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# A LIP EXERCISES IN ORTHODONTICS: A REVIEW ARTICLE

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**Abstract**

**Objectives:** The present review has been prepared in order to emphasize various types of lip exercise used for correcting the poor posture of lip musculature, necessary for the increase of the lip length and strength that is helpful in the creation of a lip seal.

**Data and Sources:** A literature review and articles were collected using PubMed, Scopus, Research gate and Google Scholar to search for lip exercise in orthodontics.

**Conclusions:** The aim of the lip exercises is the creation of normal function and health in orofacial musculatures, due to the fact that they represent significant elements in that aid in normal occlusion growth and development, however, not substitute for the mechanical appliances.

**Keywords:** Exercises, Lip, orthodontics.

## Introduction

The most widespread reason behind seeking the orthodontic treatments is the improvement of the dento-facial aesthetics. It is accepted now that the novel orthodontic treatments require a shifting away from the Angle's model of the achievement if optimal occlusions to more aesthetically focused paradigm of the soft tissues, which has been based upon the overall advantage of the patient. Based on Hulsey, "Smile represents a very important means through which the people convey the emotions." Most orthodontic literature and diagnoses have been based upon profile and lips of the patient at rest[1].

A "perfect smile" can be defined as interaction amongst teeth, gingival scaffold and lip framework. In a perfect smile aesthetic zone, teeth have to be optimally aligned and the gingival margins have to be healthy and harmonious with the lip [2].

The Excessive gingival display caused by vertical maxillary excess, a short length of the upper lip, gingival enlargement, or combination of abovementioned factors. There are various options for treating the short lip, which include the injection of the botulinum toxin of type A, lip re-positioning, hyaluronic injection, myectomy or combinations of a number of those, focused fundamentally on the restriction of muscle movements [2]. A modern muscle-training machine had been developed and Myofunctional therapy has been aided with using tools which have not been entirely orthodontic, referred to as exercisers. This equipment has been utilized for isometric exercising of perioral muscles, and will be discussed in details in this study.

## Lip Exercises

A lip exercises is therapy simply utilizing the gymnastic exercises or the exercises for the neuro-muscular reeducation[3].

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The Myo-functional therapy has been proposed in 1918 to American Society of the Orthodontists by A. P. Rogers, a Canadian student of Angle who had attempted at applying the modelling effect of the functional stimuli to the orthodontics. Since the 1930's, Roger had designed exercise that remains utilized in the present day for the treatment of the hypertonicity in the orofacial musculatures: salted hot water exercise, which dilates blood vessels; in addition to that, the relaxing of facial muscles has resulted in the improvement of the appearance. Certain types of consideration have to be taken under account regarding the myofunctional therapy's historical development, which has been aided by the non-orthodontic devices[3]. Ingervall in 1982 studied the effect of lip training and found that the training of the lips had favorable influence upon the morphology of the lips, which resulted in the increase of the height of both lips as well as the decrease of inter-labial gap[4].

The apparatuses and tools that have been utilized for increasing the muscle work were being used for a period of time. From the old-fashioned ways (i.e. circles, batons, ropes, little clubs, and so on), however, some of them remain being utilized until the present day, such as: plastic disks to keep between lips, retrolabial button, and rubber tubes to grip between teeth for isometric masticatory muscle exercising[3].

**Purposes of Lip Exercises**

Lip exercises were important in: (a) correcting poor musculature posture, necessary for the increase of the muscles' strength and thickness, which is helpful in the creation of lip seal, in addition to making the patient acquire correct habits[5] (b) increasing the size of the lip and improving its function in the individuals who have small and incompetent lips. (c), correction of short upper lips, representing one of the main gummy smile causes, and (d) significantly decreases the obstructive sleep apnea through the increase of the lip closure force and the strengthening of lip muscles [6].

