

Critical Importance of Orofacial Myofunctional Therapy and Surgical Technique in Frenectomy for OSA – A Clinical Case Report

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Abstract: This case report describes the complete resolution of severe obstructive sleep apnea (OSA) in an adult patient through combined orofacial myofunctional therapy (OMT) with lingual frenectomy confirmed through posttreatment home sleep testing. This patient initially underwent a surgically questionable frenectomy without appropriate pretreatment of OMT, leading to worsening OSA. OMT with appropriate frenectomy resulted not only in improvement but also in complete resolution of the patient's OSA. The importance of appropriate surgical technique for lingual frenectomy is emphasized, with the consequences of poorly performed lingual frenectomy and its effects on the patient's OSA reviewed in the initial presentation of the patient prior to beginning appropriate OMT.

Keywords: orofacial myofunctional therapy, lingual frenectomy, obstructive sleep apnea

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INTRODUCTION

Sleep-disordered breathing affects approximately 15% of the population and is characterized by interruptions to breathing during sleep.¹⁻³ Of the sleep breathing disorders, obstructive sleep apnea (OSA) is one of the most common and well known and is well correlated with multiple other medical conditions including diabetes, Alzheimer disease, hypertension, and cardiovascular disease as well as other related symptoms including daytime sleepiness, snoring, and morning headache.⁴⁻⁷ Current recommended primary treatments by the American Academy of Sleep Medicine for OSA include positive airway pressure (PAP) therapy, behavioral strategies (such as weight loss, positional therapy, and avoidance of alcohol and sedatives prior to sleep), oral appliance therapy (OAT), and surgical interventions.⁸ Other adjunctive treatments include bariatric surgery, pharmacologic/drug treatments, and orofacial myofunctional therapy (OMT).⁸

OMT has been shown to be effective at helping in the management of OSA in both adults and children, with no risk of negative side effects.⁹⁻¹² OMT alone has also been shown to reduce OSA index severity by approximately 50% and to improve daytime sleepiness and decrease snoring in adults.¹² However, because OMT requires appropriate tongue mobility, lingual ankyloglossia may be an impediment in OMT delivery or achieving the goals of OMT, such as appropriate tongue-jaw dissociation and proper eating, swallowing, and oral rest posture.¹³⁻¹⁷ Therefore, in certain cases appropriate frenectomy may be necessary to achieve optimal oral function for OMT.^{17,18}

This case report will demonstrate the use of OMT and lingual frenectomy as a treatment for an adult patient with

severe OSA, without the requirement for any additional treatments. This case report directly shows correlation between worsening tongue range of motion and increase in apnea-hypopnea index (AHI) from unfavorable healing after initial lingual frenectomy surgery performed without pre-surgical and postsurgical OMT and a comparative decrease in AHI after OMT and lingual frenectomy revision surgery with improved tongue range of motion. One-year follow-up sleep tests will show maintenance of the complete resolution of the patient's severe OSA.

CASE REPORT

Initial Presentation

A 61-year-old female patient employed as a dental hygienist presented to a private OMT clinic for an orofacial myofunctional assessment and consultation with "concerns of tethered oral tissue of [the] sublingual frenum". The patient was evaluated by a certified myofunctional therapist. The patient's medical history was significant for mild OSA (AHI 12.9), which had been diagnosed 4 months prior to the initial orofacial myofunctional consultation through a home sleep apnea test (HSAT) administered by a sleep physician and was being managed with OAT. Follow-up HSAT for OAT had not yet been conducted. Reported OSA symptoms at the time of assessment included making funny noises during sleep and not feeling well rested from sleep. The patient's surgical history was significant for tonsil removal when she was 8 years old and previous dental surgery for third molar extraction. The patient reported no current use of medications, no known

allergies, and current use of bioderived hormonal supplements.

General physical assessment of the patient revealed a height of 5'10", weight of 170 lb, neck circumference of 13.5", and waist circumference of 36". The patient presented with a forward neck posture, shoulder cant with the right shoulder lower than the left, and a dolichocephalic facial form with an orthognathic profile and normal nasolabial angle.

General dental assessment showed the patient in permanent dentition in Angle class I molar occlusion, incisal overjet of 2.5 mm, incisal overbite of 60%, both maxillary and mandibular midlines approximately 1.5 mm to the right of the facial midline, a V-shaped palatal form with a moderate palatal vault and mild definition of the palatal rugae (Figure 1). Temporomandibular assessment showed mandibular deviation without correction toward the left, no clicking/popping/crepitus, and no reported pain on palpation.

