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Clinical Perspective

Clinical perspectives on post-operative care for tethered oral tissues (TOTs)

Robyn A. Merkel-Walsh (*None*)
Lori L. Overland (*none*)

Contact Author
Robyn Merkel-Walsh, MA, CCC-SLP/COM®
480 Bergen Blvd. Ridgefield, NJ 07657
201-741-1918
Robynslp95@aol.com

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Erratum

Figure 3 caption corrected in this version (updated July 24, 2024)

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CLINICAL PERSPECTIVE

Clinical Perspectives on Post-Operative Care for Tethered Oral Tissues (TOTs)

Robyn Merkel-Walsh, MA, CCC-SLP, COM®,[1] Lori L. Overland, MS, CCC-SLP, FOM[2]

[1]*Diamond MYO, Ridgefield, NJ*
[2]*Alphabet Soup, Norwalk, CT*

Introduction: Post-operative frenectomy care is often focused on active wound management (AWM) and followed by neuromuscular re-education (NMR). The standard practices of AWM are varied amongst providers. AWM is often expected to be performed by caregivers who have little to no experience with AWM. In contrast, NMR is individualized to patient needs and has been emerging in external evidence as a beneficial modality for the functional implications of tethered oral tissues (TOTs). It is guided by licensed professionals but is not often accessible or recommended.

New Perspective: AWM and NMR often are similar in execution but differ in goals. AWM is focused on wound debridement and avoiding scarring or reattachment of the frena, whereas NMR is focused on airway, sleep, feeding, swallowing, speech, and optimal orofacial growth. AWM has little consensus or external evidence compared to NMR which has both internal and external evidence. AWM for oral care is also limited by scope of practice (SOP) which few licensed professionals have. NMR has a broader range of professionals such as International Board-Certified Lactation Consultants (IBCLCs), speech-language pathologists (SLPs), physical and occupational therapists (PT/OT) and registered dental hygienists (RDHs).

Conclusions: NMR has multiple benefits post-operatively, is individualized and performed by multiple professionals. It is suggested that release providers consider gentle, functionally directed post-operative NMR techniques that are individualized, and research the impact these approaches have on wound care goals.

Keywords: *tethered oral tissue, frenectomy, scope of practice, active wound management, neuromuscular re-education, internal and external evidence*

INTRODUCTION

The interest in ankyloglossia and other oral restrictions has increased amongst professionals in the fields of dentistry, otolaryngology, speech pathology, rehabilitation, and lactation. Frenectomy surgeons and therapeutic providers are experiencing a lack of consensus regarding post-operative active wound management (AWM) and neuromuscular re-education (NMR). This has led to confusion for frenectomy providers, functional providers (e.g., speech-language pathologists, lactation consultants, occupational and physical therapists, etc.), and parents/patients regarding universal guidelines for post-operative care. In addition, there is ambiguity regarding Scope of Practice (SOP) regarding which professionals perform post-operative care. Inconsistencies occur in wound management goals, versus functionally driven goals and objectives.

Correspondence: Robyn Merkel-Walsh, MA, CCC-SLP/COM®, 480 Bergen Blvd. Ridgefield, NJ 07657
Email: Robynslp95@aol.com

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Research has examined the functional impact of tethered oral tissues (TOTs) on breastfeeding (Coryllos et al., 2004; Ghaheri et al., 2017; Ghaheri et al., 2022; Pransky, et al., 2015), feeding and swallowing beyond the breast (Baxter et al., 2020; Brooks et al., 2020, Buck et al., 2020; Cordray et al., 2023; Genna et al., 2021; Ghaheri, et al., 2022), speech (Baxter et al., 2020; Chinnadurai , 2015; Dydyk et al., 2023; Ito, et al., 2015; Marchesan, 2004; Messner & Lalakea, 2002**),** voice (Summersgill et al., 2023) as well as airway and sleep (Bussi et al., 2022; Brożek-Mądry et al., 2021; Carrasco-Llatas et al, 2021; Fioravanti et al., 2021; Oh et al., 2021). To date, most research has focused on breastfeeding complications such as poor latch, maternal pain and failure to thrive; however, a growing body of evidence shows that frenectomy improves functional challenges such as speech clarity, oral transit time, feeding speed, sleep patterns, and tongue thrusting (Baxter et al., 2020).

