A case study on myofunctional therapy and malocclusions created by oral habits

Seema A Virji*, BSc, RDH, COM®; **Enoch T Ng**[§], DDS; **Santhosh Jayachandran**[†], BMedSc, DDS, MSc, FRCD(C); **Tammarie C Heit**[Δ], DDS, MICCMO

ABSTRACT

Purpose: To demonstrate the effect of an orofacial myofunctional therapy intervention by an interdisciplinary team composed of a registered dental hygienist who is also a certified orofacial myologist (COM®), a general dentist, and an orthodontist on the elimination of oral habits and changes in dental malocclusion. **Method**: This case study describes a 7-year-old female who underwent an individualized myofunctional therapy program and was given supervised education on a series of exercises targeting the muscles of mastication and facial expression over 5 months. Correct oral rest postures of the tongue and the lips were also established through therapy. **Results:** The intervention enabled the client to eliminate multiple oral habits, which corrected oral rest postures of the lips and tongue. This correction consequently improved the client's malocclusion and further prepared the client for future orthodontic treatment. **Conclusion**: Myofunctional therapy facilitated the elimination of unfavourable oral habits that led to malocclusion. Eliminating oral habits better prepared the client for orthodontic treatment and retention. Use of an interdisciplinary team facilitates optimal client care.

RÉSUMÉ

Objectif : Démontrer l'effet d'une thérapie orofaciale myofonctionnelle par une équipe interdisciplinaire composée d'un hygiéniste dentaire autorisé qui est aussi un myologiste orofacial certifié (COM®), d'un dentiste généraliste et d'un orthodontiste sur l'élimination des habitudes buccales et les changements de la malocclusion dentaire. **Méthodologie :** La présente étude de cas décrit une fille de 7 ans qui a suivi un programme personnalisé de thérapie myofonctionnelle et a reçu une éducation supervisée sur une série d'exercices ciblant les muscles de la mastication et de l'expression faciale au cours d'une période de 5 mois. La thérapie a aussi permis d'établir des postures appropriées de repos de la langue et des lèvres. **Résultats :** Grâce à la thérapie, la cliente a pu éliminer de multiples habitudes buccales, ce qui a corrigé les postures de repos buccal des lèvres et de la langue. Cette modification a par conséquent amélioré la malocclusion de la cliente et a permis de la préparer à un futur traitement orthodontique. **Conclusion :** La thérapie myofonctionnelle a favorisé l'élimination d'habitudes buccales défavorables qui ont mené à la malocclusion. En éliminant les habitudes buccales, la cliente était mieux préparée au traitement orthodontique et à la rétention. L'utilisation d'une équipe interdisciplinaire optimise les soins du client.

Keywords: abnormal oral habits; anterior open bite; malocclusion; myofunctional therapy; orofacial myofunctional therapy
CDHA Research Agenda category: risk assessment and management

INTRODUCTION

Orofacial myofunctional disorders (OMDs) include dysfunctions of the lips, jaw, tongue and/or oropharynx that interfere with normal growth, development or function of other oral structures.[1,2] A lack of intervention against OMDs at critical developmental periods may result in malocclusions and suboptimal facial development. Therapy for OMDs involves a team often composed of a registered dental hygienist or a speech language pathologist with myofunctional therapy training and certification, a general dentist, and an orthodontist. Dental hygienists can undergo training and certification in the area of myofunctional therapy to further enhance their skill set and to provide comprehensive therapy to clients of all ages.

Correct oral rest postures of the lips and tongue are essential for maintaining good facial structural integrity.[1,2] The outward force of the tongue resting on the palate guides favourable development of the maxillary arch. This force is balanced by inward forces from the buccinator muscles and the lips. Individuals with chronic airway obstructions, sucking habits, and ankyloglossia have tongue postures that disrupt the balanced forces acting on the maxillary arch.[3] Consequently, this habitually incorrect tongue rest posture changes the shape of the arch.[1-3] When the dental arches are narrowed, correct tongue rest position becomes increasingly difficult to achieve.

