Orofacial Myofunctional Disorders

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OVERVIEW

See the Orofacial Myofunctional Disorders Evidence Map for summaries of the available research on this topic

Scope: The scope of this page is orofacial myofunctional disorders in individuals of all ages.

An orofacial myofunctional disorder (OMD) includes one or more of the following: abnormal labial-lingual rest 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 (such as nail biting). These conditions can co-occur with speech misarticulations. In these instances, the articulation disorder is not developmental or phonological in nature, but rather a result of poor oral placement and inappropriate muscle development. OMD may reflect the interplay of functional behaviors, physical/structural variables, genetic, and environmental factors. (Doshi & Bhad-Patil, 2011; Elad et al., 2014; Ferreira, Mangili, Sassi, Fortunato-Tavares, Limongi, & Andradem, 2011; Garretto, 2001; Hanson, 1988; Homem, Vieira-Andrade, Faci, Ramos-Jorge, & Marques, 2014; Langmore & Pisegna, 2015; Levrini et al., 2014; Maspero, Prevedello, Giannini, Galbiati, & Farronato, 2014; Som & Naudich, 2013)

To date, Hanson (1982) still provides the most thorough definition of Orofacial Myofunctional Disorder::

OMD refers to abnormal resting labial-lingual posture of the orofacial musculature, atypical chewing and swallowing patterns, dental malocclusions, blocked nasal airways, and speech problems.

- OMDs are patterns involving oral and orofacial musculature that interfere with normal growth, development, or function of the orofacial structures, or calls attention to itself. OMDs can be found in both children and adults and can occur across the lifespan.
- OMDs, commonly seen in children, include a swallowing pattern with dentalized (anterior or lateralized) tongue movement (often referred to as tongue thrust). OMDs also encompass nonnutritive sucking behaviors like thumb and/or digit sucking, cheek

or tongue sucking, prolonged pacifier usage, clenching or bruxing, etc. and can lead to the development of abnormal movement patterns, eruption of dentition, and/or changes to the oral cavity.
- OMDs in the adult and geriatric populations occur secondary to various neurological impairments, oral hygiene problems, altered function of muscles due to aging, systemic diseases, or trauma to the oropharyngeal complex.

INCIDENCE, PREVALENCE

The *incidence* of orofacial myofunctional disorders (OMD) refers to the number of new cases identified in a specified time period. The *prevalence* of OMD refers to the number of individuals who are living with OMDs at any given time.

Estimates vary according to the definition and criteria used to identify OMDs, as well as the age and characteristics of the population (e.g., orthodontic problems, speech disorders, etc.).

Who Experiences Oromyofunctional Disorders?

- Newborns, infants, and toddlers (Abreu, Rocha, Lamounier, & Guerra, 2008b; Aniansson et al., 1994; Neskey, Eloy, & Casiano, 2009; Ricke, Baker, Madlon-Kay, & DeFor, 2005)
- Preschoolers (Barros de Arruda Telles, Ferreira, Magalhaes, & Scavone-Junior, 2009; Dimberg, Lennartsson, Söderfeldt, & Bondemark, 2011; Grabowski, Kundt, & Stahl, 2007)
- School-aged children (Bonuck et al., 2011; Felcar, Bueno, Massan, Torezan, & Cardoso, 2010; Heimer, Tornisiello Katz, & Rosenblatt, 2008)
- Adults in repeat orthodontics (Bakarcic et al., 2015; Grabowski, Kundt, & Stahl, 2007; Jang, Cha, Ngan, Choi, Lee, & Jang, 2011)
- People with craniofacial disorders, cerebral palsy, dysarthria, dyspraxia, and/or sensory-motor based speech disorders (Murray, 2002; Okuro et al, 2011; Parker et al, 2010)
- Children and adults with restricted oral frenula, sleep disordered breathing, temporomandibular dysfunction and/or facial pain
- Those with post facial trauma, post surgery
- People who are weak, chronically ill, or bed bound
- Adults who are elderly

When can Oromyofunctional Disorders Occur?

- During lactation and disruptions in early feeding experiences (Barros de Arruda Telles, Ferreira, Magalhaes, & Scavone-Junior, 2009; Jackson, 1999; Neskey, Eloy, & Casiano, 2009)
- During transition to solid foods and introduction of cups and straws

- With enlarged soft tissue (Marangu, Jowi, Aswani, Wambani, & Nduati, 2014)
- With restricted soft tissue (Han, Kim, Choi, Lim, & Han, 2012; Klockars & Pitkäranta, 2009b; Martinelli, Marchesan, & Berretin-Felix, 2014; Segan, Stephenson, & Dawes, 2007)
- During oral-preparatory, oral transit, oropharyngeal stage swallowing therapy (Lau, 2015; Rudolph & Link, 2002)
- During sensory-motor feeding therapy (Medeiros, 2007; Rudolph & Link, 2002)
- During oral placement for articulation development
- With non-nutritive suck and chewing habits (Garattini, Crozzoli, & Valsasina, 1990; Kasparaviciene et al, 2014; Larsson, 1994; Neto, Oliveira, Barbosa, Zandonade, & Oliveira, 2012)
- With respiration and daytime breathing, phonation, and voice disorders (Felcar, Bueno, Massan, Torezan, & Cardoso, 2010; Neiva, Kirkwood, & Godinho, 2009; Neskey, Eloy, & Casiano, 2009; Souki, Pimenta, Souki, Franco, Becker, & Pinto, 2009)
- With sleep disordered breathing, obstructive sleep apnea, and problems with patency of the airway during sleep (Bishara, Warren, Broffitt, & Levy, 2006; Bonuck, et al, 2011; Guilleminault & Akhtar, 2015; Pirilä-Parkkinen, Pirttiniemi, Nieminen, Tolonen, Pelttari, & Löppönen, 2008)
- During and after orthodontics and oromaxillofacial surgery (Bakarcic et al., 2015; Grabowski, Kundt, & Stahl, 2007)
- Following trauma

SIGNS AND SYMPTOMS

Signs & Symptoms of OMD in 0-3 Year Old Children:

- Poor latch during breast- or bottle-feeding
- Difficulty nursing
- Difficulties with the suck-swallow-breathe coordination
- GERD (gastro-esophageal reflux disease)
- Failure to Thrive
- Torticollis
- Tongue protrusion past the lower lip at rest or during feeds
- Tongue suckling/sucking
- Poor lingual range of motion
- Blisters on the upper lip
- Open mouth posture at rest
- High nasio-labial angle
- Difficulty tranitioning from breast/bottle to straw/cup
- *Behavioral* feeding issues
- Self-limited diet

- Difficulty transitioning to solids
- Gagging/vomiting
- Poor speech clarity
- Late emergence of speech sounds
- Prolonged non-nutritive sucking past 12 months of age