Orofacial myofunctional assessments were conducted to evaluate oral frenal attachments, tongue posture and function, mastication, and swallow functions. Lingual frenal assessment showed the patient with a thin and fibrous sublingual frenum attaching along the ventral midline of the tongue 12 mm from the tongue tip and extending along the floor of the mouth and inserting posterior to the Wharton ducts. Mandibular maximum opening was 51 mm, from which tongue range of motion ratio (TRMR) was then calculated. Maximum opening with tongue tip to incisive papillae (TIP) was 31 mm (61% of maximum mandibular opening with floor of mouth elevation, class 2 TRMR-TIP and considered within normal range of motion) and maximum opening with tongue lingual palatal suction (LPS) was 21 mm (41% of maximum mandibular opening, class 1 TRMR-LPS and considered within normal range of motion if no compensations are present) (Figure 1). Poor tongue-jaw dissociation, weak and limited suction, anterior thrust swallow pattern with facial engagement, and lip weakness were noted. The patient self-reported her tongue rest position as the anterior one-third of the tongue on the palate with the tongue tip to the "spot" and the rest of the tongue low to the floor of the mouth, which denotes a nonideal tongue rest position. The patient underwent oropharyngeal screening, which revealed a Mallampati score of 3, bilateral grade 0 tonsils, and weak palatal velum with prompts.

Prior to the patient beginning OMT, she underwent a CO2 laser lingual frenectomy with an unknown provider during a weekend conference held in a foreign country; postoperative myofunctional exercises were not performed or prescribed. The patient reported experiencing significant pain after the frenectomy and was seen for evaluation with an orofacial myologist immediately upon her return to the country. A deep horizontally oriented wound located along the anterior portion of the lingual frenum was noted, with

the frenum posterior to the wound intact (Figure 2). The assessment showed a decline in tongue range of motion for a TRMR-TIP of 28 mm and the patient was unable to perform LPS for evaluation. Postcare exercises and instructions were provided to the patient along with concerns related to scar tissue formation potentially worsening the tongue's range of motion. OMT was continued through the healing process to help rehabilitate muscle strength and optimize oral function. Because of symptoms of excessive fatigue and decline in mental clarity, a new sleep study was performed with results indicating the patient now had severe OSA (AHI 38.1). Six months after the frenectomy was performed, a reevaluation was conducted to assess the need for revisionary surgery. Assessment after complete wound healing showed scar tissue with significant deficiencies in tongue mobility with a TRMR-TIP of 25 mm and a TRMR-LPS of 24 mm. The patient was not able to achieve full tongue rest position. The patient also was unable to achieve normalization of the swallow because of insufficient tongue range of motion specific to mid-tongue elevation to seal for lingual palatal swallow. Despite her new diagnosis and even after discussions with her sleep physician, the patient declined PAP therapy noting she was unable to tolerate it and wished to continue with OAT. However, the patient also reported significant difficulties with OAT compliance because of a heightened gag reflex since her laser frenectomy, which the patient reported as not previously experiencing prior to the frenectomy. The patient was also insistent on proceeding with OMT if at all possible.

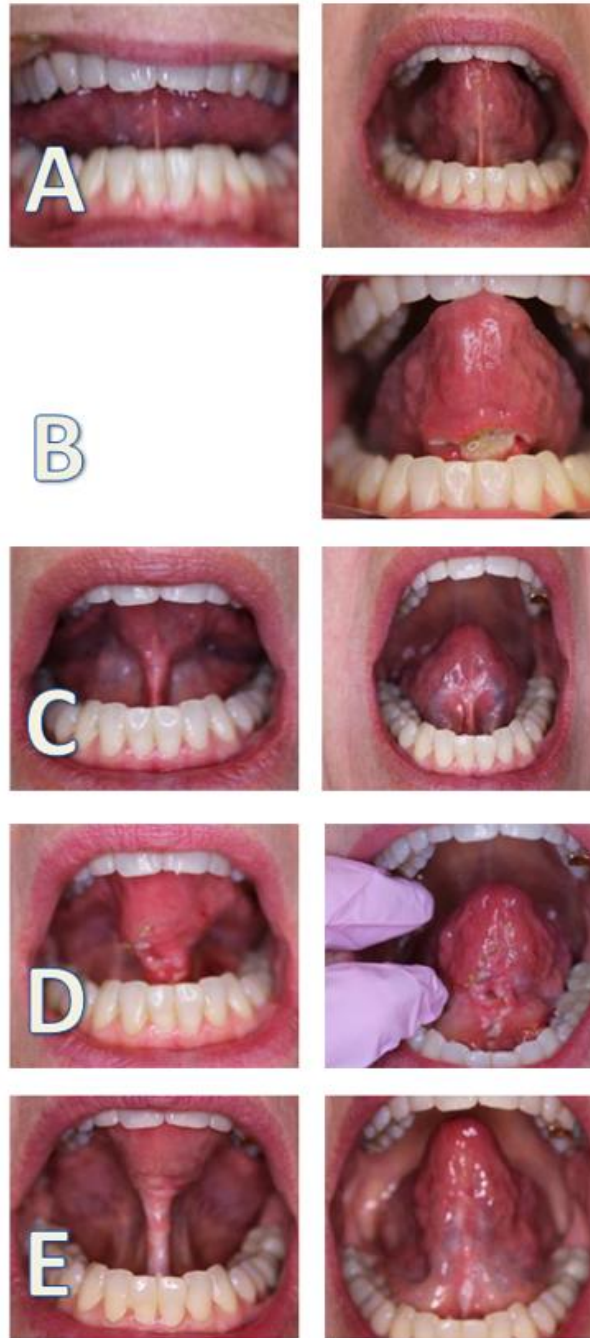
After reevaluation and education that a frenectomy revision surgery may be necessary to optimize her OMT results, the patient agreed to proceed with OMT.