Mentalis strain, or lip incompetence, refers to difficulty in holding the lips together at rest.[4] Mentalis strain has a variety of causes, including allergies, a deviated septum, tongue thrusting, weak muscle tone, and enlarged tonsils or adenoids. Certified orofacial myologists (COM®) improve the coordination and strength of muscles, allowing the client to develop greater lip competence. Lip competence is crucial for processes such as speaking, removing food from

*Orofacial Myology Edmonton, Edmonton, AB, Canada
[§]Posture Airway Integrated Research & Education Team, Edmonton; School of Dentistry, University of Alberta, Edmonton; Enjoy Dental, Edmonton, AB, Canada
[†]Level Orthodontics, Edmonton, AB, Canada
[Δ]Avalon Dental, Edmonton, AB, Canada

Correspondence: Seema A Virji; seemavirji@gmail.com
Manuscript received 14 March 2022; revised 31 May and 21 July 2022; accepted 26 September 2022

spoons, and preventing food and liquids from escaping the oral cavity.[5] Furthermore, correct oral rest posture of the tongue and lips facilitates a correct swallow pattern and promotes nasal breathing.

Lip competence is measured by lip force, which is related to the ability of perioral musculature to produce adequate pressure to tightly close the lips and keep them closed.[5] When lip force is inadequate, drooling may occur and swallowing may be affected, leading to both physical and social consequences. Lip force may be hindered by tethered tissues such as labial ties, which may also create oral hygiene and dental issues.

In addition to tongue and lip rest postures, overall body posture is also important in evaluating airway symptoms related to obstructive sleep apnea and sleep-disordered breathing. Atypical deglutition is correlated not only with posture and orocraniocervical morphology, but also with the subject's general posture, known as glossopostural syndrome.[6] If the tongue is resting low in the mouth, it may disturb postural balance due to its connections with key anatomical structures, such as the skull and the neck.

Myofunctional therapy is indicated when clients present with abnormal oral habits, including tongue thrusting, mouth breathing, bruxism, digit sucking, and prolonged pacifier use. Maladaptive oral habits may affect the balance between internal and external orofacial muscles and the inward and outward forces created.[7] OMDs, including speech difficulties, anterior open bite, and anterior protrusion of the maxillary incisors, can be attributed to oral habits such as these.

Diagnosing OMDs and providing appropriate myofunctional therapy is dependent on measuring tongue function and lip competence, as well as documenting observable features, posture, oral habits, and swallowing patterns. Rulers are used to measure spacing and range of motion, and these measurements are compared with age-appropriate normal averages. This case study demonstrates that, with myofunctional therapy and an interdisciplinary team composed of a dental hygienist/COM®, a general dentist, and an orthodontist, it is possible to eliminate malocclusions and maladaptive oral habits, better preparing the client for orthodontic therapy and retention.

Measuring tongue function

The tongue is crucial to the growth and development of orofacial bone structures.[8] A large part of the evaluation for OMDs is focused on tongue mobility, function, strength, and lingual frenum assessment. The lingual function is assessed by observing the lateral movement, protrusion, and extrusion of the tongue. Compensations are often made in the form of abnormal lip and jaw movements when a tongue tie is present. The floor of the mouth is observed for lifting or movement with tongue movement to further assess the lingual frenum for a restriction.

The lingual frenum is evaluated by assessing tongue function, including during the swallow, and by palpating under the tongue. In addition, the lingual frenum range of motion is measured using tongue movement compared

Figure 1. Zaghi[9–11] functional classification of ankyloglossia based on TRMR and posterior mobility assessment TRMR–LPS