Signs & Symptoms of OMD in Young Children

- Daytime breathing habits including open mouth posture and audible breathing (Harari, Redlich, Miri, Hamud, & Gross, 2010; Hitos, Arakaki, Sole, & Weckx, 2013; Hsu, & Yamaguchi, 2012; Ikenaga, Yamaguchi, & Daimon, 2013; Jefferson, 2010; Lee, Choi, Shin, Lee, Kwon, & Lee, 2007; Lee, Guilleminault, Chiu, & Sullivan, 2015; Mattar, Anselmo-Lima, Valera, & Matsumoto, 2004; Moore, Caulfield, & Green, 2001; Nagaiwa, Gunjigake, & Yamaguchi, 2016; Wasaki & Yamasaki, 2014)
- Nighttime breathing habits including not sleeping through the night, nocturnal bruxing, and enuresis (Ali et al., 2015; Gaultier & Guilleminault, 2001; Guilleminault & Akhta, 2015; Guilleminault, Huseni, & Lo, 2016; Guilleminault, Primeau, Chiu, Yuen, Leger, & Metlaine, 2013; Huang, Paiva, Hsu, Kuo, & Guilleminault, 2014; Marcus, 2001; Miller, Johnson, Duggan, & Behm, 201; Montgomery-Downs, & Gozal,2006)
- Airway obstruction including sinus congestion, enlarged tonsils and adenoids, and tongue falling into airway (Bueno, Grechi, Trawitzki, Anselmo-Lima, Felicio & Valera, 2015; Lee, Guilleminault, Chiu, & Sullivan, 2015; Marcus, McColley, Carroll, Loughlin, Smith, & Schwartz, 1994; Martha, da Silva Moreira, Martha, Velho, Eick, & Goncalves, 2013; Wolf, Anderhuber, & Kuhn, 1993)
- Poor nursing and difficult transition to solid foods (Gomes, Trezza, Murade, & Padovani, 2006; Hogan, Westcott, & Griffiths, 2005; Mizuno & Ueda, 2006; Moral et al, 2010; Pransky, Lago, & Hong, 2015; Sanchez, Spittle, Slattery, & Morgan, 2016; Sanchez, Spittle, Slattery, & Morgan, 2016)
- Picky eating, limited food repertoire, soft food preferences (Ikenaga, Yamaguchi, & Daimon, 2013; Malas, Trudeau, Giroux, Gauthier Poulin, & McFarland, 2017)
- Difficulties with oral preparation or oral transit including tongue thrust swallow, poor or inefficient chewing, messy eating, and/or audible eating (Stevenson & Allaire, 1991)
- Difficulties with open cup or straw drinking
- Prolonged hard-spout sippy cup usage
- Drooling and poor oral control, specifically past the age of 2 years
- Poor oral hygiene
- Restricted labial, lingual & buccal frenula (Guilleminault, Huseni, & Lo, 2016; Huang, Paiva, Hsu, Kuo, & Guilleminault, 2014; Miranda & Milroy, 2010; Ostapiuk, 2006; Pola, Garcia, Martín, Gallas, & Lestón, 2002; Pransky, Lago, Hong, 2015; Reddy, Marudhappan, Devi, Narang, 2014)
- Pharyngeal, laryngeal and esophageal reflux (Miller, Sonies, & Macedonia, 2003)

- Nonnutritive sucking habits, including pacifier use after age 12 months, as well as finger, thumb or tongue sucking (Mizuno & Ueda, 2006; Warren & Bishara, 2002; Warren, Levy, Nowak, & Tang, 2000; Warren, Slayton, Bishara, Levy, Yonezu & Kanellis, 2005; Zardetto, Rodrigues & Stefani, 2002)
- Early hard palate collapse
- Dental malocclusions, such as overjet, anterior or posterior open bite, edge to edge bite, and under bite (Ben-Bassat & Brin, 2003; Farronato, Giannini, Riva, Galbiati & Maspero, 2012; Guilleminault, Abad, Chiu, Peters & Quo, 2016; Harari, Redlich, Miri, Hamud, & Gross, 2010; Mattar, Anselmo-Lima, Valera, & Matsumoto, 2004; Ovsenik, 2009; Saccomanno, Antonini, D'Alatri, D'Angelantonio, Fiorita, & Deli, 2012; Seemann, Kundt, & Stahl de Castrillon, 2011; Stahl, Grabowski, Gaebel & Kundt, 2007; Wasaki & Yamasaki, 2014)
- Forward head posture (Okuro, Morcillo, Ribeiro, Sakano, Conti, & Ribeiro, 2011)
- Daytime bruxing and facial pain (Pizolato, Fernandes, & Gaviaio, 2011)
- Atypical speech sound elicitations with abnormal lingual dental articulatory placement for /t, d, l, n, r, k, g/ and distorted productions of /s, z/ often with an interdental or lateral lisp to include /ʧ, ʤ, ʃ, ʒ/ (Guellai, Steri & Yeung, 2014; Robb & Bleile, 1994)

Signs & Symptoms of OMD in School-Aged Children & Adults (references in previous section)

- Daytime breathing habits including open mouth resting posture and audible breathing
- Nighttime breathing habits including not sleeping through the night, bruxing, and enuresis
- Airway obstruction including sinus congestion, enlarged tonsils and adenoids, tongue falling into airway, and sleep disordered breathing
- Restricted labial, lingual, buccal frenula
- Picky eating, poor chewing, soft food diets
- Poor oral care and oral aversion
- Continued non-nutritive sucking and chewing habits
- Continued drooling and poor oral control
- Tongue thrust swallow, messy eating, and audible eating
- Esophageal reflux impacting the pharynx and larynx
- Malocclusions, poor hard palate development, and orthodontic relapse
- Forward head posture
- Bruxing and facial pain
- Continued speech/articulation distortions and poor articulatory generalization
- Open mouth resting posture, low tongue posture which does not allow for normal resting relationship between teeth and jaws

CAUSES

Oromyofunctional disorders are multifactorial in nature and are often the consequence of a sequence of events or lack of intervention at critical periods, resulting in oral dysfunction, malocclusion, and suboptimal craniofacial development. Causes of OMDs include:

- Functional airway obstruction to include elarged tonsils and adenoids, enlarged nasal turbinates, deviated septum, sinus infections, allergies (environmental or seasonal), chronic upper airway infections, asthma, sleep disordered breathing, including obstructive sleep apnea, and low oropharyngeal muscle tone resulting in airway collapse (Abreu, Rocha, Lamounier, & Guerra, 2008b; Ali et al., 2015; Bueno, Grechi, Trawitzki, Anselmo-Lima, Felicio & Valera, 2015; Gaultier & Guilleminault, 2001; Guilleminault, Abad, Chiu, Peters, & Quo, 2016; Guilleminault & Akhtar, 2015; Guilleminault, Huseni, & Lo, 2016; Guilleminault & Sullivan, 2014; Huang & Guilleminault, 2013; Huang et al., 2016; Huang, Paiva, Hsu, Kuo & Guilleminault 2014; Huang, Quo, Berkowski, & Guilleminault, 2015; Hultcrantz, Lofstrand, & Tidestrom, 2009; Lima, Baraúna, Sologurem, Canto, & Gastaldi, 2004; Martha, da Silva Moreira, Martha, Velho, Eick, & Goncalves, 2013; Rabadi, Baker, & Al-Qudah, 2014; Um, Hong, & Jeong, 2017)
- Oral resting postures, including mouth breathing (Daimon & Yamaguchi, 2014; Guilleminault & Sullivan, 2014; Harari, Redlich, Miri, Hamud, & Gross, 2010; Hitos, Arakaki, Sole, & Weckx, 2013; Ikenaga, Yamaguchi, & Daimon, 2013; Jefferson, 2010; Lee, Choi, Shin, Lee, Kwon, & Lee, 2007; Lee, Guilleminault, Chiu, & Sullivan, 2015; Nagaiwa, Gunjigake, & Yamaguchi, 2016; Okuro, Morcillo, Ribeiro, Sakano, Conti, & Ribeiro, 2011; Ovsenik, 2009; Padzy, Martrette, Tankosic, Thornton, & Trabalon, 2011; Solow & Sandham, 2002; Sperry, 1989)
- Craniofacial disorder, craniofacial dysmorphology, malocclusion (Bailey, Cevidanes, & Proffit, 2004; Ben-Bassat & Brin, 2003; Dixon, Marazita, Beaty, & Murray, 2011; Farronato, Giannini, Riva, Galbiati, & Maspero, 2012; Fatemifar et al., 2013; Grabowski, Kundt, & Stahl, 2007.; Graham et al., 2005; Guilleminault, Abad, Chiu, Peters, & Quo, 2016; Guilleminault, Primeau, Chiu, Yuen, Leger, & Metlaine, 2013; Guilleminault & Sullivan 2014; Hollier, Kim, Grayson, & McCarthy, 2000; Lisson & Scholtes, 2005)
- Sensorimotor dysfunction or disorder, functional limitations, low orofacial and oropharyngeal muscle tone (de Boysson-Bardies & Vihman, 1991; Bruderer, Danielson, Kandhadai, & Werker, 2015; Graham Jr, 2006; Guellai, Steri, & Yeung, 2014; Livingstone, Willis, Abdel-Wareth, Thiessen, & Lockitch, 2000; Sanchez, Spittle, Slattery, & Morgan, 2016; Silveira, Prade, Ruedell, Haeffner, & Weinmann, 2013)
- Dysphagia (European Society for Swallowing Disorders, 3rd Congress, 2013; Malas, Trudeau, Giroux, Gauthier, Poulin, & McFarland, 2017; Matsuo & Palmer, 2018; Sanchez, Spittle, Slattery, & Morgan, 2016)
- Restricted oral frenula (early nursing difficulty with labial, lingual, and buccal movements for latching, sucking, lingual retraction, cupping, and elevation. (Acevedo et

al., 2010; Cockley & Lehman, 2015; Coryllos, Genna, & Salloum, 2004; Defabianis, 2000; Dollberg, Botzer, Grunis, & Mimouni, 2006; Dudek-Shriber & Zelazny, 2007; Emond et al., 2014; Forlenza, Black, McNamara, & Sullivan, 2010; Guilleminault & Akhtar, 2015; Guilleminault, Huseni, & Lo, 2016; Guilleminault & Pelayo, 1998; Guilleminault & Sullivan, 2014; Huang, Quo, Berkowski, & Guilleminault, 2015; Martinelli, Marchesan, Gusmão, Rodrigues, & Berretin-Felix, 2014; Messner, Lalakea, Aby, Macmahon, & Bair, 2000; Pransky, Lago, & Hong, 2015)

- Nonnutritive sucking & chewing habits – in utero or learned later (Adair, 2003; Farsi & Salama, 1997; Poyak, 2006; Shotts, McDaniel, & Neeley, 2008; Zardetto, Rodrigues, & Stefani, 2002)
- Chewing and eating behaviors, prolonged pureed or soft food diet (Hsu & Yamaguchi, 2012; Ikenaga, Yamaguchi, & Daimon, 2013; Landouzy, Sergent, Fenart, Delattre, Claire, & Biecg, 2009; Pizolato, Fernandez, & Gaviaio, 2011; Wang & Ge, 2015)
- Idiosyncratic behaviors (Korfage, Koolstra, Langenbach, & Van Eijeden, 2005b)

ROLES AND RESPONSIBILITIES

According to the Preferred Practice Patterns (ASHA, 2004), orofacial myofunctional assessments and interventions are conducted by appropriately credentialed and trained speech-language pathologists (SLPs).

Speech-language pathologists may perform these assessments and services individually or as members of collaborative interdisciplinary teams that may include the individual, family/caregivers, and other relevant persons (e.g., educators, medical personnel, etc.).

The SLP conducts an assessment to identify and describe:

- Underlying strengths and deficits related to orofacial myofunctional factors affecting growth and development of the dentofacial structures, the functional swallow, and speech communication;
- Effects of orofacial myofunctional impairments on the individual's daily activities (capacity, participation, and performance in everyday communication and eating/drinking);
- Contextual factors serving as barriers to or facilitators of successful communication and participation of individuals with orofacial myofunctional impairments in activities of daily living.

The SLP conducts intervention designed to (ASHA, 2004):

- Capitalize on strengths and address weaknesses related to underlying structures and functions affecting the individual's orofacial myofunctional and swallowing patterns, as well as related speech patterns
- Facilitate the individual's activities and participation by assisting the person to acquire new orofacial myofunctional skills and strategies
- Modify contextual factors to reduce barriers and enhance facilitators of successful communication and participation, and provide appropriate accommodations and other supports, as well as training in how to use them.
- Participate in the integration of the comprehensive goals of the interdisciplinary team

INTERDISCIPLINARY TEAM

Orofacial myofunctional treatment includes a number of approaches, some of which may require additional training or expertise. SLPs may refer to or collaborate with:

OMD Infant and Toddler Team

- Pediatrician
- Lactation consultant
- Feeding specialist
- Speech-language pathologist – early intervention & private
- Certified Orofacial Myologist™ (COM, International Association of Orofacial Myology)
- Otolaryngologist
- Allergist
- Osteopathic medical physician
- Oromaxillofacial surgeon
- Physical therapist
- Chiropractor
- Craniosacral therapist or other bodyworker
- Occupational therapist