**Growth of the Lips**

One consideration that needs to be made before addressing a lip incompetency issue is the age of the individual. During the period of mixed dentition, vertical growth of the lips lags slightly behind vertical growth of the facial skeleton. The upper lip grows at a steadier rate than the lower lip, reaching its full potential by age 17–19, while the lower lip experiences an acceleration of growth between the ages of nine and 13, with completion of growth by age 18–19 Lip thickness peaks during adolescence, followed by gradual loss of thickness in adulthood. Learning to recognize the difference between normal, mixed-dentition-related lip parting and true lip incompetence is an important part of the treatment process[7].

**Lehman**[7] in 2019 observe that the natural smiles of males and females, we will notice that the lip line in females is an average of 1.5 mm higher than the lip line in males, showing an average of 1–2 mm of gingival display, which is considered normal. Any amount greater than 2 mm could be considered a "gummy smile" and may be a contributing factor in the poor competency of the lips. When fully grown, the average length of the philtrum (measured from sub-nasale to vermilion border at midline of the upper lip) is 20 mm for females and 23 mm for males, the strength of the lip seems higher in the males compared to the females, despite the age[3]. In addition to that, the strength of the lip could be lower in the considerably older population (older than 80 years) in comparison with the young individuals [8], but

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perhaps of more importance is the relationship of the lips to the maxillary incisors rather than the actual length of the upper lip. No matter what treatment modality is used, it is essential that the lips not only appear more esthetically pleasing, but that all aspects of function improve as well, specifically during chewing and swallowing, speech production, and saliva handling[3].

**Anatomy of the Lip**

The muscles in perioral area have been categorized based on their insertions and origins, and by their locations as well, based on major structures[9].

**Group1**— the muscles which insert into modiolus, which represents the meeting point of the fibrous, where 7 muscles are connected. It's located lateral and a little superior to every mouth angle.

i. Orbicularis oris: which purses lips and presses them towards teeth in the moment of contraction: the deep orbicularis oris is responsible for the lips' sphincter action.
ii. Zygomaticus major: at the moment of the contraction, it is elevated and then it laterally moves commissure.
iii. Levator anguli oris: which elevates commissure.
iv. Risorius: laterally draws the commissure then produces sardonic smile.
v. Buccinator: which presses cheek and lips towards teeth.
vi. Depressor anguli oris: which result in depressing and laterally moving commissure.
vii. Platysma pars: it could be considered as one of the significant lower lip depressors.

**Group2**— Muscles inserting into upper lip: they are originated from maxilla below infraorbital foramen and insert in upper lip's orbicularis muscle. Those muscles act in the upper lip elevation.

**Group3**—Muscles inserting into lower lip: which are originated from lower mandible border and insert into the lower lip skin. They perform the depressing of lower lip.

i. Levator labii superioris: elevate and evert upper lip.
ii. Levator labii superioris alaeque nasi: which dilate nostril and elevate upper lip.
iii. Zygomaticus minor: which elevate and laterally pull commissure, contributing to nasolabial fold.

**Types of Lip Exercises**

**1. Lip puffer**

This exercise includes the forcing of liquid or air between lower and upper lips and puffing lips out to maximum degree. It has to be repeated 5 to 10times a day[5], or Pump hot salt water behind the lips back and forth for 4-5 times then spit that water out and repeat the process. Half glass of water is utilized at a time. The lip puffer is of salubrious effects on the hypertonicity; it may be performed as well with the use of breath rather than the water. Air is forced behind lips as hard as possible, held it for a moment and released after that [3].

**2. Exercises for Orbicularis oris and Circumoral muscles**

It is requested from the patient to stretch upper lip over the lower one without opening their mouth. The time of the holding is 30sec with a rate of 15-20 times a day, which will result improve the upper lip's tonicity[5].

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One more exercise is to ask the patient to stretch upper lip in posterior inferior direction toward the chin through overlapping lower lip, additionally helping in the maintenance of oral seal throughout swallowing. One more lip exercise is carried out through tightly closing lips together for 5 second, relax and repeat 5 times, that helps to increase the competency[5].

**3. Gum drop exercise**

A gum drop of a large size is taken, about 1ounce. An 18inch-20inch string, based upon patient height is taken. One string end is attached to drop, and the other end is behind teeth and held by lips. A patient is requested to place their hands behind the back and bend forward until the face is parallel with floor and string is stretched. After that, the patient is requested to open and stretch their lips as far down as they can, and this process is repeated 5 to 10 times per day[5].