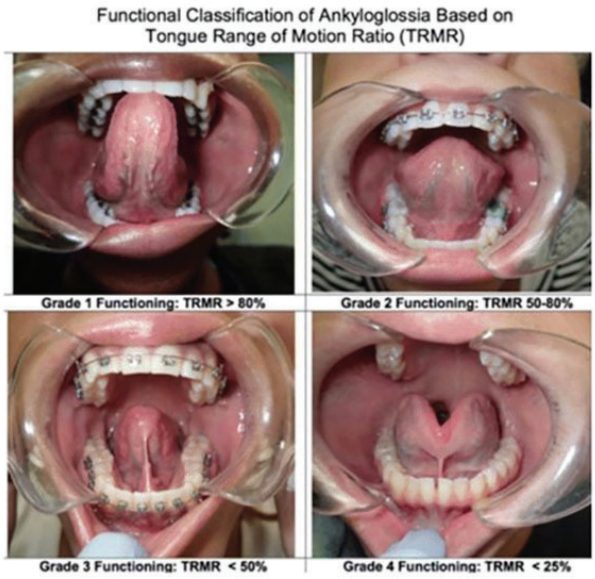

Table 1. Kotlow[13] classification of maxillary lip ties

Class	Description
Class I	Normal
Class II	Frenum inserting just above or in between the central incisors
Class III	Beginning to insert into anterior papilla
Class IV	Inserts into anterior papilla

to maximal interincisal opening (MIO), with the vertical extension of the tongue to the incisive papilla (TIP) compared to MIO and also with the tongue held in lingual palatal suction compared to MIO.[9-12] The range of motion ratio (TRMR) is the only independent measurement of tongue mobility that is directly associated with restrictions in tongue function, assuming a normal/average MIO (average of 45 mm in children).[10,12] This quantifiable lingual frenum assessment is part of the thorough assessment of tongue function (Figure 1).

The maxillary labial frenum is assessed using the Kotlow classification system[13] as defined in Table 1.

Improving lip competence

Table 2 describes the specific muscles surrounding the lips that are activated during myofunctional therapy, with an example of a therapy exercise for each muscle.

Documenting observable features of OMDs

OMDs are visible through facial features such as venous pooling. Venous pooling is caused by allergies; because nasal cavity tissue is inflamed from allergens, blood pools below the eyes.[18] Venous pooling is often associated with poor sleep and mouth breathing due to difficulties in nasal respiration and may also reflect an underlying sleep or airway issue.

Posture and oral habits in OMDs

Younger demographics often present with forward-rolled shoulders and forward head posture. There is a strong association between atypical swallowing, posture, and orocraniocervical morphology.[6] Because of this association, myofunctional therapy often incorporates body posture exercises into the treatment plan.

Swallow pattern

In addition to tongue rest posture and lip competence, correct development of the maxillary arch and occlusal pattern is also dependent on proper swallow pattern. The deglutition pattern can both stimulate and damage stomatognathic function. In deglutition disorders, the tip of the tongue, rather than curving upwards in the direction of the retro incisor spot, may push against the top or bottom teeth, or interpose itself between them.[6] This type of deglutition can create malocclusion and poor palatal development.

In this case study, evaluation of swallow pattern and compensations was completed by visual examination while the client swallowed food and water. Foods that were used for assessment were crackers and granola bars, which require chewing and bolus formation.

CASE DESCRIPTION

Consent for the use of client information in this case report was obtained from the client's parents. This case study features a healthy 7-year-old female with no underlying health conditions and no known allergies. The client was referred to the COM® by her orthodontist who noted noxious oral habits that were interfering with her dental development. Clinical findings pertaining to the client are noted in Table 3.

Photographs were taken to document profile, posture, midline deficiencies, overall orofacial muscle appearance, and venous pooling. Intraoral images were taken to document dental changes in alignment and

Table 2. Lip muscles

Muscle	Description	Function	Example of myofunctional therapy exercise
Obicularis oris	Broad elliptical muscle around the mouth	Contraction of this muscle closes the mouth	Lip pops: rolling lips over the teeth and popping open to activate the obicularis muscle
Mentalis	A paired conical facial muscle located in the chin	Protrudes the lower lip and elevates the skin of the chin[14,15]	Exercises that promote the protrusion of the lower lip and rolling of the lower lip inward over the teeth
Zygomaticus (major and minor)	Muscle of facial expression	Draws the angle of the mouth superiorly and posteriorly to allow one to smile[16]	Pulling the lip up and out towards the ear with a closed lip smile using a button on a string
Risorius	Slender, narrow muscle in the buccolabial group	Pulls the corners of the mouth outwards and upwards to create a smile or other facial expressions.[16]	Smiling while activating tongue-to-palate awareness exercises
Buccinator	Forms the anterior part of the cheek or the lateral wall of the oral cavity	Pulls back the angle of the mouth and flattens the cheek area, helping to hold the cheek to the teeth during chewing[17]	Suctioning the cheeks inward between the teeth