In-person OMT sessions were provided on a biweekly basis, with orofacial myofunctional activities directed at strengthening and improving muscle coordination for normalized eating, chewing, swallowing, and resting patterns. Orofacial myofunctional treatment goals included nasal breathing during the day and night, lips closed at rest with no facial strain, tongue fully resting on the palate at rest, proper eating, chewing, and swallowing. Orofacial myofunctional activities were introduced to strengthen the velum, genioglossus, palatoglossus, styloglossus, and orbicularis oris. Establishing correct intraoral pressure and lingual palatal suction were essential to enable a normalized lingual palatal swallow and tongue resting position. Lingual functions were established to support organization for eating, chewing, and bolus collection. Compensatory muscles of facial expression were eliminated from use during the swallow. The patient struggled to achieve a normalized swallow pattern and proper tongue rest position. The difficulty was narrowed down to midblade and posterior tongue range-of-motion deficiencies.

Figure 1: Intraoral photographs of the patient's mouth pretreatment, showing occlusion and tongue range of motion.



Figure 2. Photographs of the patient's frenum, showing tongue range of motion with maximum opening with tongue tip extended toward the incisive papilla (TIP) (left column) and tongue in lingual palatal suction (LPS) (right column). **A**, The patient's tongue range of motion at initial assessment. **B**, The patient's tongue range of motion immediately after initial laser lingual frenectomy; LPS not done because patient was unable to tolerate the exercise. **C**, The patient's tongue range of motion at the initiation of directed orofacial myofunctional therapy. **D**, The patient's tongue range of motion immediately after Z-plasty frenectomy. **E**, The patient's tongue range of motion after completion of postfrenectomy orofacial myofunctional therapy.



January 2019	<ul style="list-style-type: none"> ➤ Ordered to complete a sleep study due to concerns of not feeling well-rested after 8 hours of sleep and making funny noises during sleep.
February 2019	<ul style="list-style-type: none"> ➤ Received a diagnosis of mild obstructive sleep apnea from her medical doctor ➤ AHI_{3%} of 12.9 according to AASM guidelines ➤ Prescribed oral appliance therapy to be worn nightly for a lifetime
May 2019	<ul style="list-style-type: none"> ➤ Completed orofacial myofunctional assessment. Report to be completed and reviewed with the patient once she returns from travel.
June 2019	<ul style="list-style-type: none"> ➤ The patient was at a weekend course out of the country and an unknown provider performed a sublingual frenectomy during a CO2 laser demonstration and was reported to be in a significant amount of pain ➤ At this time of the release, the patient had not undergone pre-op myofunctional therapy and was not given any post-op myofunctional exercises ➤ The patient contacted the orofacial myofunctional therapist and plans were made to book the patient in for evaluation immediately upon her return to the country
June 2019	<ul style="list-style-type: none"> ➤ Upon evaluation, a deep horizontally oriented wound located along the anterior portion of the lingual frenum was noted, with the frenum posterior to the wound intact ➤ The assessment showed a decline in tongue range of motion for a TIP of 28 mm and was unable to perform LPS for evaluation ➤ Post-op stretching exercises were provided and OMT therapy was commenced
October 2019	<ul style="list-style-type: none"> ➤ The patient was displaying worsening symptoms of excessive fatigue and decline in mental clarity, a new sleep study HSAT was performed with results indicating the patient now had severe OSA (AHI_{3%} of 38.1) ➤ The patient declined PAP therapy as she was unable to tolerate ➤ The patient wished to continue with OAT, however, she now was experiencing significant difficulties with OAT compliance due to a heightened gag reflex since her laser frenectomy which she did not previously experience prior to the frenectomy
November 2019	<ul style="list-style-type: none"> ➤ After approximately 6 months of orofacial myofunctional therapy, the patient was referred to an oral surgeon for sublingual frenum revisionary surgery as the patient was not able to achieve full tongue rest position and normalization of the swallow due to insufficient tongue range of motion
January 2020	<ul style="list-style-type: none"> ➤ The patient completed tongue-tie release revision with oral surgeon
February 2020	<ul style="list-style-type: none"> ➤ Sleep study (without OAT) completed noting results indicating the patient no longer had OSA (AHI_{3%} of 3)
June 2021	<ul style="list-style-type: none"> ➤ Follow up sleep study HSAT was performed 16 months later with the results indicating maintenance and the complete resolution of the patient's OSA with an AHI_{3%} of 3