Therapies for the functional implications of TOTs often focus on oral motor skills that impact feeding, speech and oral resting posture. Modalities include orofacial myofunctional therapy (OMT), as well as pre-feeding/oral motor therapy, lactation support, speech therapy, and occupational therapies depending

on the age and cognitive status of the patient (Baxter et al., 2020; González Garrido, 2022; Merkel-Walsh & Overland, 2018). Additional therapy modalities include bodywork which focuses on addressing post-frenectomy changes in the sympathetic system and residual muscle strain. These therapies include but are not limited to Craniosacral Therapy (CST) (Berg-Drazin, 2016) and TummyTime® (Baxter, 2018; Rosen, 2021). Currently, more studies are needed to solidify the evidence base that identifies all areas affected by TOTS; for example, OMT has been researched (Zaghi et al., 2021) but there is a lack of evidence for bodywork to date.

In order to thoroughly understand post-operative care, we must first define AWM, NMR and SOP.

Active Wound Management

TOTs comprise the seven oral frena located in the buccal cavities (upper and lower), under the lips (maxillary and mandibular) and under the tongue. Frena can support or restrict movement. The tissue can be too tight, too short, too thick or in an atypical location (Merkel-Walsh & Overland, 2018). TOTs are defined not by structure alone, but also functional limitations (Baxter et al., 2020; Merkel-Walsh & Overland, 2018; Zaghi et al., 2019).

Surgical treatment for restricted oral frena varies based on surgical technique, instruments used, and method of behavior management based on the age of the patient (Devishree, 2012; Protasio, 2019). These factors and surgical preferences of the surgeon determines the type of wound, wound healing and aftercare that is scripted post-operatively (Canadian Agency for Drugs and Technologies in Health, 2016**).**

AWM is a general term for post-frenectomy "stretches" scripted by the surgeon. AWM aims to remove devitalized or necrotic tissue, avoid scarring or reattachment, guide wound healing (Manna et al.**,** 2022), and aid in surgical site wound healing. Surgical sites will naturally heal by either primary intention, in which the borders of the surgical site or "wound" can be closely approximated (generally with sutures), or by secondary intention, during which the sides of the wound are not approximated, resulting in delayed wound healing. (McCaughan et al, 2018; Wollheim & Meeker, 2023).

Surgeons may rely on patients, parents, or family caregivers, who have little experience with wound care, oral motor intervention or intraoral stimulation to deal with the frenectomy wound. This may be called "aftercare," "wound care," "active wound management" or "stretches." Inexperience with AWM and negative patient or caregiver perspectives may skew patient feedback, data and post-frenectomy outcomes with respect to the quality of wound healing, and the possibility of re-attachment, and recurrent functional restrictions.

The evidence on AWM post-frenectomy is limited. Surgeons base their AWM protocols on the work of Larjava (2012), who outlined the predictable changes in a wound, the migration of the wound's edges and the granulation of tissue. AWM is scripted to avert rapid healing, and/or excessive granulation which could cause the wound to retain scar tissue.

To date, we are aware of only one study that specifically looked at AWM post-frenectomy. Bhandarkar and colleagues (2022) found that improvement in breastfeeding and recurrence after frenotomy were similar between massage (AWM) and non-massage (non-AWM) groups, with no additional benefits of post-frenotomy massage. The authors, however, admitted that fewer than half of the participants followed the post-operative massage instructions. Surgeons often report anecdotal evidence regarding the importance of post-frenectomy AWM based on the principles of oral wound healing (Ghaheri, n.d.).

Neuromuscular Re-education

Neuromuscular Re-Education (NMR) dates to 1954 and "deals with retraining the brain and spinal cord in voluntary and reflex motor activities" (Huddleston, 1954). NMR targets specific functional goals and is therapeutic in nature. According to Pavan and colleagues (2014), NMR may also assist wound healing by guided mobility that helps reduce inflammation, avoid fibrosis, and support remodeling.

When considering the goals of post-frenectomy care, note that the collagen fibers of the frena may be intertwined with soft tissue, nerves, and oral mucosa (Mills, Keough, et al. 2019; Mills, Pransky, et al., 2019). NMR is therefore appropriate for functional goals as it helps restore normal movement patterns through therapeutic exercises, especially in patients that may have neuromuscular compensation pre-frenectomy. NMR should not be a one-size-fits-all approach but rather an individual script based on the task analysis of function and should be implemented to reduce and eliminate compensatory movement patterns (Merkel-Walsh & Overland, 2018).