Table 3. Client information

Pregnancy	Within normal limits; no complications for mother or baby
Delivery	Vaginal; not induced and no forceps used
Early feeding history	Breastfed for 9 months; mother experienced no latch difficulty or pain with feeding No gastrointestinal issues or acid reflux as an infant
Lips	Dry and chapped upon visual assessment; parted at times during the initial appointment Lip wedging (lower lip) habit noted (creates lip trap with lower lip)
Airway and breathing	Mouth breathing and an open lip rest posture noted Low-lying tongue rest posture Parents report heavy breathing and snoring at night Daytime fatigue reported by the client and her parents Parents report that their child is fidgety and highly active throughout the day Venous pooling under both eyes
Tonsils	Enlarged bilaterally; left tonsil grade 3 and right tonsil grade 2 Parents were encouraged to seek out an ear, nose, and throat specialist (ENT) to rule out physical airway obstruction; parents declined ENT referral
Labial frena	Mandibular labial frenum within normal limits Maxillary labial frenum as restrictive (Class IV Kotlow classification)[13]
Buccal frena	Within normal limits
Lingual frenum	Within normal limits (TRMR-TIP 83%, TRMR-LPS 64%)
Occlusion	Anterior open bite, 6 mm overjet, no overbite Open bite 4 mm to 5 mm 4 mm diastema between the upper anterior teeth Upper jaw was roughly concurrent to the centre of her face Mandibular midline deviated 1 mm to the right of facial midline
Oral cavity	High palatal vault; pronounced rugae in the palate Narrow maxilla Fissured tongue Mixed dentition Class II Division I dental pattern Mild maxillary and mandibular crowding
Swallow assessment	Anterior tongue thrust swallow upon evaluation Client reported gas, belching, cramping, and stomach pain after eating; had undergone blood tests for 14 to 15 months prior to starting myofunctional therapy to screen for food intolerances; all test results were within normal limits
Oral habits	Nail biting Toenail biting Lip wedging (upper and lower lips, more often lower lip is wedged into the overjet space) Lip licking Hair chewing Clothes chewing Pen/pencil/object chewing Constantly has hands/fingers in her mouth Bites/chews on callouses on her palms and thumbs (gets callouses from gymnastics) Bites on her thumbs Picks at her gums (especially around maxillary labial frenum; client feels this area is "itchy") Blanket chewing/sucking at night when falling asleep
Speech evaluation	No previous therapy with a speech and language pathologist (SLP); parents reported that speech development was within normal limits with no early language delays or history of articulation errors
TMJ	No clicking or popping upon palpation; no deviation upon opening
Posture	Forward head posture; left shoulder was higher than the right

appearance (Figures 2 to 6). A straight ruler was used to obtain intercanine width, intermolar width, overjet, and overbite. A range of motion (ROM) ruler was used to measure mouth opening.

Table 4 describes computing TRMR and lingual frenum assessment. All measurements were obtained using a ROM jaw scale with the client sitting upright, feet flat on the floor, legs uncrossed, and in a natural head position with

Figure 2. Upper occlusal

Figure 3. Maxillary labial frenum

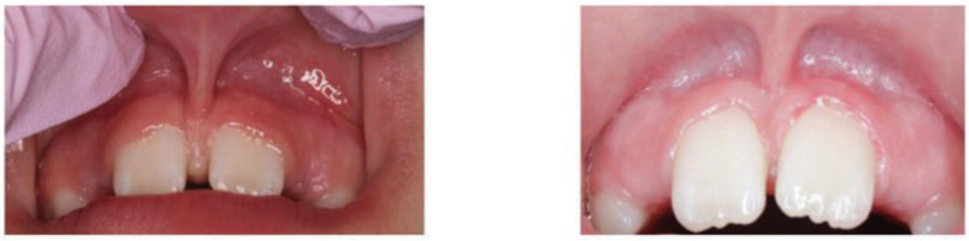

Figure 4. Tongue tip range of motion

Figure 5. Overjet and anterior open bite

Figure 6. Intraoral centre and intraoral right

a horizontal visual axis. The lingual frenum was measured as previously described in measuring tongue function.