**4. Card pull exercise**

The patient holds a card with 1 hand and attempts to pull it. Simultaneously, they attempt to tightly hold the card between upper and lower lips[5].

**5. Button pull exercise**

A 1inch-1.5inch diameter button is taken, after that, a thread passes through the holes of the button. It is requested from the patient to put the button behind their lips and pull thread outward whereas resisting it with a tight lip seal[5,3].

**6. Button tug of war**

Two 1.5inch flat buttons have been obtained, a thick thread passes between them. A button is held by patient and the other button is held by the other person. The button has to be held in place through lip pressure. In a gentle manner, pressure may be raised. The patient shouldn't be tilted or do any sudden movement, due to the fact that it could hurt them[3].

**7. Cotton roll holding**

Cotton rolls are utilized to form as lip bumper behind offending lip. Which has been indicated for the completely everted lips, over the developed mentalis and in the cases of the retruded and short upper lip which doesn't respond to the other exercises[3].

**8. Oral screen**

Which can be defined as myo-functional appliance that is utilized as exerciser of the muscles. Oral Screen can be described as custom-made acrylic screen extending backwards to the front of a user's teeth and behind their lower and upper lips. This device of lip training includes attached metal loop encouraging the user for manually pulling this device against lips. It was utilized as well for the rehabilitation of the patients with the oral motor dysfunctions. Various-size oral screens were implemented for the study and the clinical uses; none-the-less, most researches haven't determined the intensity of the exercise [3, 8].

**9. The Iowa Oral Performance Instrument (IOPI)**

This tool has been developed in 2001, is a device that is utilized for the measurement of the strength of the tongue and cheek, which was modified for also being capable of measuring the lip muscle strength. Which is why, it may be utilized for the strengthening the muscles of the lip with the bio-feedback characteristics for the exercising of the oral motor, this device, in contrast to previous devices that have

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been mentioned, digitally provides the bio-feedback in the units of kilo-pascal. Which is why, in contrast to Lip trainers, this device is capable of prescribing a set intensity for the training of the lip strength (as can be seen from figure 1). Such instrument was utilized in the research for the protocols and assessments of the lip strengthening. IOPI measures the force with the use of tongue bulb. An approach which was carried out for the assessment in lip muscle strength require placing the bulb between a pair of the wood blades. Such configuration would provide the ability to distribute pressure, which is exerted by lips, to be even across the whole bulb surface[8].

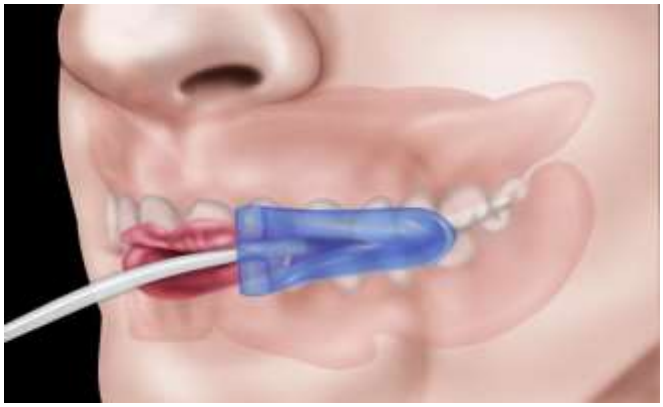

Figure 1: Iowa Oral Performance Instrument (IOPI) [8].

**10. Lip muscle strength fixation device Patakara® lip trainer**

This device has been produced from resilient and flexible rubber and plastic (Fig. 2) set to lower and upper lips loads a force that expands those lips, considering the closing of lower and upper lips against that force. The attachment handle is connected to the device's bottom and top for the purpose of allowing the users gently pull this device, which results in the generation of force towards the muscles of the lip that is proportionate to provided instructions, the training included four sessions daily, each session was 5min long for a period of two months, which results in the improvement of the strength of lip-closing, however, the strength decreased back to the base-line values right after the participant stopped the training[6].