Initially, SLPs, RDHs, and Board-Certified Orofacial Myologists® were encouraged to "stretch" frena to avoid frenectomy (Rosenfeld-Johnson, 2001). In addition, Buscemi et al. (2021) proposed tongue

stretching as a sensory based therapeutic method to reset deep tongue receptors as an aid in functional skills such as swallowing therapy. Subsequent internal (clinical data) and external (research studies) evidence have shown that frena cannot be "stretched" due to the complex three-dimensional construct of the frena fibers (Martinelli et al., 2014). Further studies show that the lingual frenum consists of sublingual glands and submandibular ducts covered by a fascial layer all overlayed on the anterior genioglossus muscle, negating the concept that the sublingual frenum was just a “string” (Mills, Keough, et al. 2019; Mills, Pransky, et al., 2019).

Prior to this research it was recognized that “stretching” frena only provided short term results within treatment sessions, with regression occurring between sessions. Now reinforced by research regarding the anatomy of the frena, the contemporary framework is that the perception of “stretching” the frena was just the structure’s response to releasing restrictions in its fascial layers. Some NMR protocols still discuss “stretching” or reducing fascial restrictions based on techniques of bodyworkers (e.g., physical, occupational, and craniosacral therapists, osteopaths, and chiropractors) and the work of Meyers’ *Anatomy Trains* (2001). Pressure with movement strategies, such as the Beckman Oral Motor Protocol (Kumin et al., 2001) and myofascial release (Ajimsha et al., 2015) have been used for decades to facilitate movement, though not specifically researched on patients with TOTs.

Scope of Practice

Scope of practice (SOP) is a specific skill set determined by national certifying agencies and state licensure boards within individual professions. For example, the American Speech-Language Hearing Association (ASHA) determines the SOP for SLPs (ASHA, 2016), and state licensure boards create bylaws to follow suit. The licensing board will then regulate professionals and protect consumers by assuring that licensees work within their SOP.

While many professionals have various NMR modalities in SOP, fewer include wound management and often under specific parameters. For example, PTs may apply to become a Board-Certified Wound Management Specialist by The American Physical Therapists Association (APTA, 2022). PTs act within their SOP to perform wound healing procedures, including sharp debridement of devitalized tissue, negative pressure wound therapy and other interventions (APTA, 2020). This is not, however, specific to oral wounds.

IBCLCs are often the first to care for nursing infants with a diagnosis of TOTs. The International Board-Certified Lactation Consultant Examiners (2018) have a specific SOP which does not include oral wound care, but rather provisions on functional supports for breastfeeding dyads (Brooks, 2017). Since IBCLCs also deal with oral function, they provide NMR for breastfeeding infants through suck training.

SLPs and OTs, as experts in oral sensory-motor skills, can assist patients with overcoming oral sensory-motor over-responsiveness so that they may tolerate wound care. They may also provide strategies to parents and caregivers to ease the process of intraoral stimulation (AOTA, 2021; ASHA, 2016, n.d.A.).

Oral wound care and wound healing are not included in SLPs’ SOP via ASHA or state licensing boards. SLPs have guidelines for targeting functional skills that may be impacted by TOTs (ASHA, 2016, n.d.A). SLPs may assign NMR tasks that are based on a task analysis of function, goal focused, and subsequently assist the surgeon in more gentle wound application techniques.

Amini (2018) asserted that Occupational Therapists’ (OT) SOP includes the prevention and amelioration of wounds and their impact on daily life. OTs routinely treat patients who are at risk for or have withstood wounds, particularly elderly populations. These wounds are defined by “abrasions, punctures, bites, surgical wounds, diabetic ulcers, pressure injuries, traumatic wounds, venous stasis ulcers, and arterial ulcers. These groups include people with physical injuries (e.g., spinal cord injuries), persistent injuries (e.g., diabetic ulcers) or open wounds (e.g., burns)” (Amini, 2018). There is, however, no mention of oral wound care.

Other professionals have similar quandaries regarding SOP. For example, RDHs are professionals who have an array of professional duties varied by their role as a clinical hygienist, where they perform dental health screenings, assist with the prevention of dental diseases, dispense fluorides amongst other roles in preventative treatment as presented in the bylaws and policy manual of the American Dental Hygienists Association (ADHA, 2022). This same policy manual, advocates for the dental hygienists’ role in the assessment and treatment of orofacial myofunctional disorders (OMDs) via policies #9-92, #10-21/11-20, and #10-20. Because of their roles in both clinical dentistry and orofacial myology, they may be called upon for assistance with post-frenectomy care. AWM,

however, is not discussed by the ADHA policy manual, but may be included or excluded in individual licensure regulations, like the state-specific ability for RDHs to administer local anesthetic, or remove sutures (New York Department of Education, Office of the Professions, 2023; North Carolina State Board of Dental Examiners, 2023).