A Wheeler brand 309888 Trigger pull scale was used to measure intraoral pressure and quantify lip incompetence. A string was attached to a 25 mm button, then attached to the trigger pull via a slip knot. The button was placed between the client's teeth and lips while the client was standing upright, with the lips closed tightly. The therapist stood across from the client and pulled the trigger, releasing the button from the lips. The reading on the trigger gauge provides an intraoral pressure reading in pounds per square inch. This reading is performed in triplicate to obtain an average measurement each visit.

Stomahesive, a vegetable-based and medical-grade material, is used as an intraoral guide to encourage correct tongue rest position during the day and at night. The client was instructed to use a single-hole punch to obtain a small amount of material and remove the paper backing to expose a sticky side which adheres intraorally. The client was further instructed to dry behind the maxillary incisors using a paper towel prior to placing the stomahesive at the incisive papilla just behind the maxillary incisors. The faster the stomahesive sticker dissolves, the more the tongue tip has been positioned correctly. It acts as a subconscious reminder and encourages the client to keep the tongue tip at the incisive papilla while the dorsum of the tongue rests on the palate.

Table 4. Objective assessment of tongue mobility[10]

Step 1	Measurement of maximum interincisal mouth opening with the mouth opened as wide as possible without pain or discomfort (comfortable mouth opening [CMO])
Step 2	Measurement of the maximum interincisal mouth opening while the tongue tip is extended to the incisive papilla (TIP)
Step 3	Measurement of the maximum interincisal mouth opening while the tongue body is held against the palate in lingual-palatal suction (LPS)
Step 4	TRMR-TIP is calculated as the percentage of TIP divided by CMO
Step 5	TRMR-LPS is calculated as percentage of LPS divided by CMO

Myofunctional therapy methods

The client was given personalized exercises that began with establishing correct tongue and lip rest postures. Table 5 describes the tongue muscles involved in treatment and an example of myofunctional therapy exercises given to the client to activate and strengthen those specific muscle groups. Many of the exercises overlap in muscle groups, but both the intrinsic and extrinsic tongue muscles and lip muscles are activated and strengthened throughout therapy.

The client underwent myofunctional therapy for 5 months with the COM®. In-office therapy was conducted monthly and a maxillary labial frenectomy was completed by a general dentist after 3 myofunctional therapy visits.

Posture

Exercises were given to help improve the client's overall posture. Examples of exercises include corner wall push ups and placing arms behind the back or around a chair while sitting to open the shoulders and chest area.

RESULTS

The patient had a Class IV maxillary labial tie. At the initial assessment, an oral habit of picking/rubbing the maxillary frenum area was reported.

During the second visit with the COM®, the client's parents reported that the client was sleeping better throughout the night and no longer snored. The client also reported reduced daytime fatigue. Correct oral rest postures had led to the elimination of toenail biting and hair chewing, as well as a reduction in the fingernail-biting habit. The client's habit of creating a lower lip trap in the open bite space had diminished, and object chewing had decreased since the first visit by maintaining correct oral rest postures. The blanket sucking habit had ceased following the removal of the blanket from the sleep environment and correction

Table 5. Tongue muscles

Muscle	Function	Intrinsic or extrinsic[a]	Example of myofunctional therapy exercise
Genioglossus	Protrusion and depression of the tongue	Extrinsic	Clicking tongue tip with back teeth together
Hyoglossus	Depression of the tongue	Extrinsic	Using a guide to physically depress the tongue as the client opens wide
Styloglossus	Retrusion and elevation of the tongue	Extrinsic	Sticking tongue straight out and to each side
Palatoglossus	Elevation of the tongue	Extrinsic	Suctioning entire tongue to the palate while opening wide (lingual palatal suction)
Superior longitudinal muscle	Shortening of the tongue	Intrinsic	Contracting and relaxing the tongue while sticking the tongue straight out
Vertical muscle	Flattening of the tongue	Intrinsic	Obtaining a tongue "roll" or grooving of the tongue while sticking the tongue straight out and rounding the lips over the tongue
Transverse muscle	Narrowing of the tongue	Intrinsic	Contracting and relaxing the tongue while sticking the tongue straight out
Inferior longitudinal muscle	Changes the shape of the tongue in mastication and deglutition	Intrinsic	Grooving tongue, shifting tongue in different directions, relaxing, and contracting tongue with tongue out