Figure 2:Patakara® lip trainer [6].

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**11. Hypoxic training of the lip**

A traction plate is inserted in upper and lower oral vestibules and attached to weight (80% of the maximal tensile strength of the orbicularis oris) with the strings. Subjects stand and tip their head forward and they are asked to bite using their molars instead of sucking on plate. This training involves the hanging of the weight for 5s, supported by lips only and after that, supported in hands for 5s carried out five times following (Figure 3). Subjects have carried out such training every day for four weeks. In the case where it had increased at two weeks after the beginning of this training, a weight that is equivalent to 80% of new value has been utilized instead. A check-list had been given to every one of the subjects for the purpose of checking whether they'd performed this training daily for keeping their motivations for performing it [10].

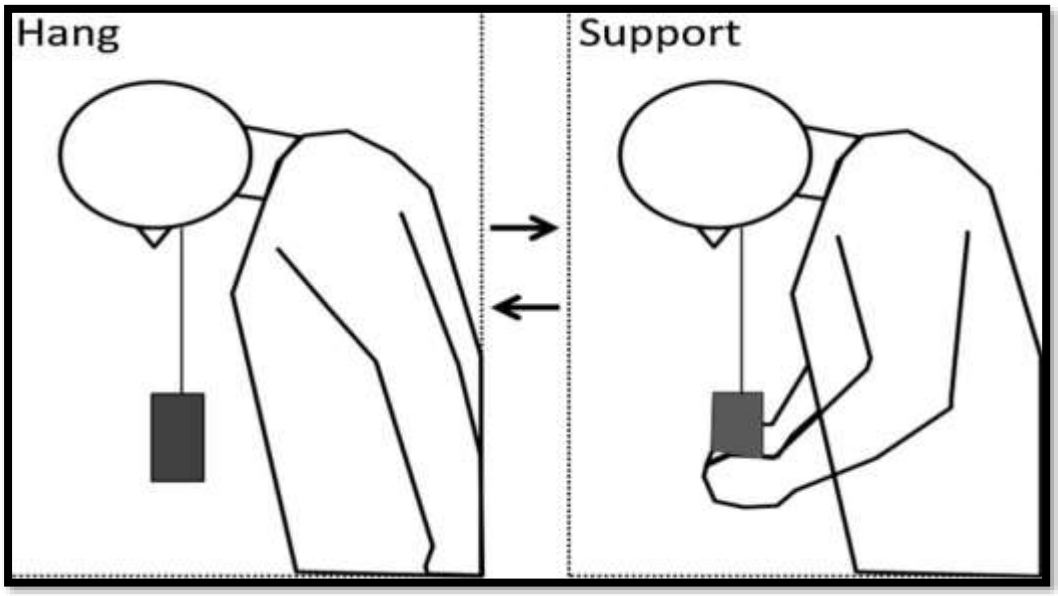


Figure 3: Hypoxic lip training [10].

**Ooya** in 2009 examined the appropriate conditions of this lip training method by measuring oxygen saturation (oxygenated hemoglobin and deoxygenated hemoglobin levels) in the orbicularis oris muscle and determined effective training conditions as aerobic exercise and hypoxic exercise. The effective conditions were found to be loading 50% of the maximum force for 5 seconds and resting for 5 seconds with 20 repetitions as aerobic exercise and loading 80% of the maximum force for 5 seconds and resting for 5 seconds with 5 repetitions as hypoxic exercise, training under the condition of aerobic exercise for 4 weeks resulted in a significant increase in endurance of orbicularis oris muscle and that training for a four-week period under the condition of hypoxic exercise increased both maximum muscular strength and muscular endurance [11,12].

**12. Myobrace lip trainer**

This device has been designed for the purpose of achieving a sufficient lip seal and strengthening the muscles of the lips. Several patients have shown lip incompetence and insufficient muscle tone signs

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around muscles of the orbicularis oris (figure 4,5). This Trainer has to be utilized for 5min twice a day [13].