OMD Pediatric Team

- Pediatrician
- Feeding specialist
- Speech-language pathologist
- Certified Orofacial Myologist™ (COM, International Association of Orofacial Myology)
- Pediatric dentist
- Otolaryngologist
- Allergist
- Orthodontist
- Functional dentist

- Oromaxillofacial surgeon
- Body worker – osteopath, chiropractor, licensed massage therapist, physical therapist, occupational therapist
- Psychologist/Neuropsychologist

OMD Adult Team

- Primary care physician
- Allergist
- Otolaryngologist
- Orthodontist
- Speech-language pathologist
- Certified Orofacial Myologist™ (COM, International Association of Orofacial Myology)
- Specialty dentist – TMD, Functional, Airway Centric, Myofunctional, Neuromuscular
- General dentist
- Other dental specialists – periodontist, endodontist, prosthodontist
- Bodyworker – osteopath, physical therapist, occupational therapist, chiropractor, cranio-sacral, massage therapist, etc
- Oral surgeon
- Plastic surgeon
- Psychologist/Neuropsychologist

ASSESSMENT

See the Assessment section of the Orofacial Myfunctional Disorders Evidence Map for pertinent scientific evidence, expert opinion, and client/caregiver perspective.

Please see ASHA's resource Assessment Tools, Techniques, and Data Sources for information on the elements of a comprehensive assessment, considerations, and best practices. Information specific to these practices in the comprehensive assessment of individuals with OMD is discussed below.

PART I. CASE HISTORY

A diagnostic written history and interview with parents/caregivers and teachers is conducted with or without the child present to help gather information regarding (Arvedson, 2008; Coulthard, Harris & Emmett, 2009; Pecoraro, Inui, Chen, Plorede & Heller, 1979):

- Birth and developmental history
    - Mother’s health during pregnancy

    - Patient's birth experience, early infancy, early nursing and feeding
    - Toddler developmental milestones
- Oral habits (e.g., thumb, digit, pacifier, object sucking, etc.)
- Prior Intervention (e.g., surgery, lactation, physical therapy, occupational therapy, speech therapy, chiropractic treatment, cranio-sacral treatment, etc.)
- Medical history illnesses that might affect oral function including:
    - Upper respiratory infections
    - High fevers
    - Seizures
    - Ear infections/myringotomy
    - Allergies – environmental and food influences
    - GERD/Reflux
    - Injuries or trauma
    - Snoring and sleep habits, enuresis
    - Use of sleep appliance such as CPAP (continuous positive airway pressure) device
    - Previous oral surgery (frenectomy, tonsillectomy, or adenoidectomy)
- Dental/Orthodontic history
    - Tooth eruption patterns
    - Oral hygiene and cavities
    - Palatal expansion
    - Orthodontic appliances and treatment plan
    - Restorative dental work (e.g., crowns, root canals, bridge, implants)
    - Mouth or facial pain association with dental intervention
- Feeding History
    - Transition to table food and early eating experiences
    - Chewing or swallowing difficulties, ability to swallow pills
    - Food inventories related to taste, texture, temperature, etc.
    - Digestive health, GERD/reflux
- Breathing History
    - Daytime breathing postures, history of nasal/mouth breathing
    - Nighttime breathing postures, signs of sleep disordered breathing
    - Oral resting postures, oral habits including nonnutritive sucking and chewing habits
- Speech & Language History
    - Babbling and language milestones
    - Sound acquisition, distortions, omissions, etc.
    - Overall intelligibility
    - Social language understanding and use

- Hearing history
- Previous speech-language history

PART II. OROMYOFUNCTIONAL ASSESSMENT

A thorough assessment of oral structure, oral function, and individual behavior will provide a more accurate differential diagnosis and help determine the most appropriate treatment plan. This includes, but is not limited to, the following:

- Body posture including hip, shoulder and head posture (Ballard, Auer, & Khoury, 2002; Bosma, Hepburn, Josell, & Baker, 1990; Camacho et al, 2015)
- Breathing mechanism and postures (Arens et al., 2003; Ballard, Auer, & Khoury, 2002; Bosma, Hepburn, Chervin, Hedger, Dillon, & Pituch, 2000; Connaghan, Moore, & Higashakawa, 2004; Fitzpatrick, McLean, Urton, Tan, O'donnell, & Driver, 2003; Friedman, Hamilton, & Samuelson, 2012; Friedman, Hamilton, Samuelson, Lundren, & Pott, 2013; Gewolb & Vice, 2006; Takemoto, 2001; Valera, Trawitzki, & Anselmo-Lima, 2006)
- Phonatory function and impact (Connaghan, Moore, & Higashakawa, 2004; Junqueira, Marchesan, de Oliveira, Ciccone, Haddad, & Rizzo, 2010)
- Resonance function and impact
- External features of the face and head including:
    - Head shape, facial shape, profile (mesiocephalic, brachycephalic, doliocephalic)
    - Impact on midline, symmetry
    - Alignment of eyes, ears, nostrils
    - Alignment and direction of jaw growth and symmetry

  (Ballard, Auer, & Khoury, 2002; de Felicio, Medeiros, & Melchior, 2012; Valera, Trawitzk,i & Anselmo-Lima, 2006)
- Functional integrity of the cranial nerves (CNs) with special attention to CN V & VII (Allanson, 1997; Bahr, 2001; Chizawsky, 2005; Da Costa, van den Engel-Hoek, & Bos, 2008; Junqueira, Marchesan, de Oliveira, Ciccone, Haddad, & Rizzo, 2010; Rogers, & Arvedson, 2005)
    - Cranial Nerve V
        - Observe jaw opening/closing and side-to-side jaw movements. Palpate the masseter, and have the child bite down, feeling for (appropriate) bulging as the muscle contracts during chewing and swallowing
    - Cranial Nerve VII
        - Observe the client smiling, eating, laughing, puckering, and smiling. Test resistance of the four quadrants of the lips, with either a gloved finger or a tongue depressor while the child or young person keeps his or her lips closed tightly.
    - Cranial Nerve X
        - Gag response
    - Cranial Nerve XII

        - Check tongue protrusion, retraction, lateralization, and elevation. Check strength by pushing against the tongue with a tongue depressor.
- Jaw function & temporomandibular joint (TMJ) at rest, during eating/drinking, and during speech (Ballard, Auer, & Khoury, 2002; Coulthard, Harris, & Emmett, 2009; Fitzpatrick, McLean, Urton, Tan, O'donnell, & Driver, 2003; Gewolb & Vice, 2006; Green, Moore, Higashikawa, & Steeve, 2000; Green, Moore, & Reilly, 2002; Iguchi, Magara, Nakamura, Tsujimura, Ito, & Inoue, 2015)
- Lip structure, function, and symmetry; presence of maxillary or mandibular lip ties (Ballard, Auer, & Khoury, 2002; Gewolb & Vice, 2006; Green, Moore, Higashikawa, & Steeve, 2000; Green, Moore, & Reilly, 2002)
- Tactile sensitivity outside and inside the mouth
- Structure and function of the teeth, as well as malocclusion including:
    - Primary, mixed, and permanent dentition
    - Anterior occlusion classification with occlusion description: open bite, overjet, overbite, underbite, crossbite
    - Posterior occlusion classification with occlusion description: unilateral or bilateral crossbite
    - Oral hygiene impact
    - Type of dental or orthodontic appliance in place or used