[a]Intrinsic muscles are the least affected by frenum attachment

Table 6. Client measurements

Measurements	8 July 2019	19 August 2019	22 November 2019	31 January 2020
Upper lip	14 mm	15 mm	15 mm	15 mm
Lower lip	7 mm	8 mm	8 mm	8 mm
Intraoral pressure	1.5 PSI	1.5 PSI	2.5 PSI	3 PSI
Overjet	Anterior open bite: 6 mm	Anterior open bite: 5 mm	Anterior open bite: 3 mm	Anterior open bite: 2 mm
Canine to canine	28 mm	29 mm	29 mm	30 mm
Vertical opening/range of motion	42 mm	45 mm	45 mm	46 mm
Tongue tip up to palate	35 mm	35 mm	35 mm	35 mm
Tongue suctioned to palate	27 mm	27 mm	25 mm (–2 mm from initial visit but can now suction entire posterior portion of the tongue to palate)	32 mm

of the oral rest postures of the lips and tongue. However, the client continued picking, brushing, and massaging her gums at the maxillary frenum.

Three months after the initiation of myofunctional therapy, the overjet had reduced by 2 mm, and the anterior open bite had closed by 2 mm. Oral habits that were eliminated by this visit were biting and sucking on thumbs, and chewing hair and other objects. The blanket had not been returned to the client's bed, so elimination of the blanket sucking habit was maintained. However, the client still habitually massaged and picked at the upper lip maxillary labial frenum area. The COM® referred the client to a general dentist to have a maxillary labial frenectomy which was completed with a diode laser.

During a post-operative follow-up, the client and parents reported a noticeable reduction in the habit of massaging and picking at the gums at the maxillary frenum area. Also reduced was the habit of having hands in and around the mouth multiple times a day. After 6 months of therapy, the client achieved improvement of her anterior open bite and eliminated all remaining oral habits with significant improvements to her self-esteem, dental, and overall health.

At the final therapy visit, all oral habits presented at the beginning of therapy had been eliminated. Correct lip and tongue rest postures were habituated. The client continued to see the referring orthodontist and began palatal expansion treatment 5 months after completing myofunctional therapy.

At her annual myofunctional therapy visit the family revealed that none of the initial presenting oral habits had returned.

DISCUSSION

Myofunctional therapy is a challenging treatment requiring self-control and compliance, but with the interdisciplinary knowledge of oral health professionals, changes to dental occlusion can be facilitated without appliances, promoting correct orofacial development in children. Further orthodontic treatment may be needed for some clients, but myofunctional therapy prevents orthodontic relapse thanks to the elimination of malocclusion-producing oral habits. Myofunctional therapy also treats the main cause of the OMDs including dysfunction of the lips and tongue posture prior to orthodontic treatment.

To prevent recurrence of the client's maladaptive oral habits, the COM® recommended that the parents 1) remove the trigger blanket from the bedroom, which the client would suck on at night to fall asleep; 2) cover her hands with gloves to prevent nighttime sucking or chewing of the fingers once the blanket was removed; and 3) encourage the client to wear gloves during the day at times when the client tended to put her fingers in her mouth. Physical reminders such as adhesive bandages and gloves can help clients to remember the end goal and prevent the oral habits associated with the hands and the mouth.

CONCLUSION

Myofunctional therapy can aid in changing dental malocclusions by eliminating abnormal oral habits. Correction of the tongue and lip rest postures promotes correct orofacial development and can shorten orthodontic treatment time. This case study demonstrates the integral role that COM®s play in client care and shows the changes that can occur following the elimination of multiple oral habits prior to beginning orthodontic treatment. Early myofunctional intervention is a key factor in promoting correct craniofacial growth and development.