It should also be noted that AWM is not part of orofacial myofunctional training, at least not by the International Association of Orofacial Myology (IAOM) who has a specific outline of the roles of the Board-Certified Orofacial Myologist® (COM®). The IAOM states that the COM® may treat abnormal rest postures, noxious oral habits, abnormal breathing patterns, poor mastication, poor bolus formation and deglutition, abnormal swallow patterns and abnormal speech (Billings et al., 2018). ASHA (n.d.A.) assigns SLPs specific roles as well, including 1) establish patent nasal airway, 2) improve speech sound placement, 3) eliminate non-nutritive sucking habits 4) modify handling and swallowing of a bolus, 5) improve oral resting posture, and 6) provide strength and resistance training.

Confusion regarding SOP often leaves surgeons delineating AWM to professionals who may not have this skill set within their national SOP and/or state licensure bylaws. This may mislead the patient, caregiver and/or professional to believe that wound healing is the primary responsibility of the treating therapist (e.g., SLP). This is especially true when the application of techniques overlaps. Alternatively, an NMR task that is functionally directed may resemble the same movements or techniques that are designed to guide wound healing and avoid scarring. Therefore, professionals must be savvy to self-investigate and explore their roles with post-operative frenectomy. Semantics matter in the professional delivery of outlining goals and objectives with careful explanation as to why a professional is performing a technique.

NEW PERSPECTIVE

Since AWM for post-frenectomy care is scant in the literature, and SOP for AWM is ambiguous in national and state guidelines, the authors propose that the principles of NMR guide pre- and post-operative care for patients who undergo a frenectomy, as they are goal directed, gentle, and consider oral sensory-motor normative data and sensory regulation. A foundational philosophy of NMR when treating patients with TOTs both pre- and post-operatively is based on a set of expected oral sensory-motor milestones that infants, babies, and toddlers should achieve from 0 – 3 years as pre-requisites for pre-feeding, feeding/swallowing, and speech across the lifespan. These norms are carefully described by Bahr (2010), Morris & Klein (2010), and Overland and Merkel-Walsh (2013) and include the presence, absence, integration, or resolution of infantile reflexes in the first 3 years as they relate to feeding. For example, if a 2-year-old child does not have adequate tongue lateralization secondary to ankyloglossia, they may root the head toward a bolus presented to the molars for chewing. This is an indication of a retained rooting reflex that should have been resolved by 6 months (Merkel-Walsh & Gatto, 2021). Therefore, NMR may target 1) pre-feeding oral sensory-motor function; 2) feeding and swallowing; and 3) speech, in addition to additional orofacial myofunctional challenges. It is our theoretical foundation that NMR should be considering functional goals based on a thorough clinical assessment prior to frenectomy to establish baselines.

Pre-feeding and Oral Sensory-Motor Function

As we explained in a previous publication (Merkel-Walsh & Overland, 2018), there are specific ways in which TOTs may affect the normal oral sensory-motor developmental sequence. For example, in the first months of life, a disruption to the structure can impact a newborn's health, ability to self-regulate, and safe, nutritive feedings. If the lips or tongue are not fully mobile, the 1:1 correspondence between the suck and swallow could be impacted. When the infant is lip-tied, the labial seal on the breast or bottle can be impacted causing feeding difficulties (Ghaheri et al., 2017). When an infant is tongue-tied, the tongue restriction may cause it to rest in the airway, interfering and reducing the flow of oxygen to the brain, thus interfering with normal neurologic growth and development, and may have the potential to also affect the cardiovascular and respiratory systems (Kotlow, 2015).

Multiple signs and symptoms can occur during this period including but not limited to: gastroesophageal reflux, colic, frequent spit-up, gassiness, fussiness, refusal of the breast or bottle, painful latching, nasal congestion from nasopharyngeal backflow (Kotlow, 2001), and failure to thrive (Forlenza et al. 2010). Tongue tie may also interfere with the ability to draw the breast nipple or bottle teat into the oral cavity, causing difficulty stabilizing the nipple and difficulty facilitating transfer of milk. Lip tie may interfere with the gape response, labial seal, and stabilizing the nipple (Ghaheri et al., 2017).