  (Castelo, Bonjardim, Pereira, & Gavião, 2008; Castelo, Gaviao, Pereira, & Bonjardim, 2010; Castelo, Pereira , Andrade, Marquezin, & Gaviao, 2010; Cattoni & Fernandes, 2004; Cichero, 2017; Coulthard, Harris, & Emmett, 2009; de Felicio & Ferreira, 2008; de Felício, Folha, Ferreira, & Medeiros, 2010; de Felício, Folha, Ferreira, Paskay, & Sforza, 2015; de Felicio, Folha, Gaido, Dantas, & Azevedo-Marques, 2014; de Felício, Medeiros & de Oliveira Melchior, 2012; Genaro, Berretin-Felix, Rehder, & Marchesan, 2009; Graziani, Fukushiro, & Genaro, 2015; Iguchi, Magara, Nakamura, Tsujimura, Ito, & Inoue, 2015: Junqueira, Marchesan, de Oliveira, Ciccone, Haddad, & Rizzo, 2010; Macedo & Bianchini, 2014; Marchesan, Berretin-Felix & Genaro, 2012; Paskay, 2012; Rossi, Rossi, Rossi, Yamashita, & Pignatari, 2015; Varjao, 2012)
- Structure and function of the tongue including:
    - Normal resting posture(s)
    - Appearance, relative size, scalloping
    - Presence of lingual restriction, anterior or posterior tongue tie
    - Anterior and lateral stability, resting deviations
    - Lingual mobility, extension, elevation of blade to hard palate, diadochokenesis

  (Ballard, Auer, & Khoury, 2002; Bosma, Hepburn, Josell, & Baker, 1990; de Felício, Medeiros, de Oliveira, & Melchior, 2012; Friedman, Hamilton, Samuelson, Lundgren, & Pott, 2013; Geddes, Langton, Gollow, Jacobs, Hartmann, & Simmer, 2008; Gewolb & Vice, 2006; Green, Moore, Higashikawa, & Steeve, 2000; Green, Moore, & Reilly, 2002; Hiiemae & Palmer, 2003; Hong, Lago, Seargeant, Pellman, Magit, & Pransky, 2010; Marchesan, 2012; Martinelli, Marchesan, & Berretin-Felix, 2012)
- Hard palate structure and function including:

    - Shape of palate in relation to dental arch and tongue accommodation
    - Signs of clefting or fistulas
    - Status of rugae definition

    (Arens et al., 2003; Bosma, Hepburn, Josell, & Baker, 1990; Coulthard, Harris, & Emmett, 2009; de Felício, Medeiros, & de Oliveira Melchior, 2012; Friedman, Hamilton, Samuelson, Lundgren, & Pott, 2013; Geddes, Langton, Gollow, Jacobs, Hartmann, & Simmer, 2008; Gewolb & Vice, 2006; Jacobs, Dickinson, Hart, Doherty, & Faulkner, 2007; Kumar et al., 2014)
- Soft palate structure and function including:
    - Status of lingual and palatal tonsils
    - Velopharyngeal function

    (Arens et al., 2003; Bosma, Hepburn, Josell, & Baker, 1990; Coulthard, Harris, & Emmett, 2009; de Felício, Medeiros & de Oliveira Melchior, 2012; Friedman, Hamilton, Samuelson, Lundgren, & Pott, 2013; Geddes, Langton, Gollow, Jacobs, Hartmann, & Simmer, 2008; Gewolb & Vice, 2006; Jacobs, Dickinson, Hart, Doherty, & Faulkner, 2007; Kumar et al., 2014)
- Eating and swallowing including:
    - Nursing, bottle-feeding
    - Saliva swallows and facial movements
    - Drinking from cup and straw
    - Pill swallowing
    - Breaking and/or biting through foods
    - Chewing heirarchy, balance, strength
    - Tongue function, pushing food forward, smacking against hard palate
    - Oral prep and oral transit

    (Ballard, Auer, & Khoury, 2002; Coulthard, Harris, & Emmett, 2009; de Felício, Medeiros & de Oliveira Melchior, 2012; Geddes, Langton, Gollow, Jacobs, Hartmann, & Simmer, 2008; Gewolb & Vice, 2006; Hiiemae & Palmer, 2003; Iguchi, Magara, Nakamura, Tsujimura, Ito, & Inoue, 2015; Jacobs, Dickinson, Hart, Doherty, & Faulkner, 2007; Lau & Kusnierczyk, 2001)
- Type of tongue thrust swallow including:
    - Anterior
    - Bicuspid
    - Molars unilateral
    - Molars bilateral
    - Full anterior
    - Full lateral

    (Cichero, 2017; de Felicio & Ferreira, 2008; de Felício, Folha, Ferreira, & Medeiros, 2010; de Felício, Folha, Ferreira, Paskay, & Sforza, 2015; de Felício, Medeiros & de Oliveira Melchior, 2012; Folha, Valera, & de Felicio, 2015; Genaro, Berretin-Felix, Rehder, & Marchesan, 2009; Graziani, Fukushiro, & Genaro, 2015; Junqueira, Marchesan, de Oliveira, Ciccone, Haddad, & Rizzo, 2010; Macedo & Bianchini, 2014; Paskay, 2006)
- Non-nutritive sucking or chewing habit Impact (Lau & Kusnierczyk, 2001)

- Articulation Impact including:
    - Standardized and non-standardized articulation tests
    - Observation of oral placement patterns in relation to oral function

  (Connaghan, Moore, & Higashakawa, 2004; Green, Moore, & Reilly, 2002; Hiiemae & Palmer, 2003; Junqueira, Marchesan, de Oliveira, Ciccone, Haddad, & Rizzo, 2010; Ong & Stone, 1998; Pizolato, Fernandes, & Gaviaio, 2011; Takemoto, 2001; Varjao, 2012)
- Child/Patient's ability to participate in treatment (Coulthard, Harris. & Emmett, 2009; Sugawara, Ishihara, Takano-Yamamoto, Yamashiro, & Kamioka, 2016)
- Parent/Caregiver's ability to support treatment
- Determination of referrals and other team member support (Junqueira, Marchesan, Ide Oliveira, Ciccone, Haddad, & Rizzo, 2010)

TREATMENT

See the Treatment section of the Orofacial Myofunctional Disorders evidence map for pertinent scientific evidence, expert opinion and client/caregiver perspective.