1. The strap is attached to this device through pushing it upward via a hole on Myobrace® tab.
2. It is pushed downward via the hole on strap. The strap end is pulled for the purpose of securing it in place.
3. The device is inserted with lip bumpers on lower side.
4. The lips are closed over Lip Trainer ™, the strap is horizontally held and pulled on it at the same timed as keeping lips tightly squeezed together.
5. In the case that the device falls out, it is placed back in the mouth and just enough force is used for lips to hold this device in place.
6. This exercise is varied through slightly pulling the strap upward and after that, slightly downward for the individual strengthening of lower and upper lips.
7. This exercise is repeated for 5min.

**Features of the Appliance**

• Ideal Arch Shape optimally adapts to orbicularis oris and plays a role in helping the strengthening of muscles in the case of being combined with Strap-Tether.
• Lip Bumper provides the feedback to muscles of the lower lip so that mentalis muscle doesn't activate in the case where the patient swallows[13].
• Strap-Tether provides the patient with the ability of pulling appliance in a number of the directions and provides the ability for the individual training of the lip muscles.

**Applications**

1. Proper for any Myobrace® treatment stage, especially for finalizing the treatment.
2. Helpful in orbicularis oris strengthening.
3. Proper for the patients who have incompetent lips in establishing the lip seal.
4. Helpful in transition to the nasal breathing through addressing the incompetence of the lip.

The Myotalea® LipSeal Trainer can be described as attachment coming with Lip Trainer ™ and attaches to Strap-Tether so that a patient has the ability of pulling Lip Trainer ™ in a variety of the directions for the training of the perioral muscle. None-the-less, it can be serving as dedicated tool that is utilized for the improvement of the strength and seal of the lip. It features Training Board and Lip Seal Spade in the one appliance. Through either holding Training Board or Lip Seal Spade between lips, the patient would train their habitual posture lip to be sealed. Therefore, it may be utilized as well in combination with Myosa® or Myobrace® appliance for additional level of the difficulty. As soon as the patient becomes able of easily holding Training Board between the lips, they could try holding Lip Seal Spade between his/her lips, requiring more strength and tone for the advanced training[13].

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Figure 4: The Myotalea® Lip Trainer [13].

Figure 5: tongue lip press [13].

**Discussion**

The incompetence of the lip has many different adverse impacts that result in the defects of the articulation and the periodontal illness due to the dry mouth as well as development of different malocclusion types like the open bite and maxillary protrusion. On the other hand, the competence of the lips has a significant impact on the craniofacial complex growth and development. As a result, the improvement of the incompetence of the lip could be helpful in resolving those issues, a lip exercise that is utilized as an approach of training for the correction of the lip incompetence[14].

The increase in the strength of the skeletal muscle through the training has been accounted for by changes of the structure of the muscle, which includes cross-sectional area, muscle mass, and fiber type composition, besides a variation in the neural adaptations, the changes of the skill in the task, etc. The strength gains acquired throughout early training stages have been explained by neural adaptation with no visible hypertrophy[15].

Orbicularis oris muscle consists of 71.80% muscle fibers of type II, which represent fast-twitch fibers that are suitable or the instantaneous exercises that are related to the strength of the muscle. In addition to that, the muscle consists of 28.20% type I muscle fiber, which are slow-twitch fiber types that are suitable for the aerobic exercise that is related to the endurance of the muscle, 2 potential reasons for increasing the sealed lip ratio with the muscular training of the hypoxic orbicular oris. One of the potential reasons is the type I muscle fiber reinforcement that aerobic training also results in the

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increase of the muscular endurance of the orbicular oris instead of the muscular strength. The other potential reason for increasing the ratio of the sealed lip with the training of the hypoxic muscle could be the reinforcement of the type II muscle fibers enhancing the strength as well as endurance of the orbicularis oris muscle [10].

**Conclusion**

Different types of lip exercise used for the creation of normal function and health in orofacial musculature, due to the fact that they're significant elements that aid the development and growth of the normal occlusions, but not replace the mechanical appliances.

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