When conducting an assessment, the task analysis of oral sensory-motor skills in relation to feeding safety and nutrition are critical. In addition, compensatory strategies used when these skills are decreased or absent should be noted (Merkel-Walsh & Overland, 2018). Since ankyloglossia has been studied regarding range of motion (Zaghi et al., 2021), the pre-feeding and oral-motor skills that are impacted are then targeted as individuated goals in an NMR plan of care. Ideally NMR should start before surgery, or at the very least be considered post-operatively to design an appropriate NMR plan of care.

The surgeon and treating therapist(s) have different goals but the techniques for AWM and NMR often look the same. For example, SLPs may gently lift the tongue with their gloved fingers or use therapeutic tools to elevate the tongue. NMR therapeutic tools have been reported to be more easily tolerated than the deeper stretches assigned in AWM. NMR goals are focused on functional objectives such as tongue retraction with tip elevation, oral resting posture, speech, and swallowing, but the methodology in NMR may also serve as a wound care strategy because of the gentle "stretch" that is applied.

For example, we previously described an NMR technique that targets lingual retraction with tip elevation and dissociation as well as jaw-tongue dissociation as "manual tongue tip elevation." (Merkel-Walsh & Overland, 2018). This can be performed with gloved fingers (Figure 1) or with a therapeutic tool (Figure 2). This action may also facilitate reduced fascial tension. The target functional objectives are oral placements for lingual alveolar phonemes and tongue tip elevation for swallowing and proper oral resting posture. This technique, however, could easily mimic "stretching" for AWM and match the surgeon's goals of controlling the speed of healing, avoiding scarring and reattachment because it provides gentle retract and lift movements, with little contact to the wound (Figure 3).

Figure 1: Manual tongue tip elevation with gloved fingers

Feeding/Swallowing

Feeding strategies for patients with TOTs start at birth with the IBCLC to begin suck training. Challenges with breastfeeding secondary to TOTs may be identified in the first few days of life (Campanha et al., 2019), though not all babies with ankyloglossia have breastfeeding complications (Costa-Romero, 2021). When lactation support does not resolve complications associated with TOTs, a pediatric feeding specialist (SLP or OT) may be consulted. These specialists implement pre-feeding techniques as described above that will support safe and effective feeding with nutritional goals and rule out other diagnosis such as pharyngeal dysphagia that may be interfering with breastfeeding (Caloway et al., 2019).

Other challenges may occur in infancy, such as mothers who must change their babies from breastfeeding to bottle feeding, that may give rise to other issues. Since the breast can conform to the mouth but the bottle teat cannot (Genna, et al., 2021), compensations the baby may have used for breastfeeding are not successful for bottle feeding. It is important to understand that babies with TOTs may use compensatory motor skills for feedings and this does not always self-correct post-frenectomy without feeding therapy.

Over time, feeding and swallowing issues may worsen and include slow feeding time, picky eating and/or oral phase challenges (Baxter et al., 2020). SLPs may treat all four phases of swallowing including the oral preparatory, oral transit, pharyngeal and esophageal phases (ASHA, 2016) as well as self-limited diets and

Figure 2: Manual tongue tip elevation with a therapeutic tool.

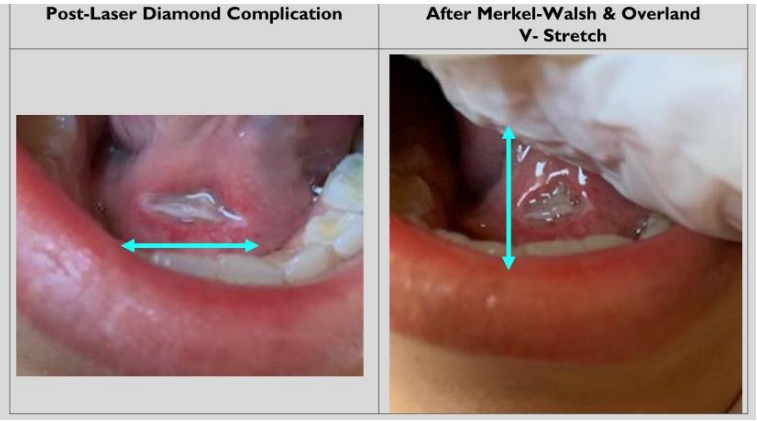

Figure 3. Manual tongue tip elevation (after frenectomy). In the image on the left, the wound became horizontal, which is undesirable. In the image on the right, the wound became vertical, which is desirable for healing.

picky eating habits that may be associated with TOTs (Potock, 2017). Merkel-Walsh (2014) described a case in which a child with feeding problems since birth and concomitant tongue-tie developed food aversions and self-limited his diet to small pieces of crunchy solids due to an inability to move and collect a cohesive bolus for deglutition.