TREATMENT GOAL OF OROFACIAL MYOFUNCTIONAL DISORDERS

Introduction

Orofacial myofunctional therapy creates an oral environment in which normal processes of orofacial and dental growth, as well as development can occur. Orofacial myfunctional therapy aims to improve facial proprioception, tone, and mobility in order to address one or more of the following (Homem, Vieira-Andrade, Falci, Ramos-Jorge & Marques, 2014):

- Correcting the resting postures of the tongue, lips, and jaw
- Establishing a consistent oral (dental) freeway space
- Encouraging nasal breathing and normalized respiration
- Balancing and equalizing the muscle function and tonicity of the tongue, lips, muscles of mastication and deglutition, as well as muscles of the face, head and neck
- Eliminating oral habits/behaviors and oromotor/orofacial functional behaviors negatively affecting muscle tone and/or impacting the growth and development of the face and dentition (e.g., nonnutritive sucking and noxious oral habits, as well as dual bite patterns while establishing oromotor consistencies)
- Correcting abnormal chewing and deviated swallowing patterns; correcting muscular deficiencies of resting postures of the tongue, lips, mandible, head, and neck; correcting *tongue thrust* swallowing (preparatory and oral phases)
- Eliminating parafunctional habit patterns that may cause destruction of the dentition especially bruxism, muscle bracing, and/or clenching

- Providing neuromuscular re-education and retraining to eliminate impairment in muscle tone and function
- Eliminating deviated range of motion, muscular and functional deviations of the mandible, especially those related to resting postures, chewing, open/closure patterns, speech functional movements/patterning of the tongue, lips and mandible, and orofacial/oromotor functions of related activities of daily living .

OMT is recognized as an effective treatment for the following:

- To improve breathing post tonsilloadenoidectomy (Huang, Guilleminault, Lee, Lin & Hwang, 2014)
- To improve symptoms of sleep disordered breathing and obstructive sleep apnea (Diaferia, Badke, Santos-Silva, Bommarito, Tufik, & Bittencourt, 2013; de Felicio et al., 2016; Guilleminault, Huang, Monteyrol, Sato, Quo, & Lin, 2013; Guilleminault & Sullivan, 2014; Huang & Guilleminault, 2013; Huang, Guilleminault, Lee, Lin, & Hwang, 2014; Villa et al., 2015; Villa, Evangelisti, Martella, Barreto, & Del Posso, 2017)
- To improve symptoms of asthma and other breathing disorders (Campanha, Fontes, Camargos, & Freire, 2010).
- To improve lingual range of motion post frenectomy (Ferrés-Amat, Pastor-Vera, Ferrés-Amat, Mareque-Bueno, Prats-Armengol, & Ferrés-Padró, 2016; Francis et al., 2015; Hari, Iyer, & Sudarson, 2015; Klockars & Pitkäranta, 2009a)
- To stabilize occlusion post orthodontics and oromaxillofacial surgery (Aristizabal & Smit, 2014; Asiry, 2015; Bailey, Cevidanes, & Proffit, 2004; Gallerano, Ruoppolo, & Silvestri, 2012; Homem, Vieira-Andrade, Faci, Ramos-Jorge, & Marques, 2014; Maffei, Garcia de Biase, de Souza, Camargo Vianna-Lara, Gregio, & Azevedo-Alanis, 2014; Saccomanno, Antonini, D'Alatri, D'Angelantonio, Fiorita, & Deli, R. 2012; Smithpeter & Covell, 2010; Sugawara, Ishihara Takano-Yamamoto, Yamashiro, & Kamioka, 2016; Van Dyck, Dekeyser, Vantricht, Manders, Goeleven, Fieuws, & Willems, 2015; Van Lierde, Luyten, D'haeseleer, Van Maele, Becue, Fonteyne, Corthals, & DePauw, 2015; Varjao, 2012)
- To improve infant nursing (Einarsson-Backes, Deitz, Price, Glass, & Hays, 1994; Ferrés-Amat, Pastor-Vera, Rodríguez-Alessi, Ferrés-Amat, Mareque-Bueno, & Ferrés-Padró, 2016; Ramsay & Hartmann, 2005; Steeve, Moore, Green, Reilly, & McMurtrey, 2008)
- To improve chewing and feeding (He, Stavropoulos, Hagberg, Hakeberg, & Mohlin, 2013; Hill, 2005; Le Reverend, Saucy, Moser, & Loret, 2016; Mennella, Reiter, & Daniels, 2016; Mennella, Reiter, & Daniels, 2016)
- To improve swallowing and symptoms of dysphagia (Burkhead, Sapienza, & Rosenbek, 2007; Byeon, 2016; Crary & Carnaby 2014; Kays & Robbins, 2006; Langmore & Pisegna, 2015; Richter, 2010; Steele, 2012; Steele et al., 2013; Wada, Tohara, Iida, Sato, & Ueda, 2012; Yeates, Molfenter, & Steele, 2008).
- To improve articulation (Ali, 2015; Ruark & Moore, 1997; Steeve, Moore, Green, Reilly, & McMurtrey, 2008; Wohlert & Smith, 2002)
- To eliminate detrimental oral habits (Aizenbud, Gutmacher, Teich, Oved-Peleg, & Hazan-Molina, 2014; Borrie, Bearn, Innes, & Iheozor-Ejiofor, 2015; Hill, 2005; Silvestre-Donat, & Silvestre-Rangil, 2014)

- To improve symptoms of TMD (temporo-mandibular dysfunction) and facial pain (de Felício, de Oliveira, & da Silva, 2010; Machado, Mazzetto, da Silva, & de Felicio 2016; Melchior, Machado, Magri, & Mazzetto, 2016)
- To support craniofacial development (Graham Jr, 2006; Graham et al., 2005; Laughlin, Luerssen, Dias, & Committee on Practice and Ambulatory Medicine, 2011; Page, 2003; Wen, Baur, Simpson, Rissel. & Flood, 2011)
- To improve symptoms in special populations (Miranda, Cardoso, & Gomes, 2016; Lazarus, 2006; Ray, 2001; Ray, 2002)
    - Dysarthria
    - Apraxia
    - Head and neck cancer

SPECIAL CONSIDERATIONS IN TREATMENT PLANNING FOR OMD'S

See the Special Considerations in Understanding Orofacial Myfunctional Disorders Evidence Map for pertinent scientific evidence, expert opinion, and client/caregiver perspective.

