one elastic swallow: An intra-oral elastic is placed on the tip of the tongue, patient is asked to elevate the tongue and hold the elastic against the rugae and swallow.

b. **Tongue hold pull exercise:** Place an intraoral elastic and lift the elastic into position on the rugae area. After positioning the tongue, the patient is asked to open the mouth. This exercise helps to stretch the frenum.

c. Two elastic swallow: Put one elastic on tip of tongue, another on middle one third of tongue, raise it against the palate and swallow.

Exercise for Pterygoid muscle:[3]-

This exercise is advised in cases of distoocclusion, ask the patient to protrude the mandible as much as he can and then retract. The exercise should be repeated till the person is tired. Developing this habit helps in keeping the mandible in its correct position.

The use of wind musical instruments:[3] -

Wind musical instruments are used as an aid in the treatment of malocclusions of the teeth and in bringing about a normal condition of the facial musculature.

A cup-shaped mouthpiece instruments (like trumpet, bugle) are indicated in hypotoned cases of Class II division 1 malocclusion and Class I with protruding upper anteriors.

In Class III malocclusions characterized by hypotrophy of the premaxilla or by a receding maxilla it is advisable to use simple reed instruments, such as the clarinet or saxophone.

Double reed instruments (like oboe, English horn, and bassoon) are indicated in all cases hypotonicity and requiring muscle toning effect. They are valuable in cases of flabby and short lips.

The instruments having a hole or aperture in the head of the instrument for a mouthpiece (like piccolo and flute) are valuable in Class I and Class III cases presenting short upper lip and abnormal mentalis muscle.

Purpose and limitation of Muscle Exercises

The purpose of muscle exercises is to create a normal health and function in the orofacial musculature, as they are important elements in aiding growth and development of normal occlusion.

Myotherapy is no substitute for mechanical appliance. They must be used together with mechanotherapy.
It will not greatly alter the bony growth pattern or perform heroic tooth movements. They can however, aid in unfolding the inherent potential of the case and increase the chances of successful retention.

III. Summary and Conclusion

Gum chewing exercise is effective to increase maximum bite force and masticatory performance of preschool children and the effects are maintained after exercise completion. Every clinical examination of children in the deciduous dentition with sucking habits should include assessment of orofacial functions, especially the swallowing

pattern, which was found to be an important factor in the etiology for posterior crossbite development. Fibrosis without predominant myogenic regeneration was the major histological consequence of surgical tongue volume reduction. The proposed treatment resulted in improved masseter muscle thickness in patients with Class III dentofacial deformity.

IV. **REFERENCES**

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