There are various scenarios in which a patient may seek post-operative feeding and/or swallowing interventions (NMR) before or after a frenectomy. For example, breastfeeding may have been successful due to supports from an IBCLC, but when the mother returned to work and introduced a bottle, latching on to the teat was challenging. Perhaps breast and bottle feeding were successful, but baby-led weaning was unsuccessful. When these issues occur, NMR for feeding and/or swallowing may include postural supports, diet modifications, therapeutic utensils, maneuvers, exercises, oral-motor interventions, feeding strategies, sensory stimulation, behavioral intervention, biofeedback, utensils, food chaining, manipulation of food placement, tactile tools, intraoral appliances, and tube feedings (ASHA, n.d.B; Merkel-Walsh & Overland, 2018).

Speech

NMR is also relevant to speech clarity. The earliest known published discussions of the interaction of ankyloglossia and speech were in 1959 by Browne (1959) and Oldfield (1959). Oldfield stated "in the past many parents thought that, if their child did not speak at the time, they expected it to, its tongue was tied. If, therefore, it was untied it might then be able to speak" (pp. 1181-1182).

SLPs with orofacial myofunctional training have clinically noted a correlation of difficulties with oral (phonetic) placements and subsequent speech sound disorders when treating patients with TOTs. Though debated, there is some research focused on TOTs and speech. Some key factors in these studies included open wound versus stiches (Daggamati et al., 2019), the experience of the surgeon and clinician (Gaudiano et al., 2019), the combination of surgery and speech therapy as an ideal combination (Baxter & Hughes, 2018; Meaux et al., 2016; Tripodi et al., 2021), the impact of ankyloglossia on tongue mobility and speech (Messner & Lalaka, 2002), and the prevalence of /s/, /z/, and /r/ as misarticulated phonemes (Marchesan, 2004).

ASHA (n.d.A.) stated that children with OMDs (including ankyloglossia) can have issues with atypical speech sound elicitation such as abnormal lingual dental articulatory placement for /t/, /d/, /l/, /n/, /r/, /k/, /g/ and distorted productions of /s/ and /z/. In addition, they may present with an interdental or lateral lisp affecting productions of /s/, /z/, /tʃ/, /dʒ/, /ʃ/, and /ʒ/. The American Academy of Pediatric Dentistry (2022) suggested that prior to a frenectomy, an evaluation with an SLP is needed whenever speech sound errors are noted. In contrast, Ghayoumi-Anaraki et al. (2022) and Salt et al. (2020) concluded that there is a low correlation of speech sound disorders and ankyloglossia.

Patients with TOTs, depending on the location of restriction, may have compensatory placements for speech sounds and weak oral placements such as interdental placement of lingual alveolar phonemes, jaw fixing, weak jaw grading, poor jaw-tongue dissociation, weak upper lip movements (labial TOTs), decreased precision of coarticulation, vocal tension, hypernasality and distortions and misarticulations of /s/,/z,/ /l/, /r/, /ʒ/, /dʒ/, /ʃ/, /tʃ,/, /k/ and /g/ (Merkel-Walsh & Overland, 2018).

NMR Considerations

When considering pre-feeding, feeding, and speech, therapeutic interventions should consider that compensations may lead to reinforcement of orofacial

myofunctional maladaptation. For example, a patient may be able to achieve /t/, /d/, /l/ or /n/ by placing the tongue tip interdentally; however, interdental placement may also be associated with poor lingual resting posture and swallowing as the same muscles are used for all three functions and are often concomitant in OMDs (ASHA, n.d.A). The philosophy of treating OMDs is similar to that of treating TOTs in that it includes remediation of compensatory skills. Therefore, therapy for speech sounds associated with TOTs must address standardized oral placements for speech. Improving these skills via Oral Placement Therapy (OPT) is also a form of NMR (Bahr & Rosenfold-Johnson, 2010; Merkel-Walsh & Overland, 2018).