ADDRESS DISORDERED BREATHING

Overview

Aside from being our most life sustaining function, nasal patency and the ability to breathe effortlessly and quietly through the nose are integral to the optimization of craniofacial growth and muscle functions which support continued nasal breathing, proper swallowing patterns, chewing, speaking, voicing, oral resting posture, and overall body posture. When nasal breathing is obstructed or inefficient, these functions often become impaired (de Felicio et al., 2016; Valera et al., 2003; and, de Serres et al., 2002).

As a 24/7 function, breathing is considered in the context of both daytime breathing and nighttime sleep breathing patterns. Disordered breathing patterns may underlie OMDs, result from OMDs, as well as coexist with them. Mouth breathing is a common disordered breathing pattern in the daytime and occurs when an individual ceases breathing solely through the nose or supplements nasal breathing with oral breathing (Abreu, 2008). Disordered nighttime sleep breathing patterns fall under the spectrum of sleep-disordered breathing (SDB). Sleep-disordered breathing is associated with collapse at any level of the upper airway during sleep that results in abnormal breathing (Guilleminault & Akhtar, 2015). The spectrum of SDB includes the following conditions:

- Mouth breathing
- Primary snoring
- Upper airway resistance syndrome (UARS)

- Obstructive sleep apnea (OSA)

In addition to impairing oral functions, the aforementioned disordered breathing patterns may also lead to diminished capacity to achieve optimization of a range of human functions relevant to the speech-language pathology, including:

- Learning and academics (Kuroishi et al., 2015; Galland et al., 2015; Gozal, 2008; Goodwin et al., 2005)
- Cognition (Smith et al., 2017; Hunter et al., 2016; Brockman et al., 2012; Kohler et al., 2009; Gottlieb et al., & 2004)
- Socialization (Singh & Zimmerman, 2015 & O'Brien et al., 2011)
- Behavioral and emotional health (Kouros & El-Sheikh, 2015; Lee et al., 2014, Bebee, 2006)
- Autonomic function (Gozal et al., 2014 & Liao et al., 2011)

Incidence & Prevalence of Breathing Disorders

Daytime mouth breathing and conditions along the spectrum of sleep-disordered breathing may occur at any point during the lifespan.

Gender

- Male children are twice as likely to experience SDB (Goodwin, 2005)

Children

Due to the size of craniofacial structures in relationship to the size of the tonsils and/or adenoids in the growing child, the following has been reported in the pediatric population:

- 55 percent mouth breathe (Abreu, 2008)
- Up to 34.5 percent experience primary snoring (Bourke, 2011)
- To date, prevalence of upper airway resistance syndrome has not been studied and is likely underdiagnosed (Thomé- Pacheco, Ferreira Casagrande, Pacheco Teixeira, Silveira Finck, & Martins de Araujo, 2015)
- 1 to 5 percent have obstructive sleep apnea, with peak prevalence occurring between 2 to 8 years of age (Tan, Gozal, & Kheirandish-Gozal, 2013)

Adults

In the general population, 9 to 38 percent have been found to have OSA (Senaratna et al., 2017)

Special Populations

- Children with craniofacial syndromes are at risk for SDB (Tan, Kheirandish-Gozal, Abel, & Gozal, 2015)
- 27-62 percent of those with neuromuscular disease have SDB (Mosquera et al., 2014).

- Premature infants are at increased risk of disordered sleep breathing (Huang et al., 2014).

Signs & Symptoms

Regardless of clinical setting, the SLP alone and interdisciplinary teams have numerous opportunities to observe craniofacial structures, oral functions, and daytime behaviors with their origins in daytime breathing and nighttime sleep breathing patterns.

Daytime Symptoms of Mouth Breathing

- Open or pursed lips/dry lips (Thomé-Pocheco, 2015 et. al; Abreu et al., 2008)
- Low forward tongue position (Harari et al., 2010; Correa et al., 2008)
- Short upper lip with reduced function (Abreu et al., 2008)
- Voluminous and everted lower lip (Abreu et al., 2008)
- Anterior oral seal: lip to tongue (Harari et al., 2010)
- Hypotonic oral facial musculature (Abreu et al., 2008)
- Forward head posture (Krakauer, & Guilherme, 2000; Cuccia et al., 2008)
- Facial retrusion (Valera et al., 2006)
- Posterior cross bite, open bite, overjet (Valera et al., 2006)
- Nasal congestion (Harari, 2010)
- Drooling (Kuroishi et al., 2015)
- Halitosis (Motta et al., 2011)
- Hyponasal speech (Kuroishi et al., 2015)
- Alterations of muscle activity for speaking, chewing, and swallowing (Dutra et al., 2006)

Structural and Functional Symptoms of Sleep-Disordered Breathing
The following orofacial myofunctional disorders are clinical markers for SDB:

- Enlarged tonsils (Ikavalko et al., 2012)
- Elongated uvula (Yoon, Zaghi, Ha, Law, Guilleminault, & Liue, 2017)
- Reduced intraoral volume (Friedman et al., 2013; Kim & Guilleminault, 2011)
- Narrow maxillary arch (Yoon, Zaghi, Ha, Law, Guilleminault, & Liue, 2017; Berwig et al., 2011; Banabilh, et al., 2010)
- Tongue scalloping (Weiss et al., 2005)
- Restricted lingual frenum (Yoon et al., 2017; Guilleminault, et al., 2016; & Huang et al., 2015)
- Malocclusion (Ikavalko et al., 2012)
- Forward head posture in sitting, standing, and walking (Sonneson, 2017; Krakauer, & Guilherme, 2000; Cuccia et al., 2008))
- Interdentalized speech sounds /s, z, t, d, n, l/

- Tongue thrust swallow and abnormal swallow patterns (de Felicio et al., 2016)
- Impaired mastication (Valera et al., 2003)

Daytime Behaviors in Children

As a result of hypoxia and subsequent changes to neural structures and functions, disordered breathing patterns may result in the following:

- Increased fidgeting and hyperactivity (Sedky et al., 2014; Chervin et al., 2005)
- Decreased attention, recall, and visual fine motor function (Chan et al., 2014)
- Impaired executive function skills (Hunter et al., 2016; Karpensiki et al., 2008)
- Poor academic performance (Galland et al., 2015)
- Decreased self-regulation and increased aggression (O'Brien et al., 2011; Bebee et al., 2006)
- Behavioral problems (Gottlieb et al., 2003)

Nighttime Symptoms

- Cessation of breathing and/or gasping for air
- Snoring
- Audible breathing
- Mouth open posture
- Bruxism (Khoury et al., 2008)
- Enuresis (Goldbart et al., 2010)
- Sweating
- Positional changes and/or hyperextension of the neck (Neiva, Kirkwood, & Godinho, 2009)
- Frequent arousals leading to fragmented sleep (Goodwin et al., 2005)
- Restless sleep
- Night terrors, sleep walking (Goodwin et al., 2004)

Individuals with SDB often do not feel refreshed in the morning, even after ample sleep, awaken with a dry mouth, may have longer sleep latency times, and may experience excessive daytime sleepiness (Goodwin, 2005).