ACKNOWLEDGEMENTS

The authors would like to acknowledge Christina Chan and Joanne Lafrance for their contributions in the formatting of this manuscript. We would also like to thank Soroush Zaghi, MD, for allowing the use of his images for TRMR tongue tie assessment.

CONFLICTS OF INTEREST

The authors have declared no conflicts of interest.

REFERENCES

1. Proffit WR. Equilibrium theory revisited: factors influencing position of the teeth. *Angle Orthod*. 1978;48(3):175–86.
2. Mason RM, Frankin H. Orofacial myofunctional disorders and otolaryngologists. *Otolaryngol (Sunnyvale)*. 2014;4(4):e110.
3. Lehman A. Oral rest posture: a key piece of the obstructive sleep apnea puzzle. *Dentistry iQ* [Internet]. 2016 [cited 2021 March 9]. Available from: www.dentistryiq.com/dental-hygiene/clinical-hygiene/article/16352579/oral-rest-posture-a-key-piece-of-the-obstructive-sleep-apnea-puzzle.
4. Drubi A. What Is Lip Incompetence? [Internet]. 2020 [cited 2021 April 5]. Available from: www.drubiorthodontics.com/what-is-lip-incompetence/.
5. Wertsén M, Stenberg M. Measuring lip force by oral screens. Part 1: Importance of screen size and individual variability. *Clin Exp Dent Res*. 2017;3(3):87–92.
6. Scoppa F. Glosso-postural syndrome. *Ann Stomatol (Roma)*. 2005;LIV(1):27–34. Available from: https://docplayer.net/18771733-Glosso-postural-syndrome.html
7. Grippaudo C, Paolantonio EG, Antonini G, Saulle R, La Torre G, Deli R. Association between oral habits, mouth breathing and malocclusion. *Acta Otorhinolaryngol Ital*. 2016;36(5):386–94.
8. Dezio M, Piras A, Gallottini L, Denotti G. Tongue-tie, from embriology to treatment: a literature review. *JPNIM*. 2015;4(1):e040101.
9. Marchesan IQ. Lingual frenulum protocol. *Int J Orofacial Myology*. 2012;38:89–103.
10. Zaghi S, Shamtoob S, Peterson C, Christianson L, Valcu-Pinkerton S, Peeran Z, et al. Assessment of posterior tongue mobility using lingual-palatal suction: Progress towards a functional definition of ankyloglossia. *J Oral Rehabil*. 2021;48(6):692–700.
11. Yoon A, Zaghi S, Weitzman R, Ha S, Law CS, Guilleminault C, et al. Toward a functional definition of ankyloglossia: validating current grading scales for lingual frenulum length and tongue mobility in 1052 subjects. *Sleep Breath*. 2017;21(3):767–75.
12. Müller L, van Waes H, Langerweger C, Molinari L, Saurenmann RK. Maximal mouth opening capacity: percentiles for healthy children 4–17 years of age. *Pediatr Rheumatol Online J*. 2013;11:17.
13. Kotlow LA. Diagnosing and understanding the maxillary lip-tie (superior labial, the maxillary labial frenum) as it relates to breastfeeding. *J Human Lact*. 2013;29(4):458–64.
14. Luo EK. Mentalis [Internet]. 2019 [cited 2021 March 9]. Available from www.healthline.com/human-body-maps/mentalis-muscle#1.
15. Vasković J. Mentalis muscle [Internet]. [cited 2021 March 19]. Available from: www.kenhub.com/en/library/anatomy/mentalis-muscle.
16. Stel M, van Dijk E, Olivier E. You want to know the truth? Then don't mimic! *Psychol Sci*. 2009;20(6):693–99.
17. Fehrenbach MJ, Herring SW. *Illustrated anatomy of the head and neck*. 4th ed. St. Louis: Elsevier/Saunders; 2012. p. 91.
18. Leonard J. What are allergic shiners? *Medical News Today* [Internet]. 2017 [cited 2021 March 19]. Available from: www.medicalnewstoday.com/articles/320211.