OMT, another form of NMR, was developed by orthodontists/ dentists and SLPs who understood that there was a close relationship of oral structures and the functions of the orofacial musculature (Mills, 2011). It is a modality of treatment for those who present with abnormal labial-lingual resting posture, bruxism (teeth grinding), poor nasal breathing, tongue protrusion while swallowing, poor mastication and bolus management, atypical oral placement for speech, lip incompetency, and/or digit habits and sucking habits (Billings et al, 2018; IAOM, 2023).

Patients across the lifespan with TOTs can face any of the challenges listed within the OMD definition but the age and cognitive status of the patient is key in determining the form of NMR because they cannot engage in the volitional movements and self-monitoring that OMT requires. Children ages 4 and above can be treated with OMT (Merkel-Walsh, 2020). Zaghi et al. (2019) recently reported positive outcomes with OMT and frenectomy combined. González Garrido (2022) also reported improvements with frenectomy and OMT from a systematic review of the literature. Specifically, tongue mobility, strength and endurance, sleep apnea, mouth breathing and snoring, quality of life, clenching teeth, myofascial tension, pain after surgery and speech sound production improved; however, caution was warranted because of the small number of studies.

The authors propose a new perspective, summarized in the Appendix, that post-operative intervention for TOTs should focus on functional goals and therapeutic strategies as opposed to the typical "stretching" assigned by release providers. Patients and caregivers alike benefit from professional therapeutic guidance, training, and goal-focused care that is derived from a task analysis of functional needs. Post-operative NMR may include multiple modalities of pre-feeding, feeding, oral placement, orofacial myofunctional, and speech interventions. Therapy approaches may be passive or volitional depending on the patient's age, cognitive status, and ability to volitionally execute and self-monitor exercises. Figure 4 provides an infographic of a sample NMR session with a patient with TOTs, illustrating the complexity of the approach.

CONCLUSION

In summary, post-operative care for patients who undergo frenectomy is often determined by the surgeon's directions. Since AWM and NMR may overlap in execution of techniques but do not share the same goals, patients, parents, and caregivers alike may be confused and inexperienced with AWM protocols.

The literature reviewed in this paper suggests that there is a fair amount of evidence that varying forms of oral motor interventions, ranging from pre-feeding techniques and OPT (Merkel-Walsh & Overland, 2018) to OMT (González Garrido, 2022) have positive treatment outcomes and are of no harm to the patient. Most of the external evidence available supports NMR.

The effectiveness of AWM may warrant further investigation due to the lack of representation in the literature. The science behind wound healing, clinical data, and patient feedback drives surgeons' decisions regarding AWM. Certainly, the medical expertise of the surgeon is part of the evidence-based medicine decision-making process, but closer analysis would benefit patients and professionals alike.

The authors suggest that frenectomy providers continue to learn from oral motor, feeding and orofacial myofunctional specialists regarding gentle, functionally directed post-operative techniques that are uniquely goal directed for pre-feeding, feeding, and speech, as opposed to rudimentary techniques that may not be individualized to the patient's treatment goals. There is also concern about the limited number of professionals who clearly have oral wound care management in their scope of professional practice according to national organizational bylaws and guidelines (ADHA, 2022; AOTA, 2021; APTA, 2017; APTA, 2022, ASHA, 2016; IAOM, 2023; IBCLE, 2018).

In contrast, a wider range of professionals can directly treat oral motor deficits, which may secondarily aid in a post-surgical plan that manages AWM through NMR simultaneously and places less stress on the patients