Total OMT treatment time prior to lingual ankyloglossia revision surgery was 6 months. Because the primary reason for lingual ankyloglossia release was for myofunctional purposes, no sleep study was ordered. A lingual frenum Z-plasty revision surgery was performed by a board-certified oral maxillofacial surgical specialist with the patient under general anesthesia and without complications for the purposes of increasing tongue range of motion for the improvement of OMT outcomes. OMT was continued post-surgery, with the importance of specific activities targeting the intrinsic and extrinsic muscles of the tongue emphasized. Total treatment time of postsurgical OMT was extended to 9 months because of COVID-19 disrupting regular appointments, at which point the patient showed maximization of oral muscular movement and normalization of eating, chewing, swallowing, and rest posture. The patient's maximum mandibular opening was 53 mm, tongue range of motion TIP measurement was 48 mm (90% of maximum opening), and LPS was 29 mm (54% of maximum opening). The patient reported her tongue rest position was fully along the palate up until the soft palate. Based on the patient's oral motor function improvements and a reported increase in weight of 20 lb, a new HSAT was performed without use of the dental appliance from OAT, for which the patient reported significant continued compliance difficulties, with results indicating the patient now no longer had OSA (AHI 3). Following this HSAT result, the patient discontinued OAT. A follow-up HSAT was performed 16 months later, with the results indicating maintenance and the complete resolution of the patient's OSA, with an AHI of 3.

DISCUSSION

Current guidelines recommend that the primary treatment for OSA is PAP therapy, with alternative treatments including behavioral strategies, OAT, and surgical interventions.⁸ However, there are significant limitations with these treatments, including patients declining and/or discontinuing these treatment options due to discomfort, fear of negative side effects, lack of compliance, lack of efficacy for the treatment of severe OSA, and associated risks with treatments (such as surgical risks, including from having OSA).^{8,19-27}

Although previous research has shown that OMT does not provide complete resolution of OSA, this case report shows that OMT in combination with lingual ankyloglossia released through frenectomy may be an appropriate treatment option for patients who otherwise forgo primary treatment options for OSA, especially in patients with a restrictive lingual frenum either naturally or from previous lingual frenectomy surgery.¹² Patients with residual restrictive frenums or worsening range of motion from inappropriate surgical technique and lack of coordinated OMT may particularly benefit from this type

of corrective therapy. However, this case report also shows the importance of tongue function and the effect that lingual frenal restrictions can have on patients with OSA. This may be particularly important for patients with a phenotypic presentation of OSA predominated by tongue base collapse, as increased tongue range of motion from lingual frenectomy with improved neuromuscular tone from OMT may directly address this component of OSA.^{28,29} As shown in this case report, inappropriate use of lingual frenectomy can have significant negative consequences for patients that may not be otherwise considered by either professionals who perform this procedure or by patients seeking frenectomy for lingual ankyloglossia. This is in agreement with previous published research on infants and children on the importance of surgical technique for frenectomies and the effect of restrictive lingual frenums on pediatric OSA, and that appropriately conducted frenectomies with OMT can significantly improve signs and symptoms of OSA in adults.³⁰⁻³⁴ Appropriate training prior to providing any frenectomy surgery and interdisciplinary collaboration to ensure appropriate preoperative and postoperative OMT are of vital importance when performing a frenectomy in both children and adults, especially for patients for whom services are being provided specifically to address OSA.

CONCLUSION

This case report shows the successful combined use of OMT and lingual frenectomy as a comprehensive treatment for a patient with severe OSA. This case report also emphasizes the importance of proper surgical technique for lingual frenectomy, which if done inappropriately can significantly worsen a patient's OSA. Further research into the combination of OMT and lingual frenectomy is necessary to determine appropriate patient selection criteria, delivery methodology, and generalizability to patients with OSA who cannot tolerate or who decline primary OSA treatment options.

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ABBREVIATIONS

AHI: apnea-hypopnea index
HSAT: home sleep apnea test
LPS: lingual palatal suction
OAT: oral appliance therapy
OMT: orofacial myofunctional therapy
OSA: obstructive sleep apnea
PAP: positive airway pressure
TIP: tongue to incisive papilla
TRMR: tongue range of motion ratio

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DISCLOSURE STATEMENT

The authors have no conflicts of interest to declare.