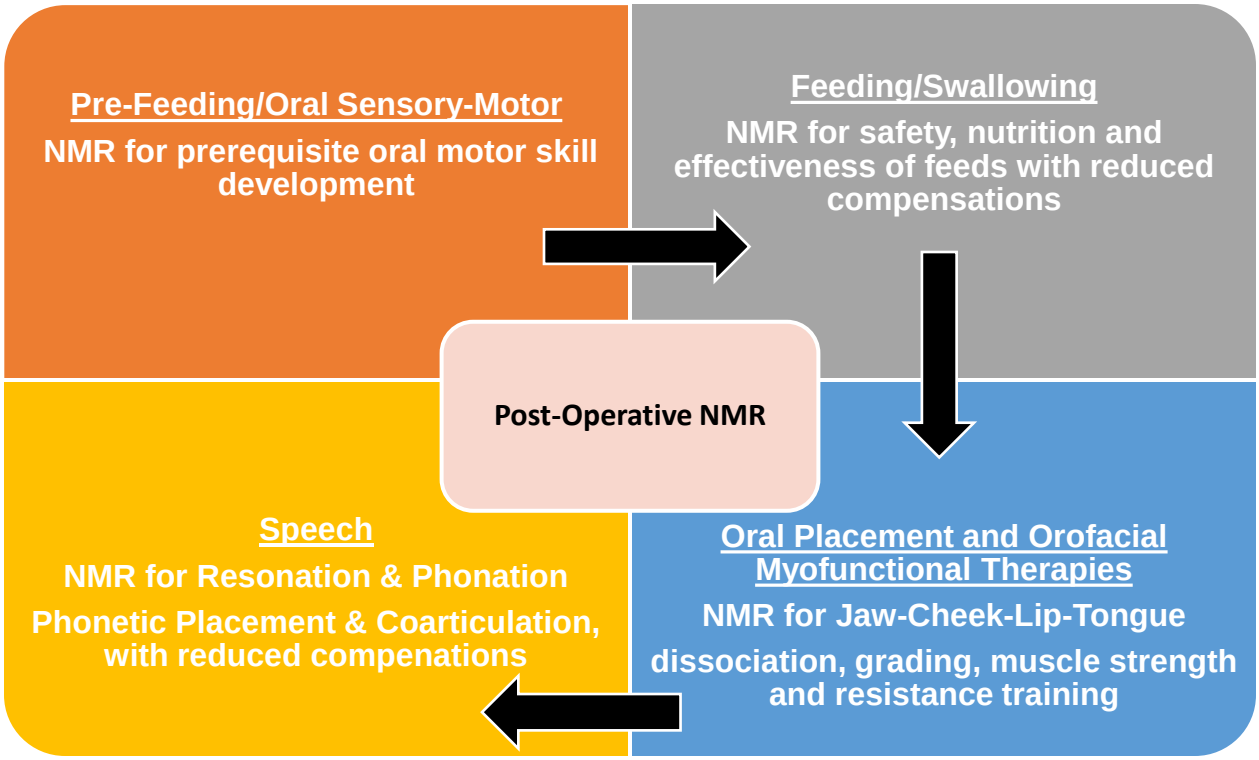

Figure 4: Example of neuromuscular re-education (NMR) in a speech therapy session to treat the functional implications of tethered oral tissues (TOTs).

and caregivers. Through decreasing sensory over-responsiveness along with experience in working intraorally, surgeons can have professional therapeutic support, rather than solely relying on inexperienced patients, parents, and caregivers to independently perform AWM. Patients and caregivers alike benefit from professional guidance, training and goal-focused care that is derived from a task analysis of functional needs. This new perspective suggests that release providers consider gentle, functionally directed post-operative NMR techniques that are individualized, and research the impact these approaches have on AWM care goals.

Based on the results of this clinical perspective, the authors suggest an empirical study comparing patients who undergo AWM versus functionally based neuromuscular reeducation. We hypothesize that patients who receive both AWM and NMR (an experimental group) would have better outcomes than those who receive AWM alone (a control group).

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APPENDIX

The proposed perspective was based on creating a classic U-Shaped Diagram to outline a clear justification of why this research topic needed further evaluation and formed the potential implications of the new perspective to further develop the field.

Current perspective	New perspective	Conclusions
Post-operative frenectomy care is often focused on active wound management (AWM) and then followed by neuromuscular re-education (NMR) The standard practices of AWM are varied amongst providers in terms of frequency, duration, topicals, pain management and technique. AWM is expected to be performed by caregivers who have little to no experience with wound care. Neuromuscular re-education is individualized to patient needs and has been emerging in external evidence as beneficial modality for the functional implications of tethered oral tissues (TOTs). It is guided by licensed professionals but unfortunately is not often accessible or recommended.	AWM and NMR are often similar in execution but differ in goals. • While AWM is focused on wound debridement, avoiding scarring and reattachment of the frena, NMR is focused on patency of the airway, sleep, feeding, swallowing, speech, and optimal orofacial growth. • AWM has little consensus or external evidence compared to NMR which has both internal and external evidence. • AWM for oral care is limited by scope of practice (SOP) which few licensed professionals have. NMR has a broader range of professionals such as IBCLCs, RDHs, physical, occupational and speech therapists	We suggest that release providers continue to learn from professionals who specialize in oral motor function regarding gentle, functionally directed pre- and post-operative techniques that are individualized and continue to research the impact these approaches have on wound care goals. NMR has multiple benefits post-operatively, is individualized, and performed by multiple professionals. Patients and caregivers alike benefit from professional guidance, training, and goal focused car that is derived from a task analysis of functional needs.