Other Potential Symptoms

- Gastroesophageal Reflux Disorder (GERD)
- Failure to thrive secondary to inability to reach REM (rapid eye movement) stage sleep where growth hormone is released.

Causes

Abnormal daytime and nighttime breathing patterns can result from any condition that obstructs the airway or diminishes the ability to breathe effortlessly and quietly in and out through the nose.

- Mouth breathing is a predisposing factor of SDB (Thomé-Pocheco et al., 2015)
- Adenotonsillar hypertrophy is the most common cause of OSA in children
- Allergic rhinitis
- Nasal congestion and/or frequent upper airway infections
- Deviated septum
- Enlarged turbinates
- Restricted lingual frenulum
- Low muscle tone
- Craniofacial syndromes or craniofacial growth alterations

Role of the SLP in Breathing

Secondary to the prevalence of disordered breathing patterns, their impact on a wide range of human functions relevant to the SLP and significant consequence across the lifespan, the SLP has a critical role in the screening and interdisciplinary management of these conditions.

Screening of daytime and nighttime breathing patterns is conducted by an appropriately trained speech-language pathologist with accompanying knowledge of essential interdisciplinary referrals for medical and therapeutic management.

With appropriate training, the SLP may also provide management of abnormal breathing patterns through nasal retraining (re-education) within or alongside an orofacial myofunctional therapy program to address comorbid oral dysfunctions in resting postures, chewing, swallowing, and speaking. Both screening and management are conducted within the context of the interdisciplinary team.

As part of screening for disordered breathing patterns, SLPs may identify and describe

- Potential signs and symptoms of disordered daytime breathing patterns (e.g., mouth breathing)
- Orofacial myofunctional disorders as signs and symptoms of potential sleep-disordered breathing
- Appropriate referrals for medical assessment and interdisciplinary team management
- Relationships between signs and symptoms of potential disordered breathing patterns and OMDs impacting oral functions within the context of daily living activities (e.g., chewing, swallowing, speaking, nighttime sleep breathing)

- The impact of abnormal breathing patterns to craniofacial growth as it relates to oral functions, airway management, quality of life, and health risks
- The consequences of daytime behaviors (e.g., learning, academics, socialization, emotional health, etc.)
- Sleep wellness and hygiene practices

ELIMINATE NONNUTRITIVE SUCKING

Prolonged nonnutritive sucking (e.g., pacifier, finger, and object sucking) is a risk factor for increased malocclusion (Sousa et al., 2014). Pacifier use likely limits later developing feeding skills while appropriate mouthing activities support later developing feeding skills such as cup drinking (Silveira, Prade, Ruedell, Haeffner, & Weinmann, 2013).

The American Academy of Pediatric Dentistry (2014) suggested dentists offer parents and caregivers guidance to help their children stop sucking habits by age 3 years or younger. Some researchers suggested discontinued pacifier use by 10 months of age secondary to increased incidence of middle ear problems with pacifier use after that age (Niemela, Pihakari, Pokka, Uhari, & Uhari, 2000). Children can be weaned from the pacifier (if used) around 5 to 6 months when discriminative mouthing and feeding begin.

Nonnutritive sucking and suckling begin in utero. This is generalized mouthing at the front of the mouth. Differentiated or discriminative mouthing develops around 5 to 6 months of age with more appropriate mouthing toys and feeding activities. Discriminative mouthing is important for the development of oral discrimination within the mouth used in eating, drinking, and speaking (Garattini, Crozzoli, & Valsasina, 1990; Lau, 2015; Nyqvist, Färnstrand, Eeg-Olofsson, & Ewald, 2001).

Appropriate nonnutritive mouthing activities (e.g., biting, chewing, and discriminative mouthing) seem to evolve into higher skill oral levels as the oral reflexes (e.g., phasic bite, transverse tongue, etc.) become integrated. Early intervention specialists, particularly those who work with children who have diagnosed OMDs, should be encouraged to wean infants and toddlers from pacifiers and other sucking toys as early as possible. Parents and caregivers can be taught to ignore problematic behaviors and offer praise, positive attention, and rewards as their child engages in appropriate mouth behavior to help the child break the habit.

Structured intervention is generally recommended by age 4 to reduce potential for dentofacial changes (Warren & Bishara, 2002; Warren et al., 2005; Zardetto, Rodrigues, Stefani, 2002). However, the use of dental habit elimination appliances like a rake, crib, or thumb guard are generally not recommended (Mason & Franklin, 2009) due to limited success rate, potential for excessive weight loss, pain, poor sensory perception, and development of atypical lingual movement secondary to the placement of these devices (Moore, 1999).

MODIFY HANDLING AND SWALLOWING OF SALVIA, LIQUIDS AND SOLIDS

Individuals with known OMDs usually require therapy consisting of oral phase dysphagia intervention. Swallowing patterns associated with drinking and appropriate bolus management (e.g., chewing with mastery of the rotary chew, bolus manipulation and collection, as well as the motor sequencing of the swallow onset) fall within this phase. (Gomes, Trezza, Murade, & Padovani, 2006; Logeman, 2000) . Infants and toddlers who have craniofacial, genetic and/or structural deficits frequently present with the pre-cursors to OMDs such as restricted oral frenula (Gosa, Carden, Jacks, Threadgill, & Sidlovsky, 2017; Hogan, Westcott, & Griffiths, 2005; Mizuno & Ueda, 2006; Sanchez, Spittle, Slattery, & Morgan, 2016).

Oral phase treatment programs usually address pre-feeding skills to ensure safe and effective nutritive feeding (Lau, 2015; Jackson, 1999; Overland, 2010; Patil, Singh, & Subba Reddy, 2003; Sanchez, Spittle, Slattery, & Morgan, 2016). Understanding normal oral sensory-motor development and reflex skill integration increases recognition of abnormal. (Bahr, 2001; Medeiros, 2007; Morris & Dunn-Klein, 2000; Overland & Merkel-Walsh, 2013).

The goals of improving bolus mastication, manipulation, and bolus formation in OMDs include but are not limited to:

- Cheek support and activation to support bottle- and the breast-feeding
- Lip closure with tongue retraction for spoon-feeding
- Lip rounding with tongue retraction for straw-drinking
- Tongue lateralization to support placement and collection of the bolus and a rotary chewing pattern
- Improved mastication, bolus formation, and motility
- Improved lingual position for swallowing

Tools

Therapeutic intervention often involves the selection of appropriate oral tools to support the designated goals. For example, straws, lip or bite blocks, appropriate food items, etc. can improve jaw-lip-tongue dissociation needed for eating and drinking (Hill, Kurkowski, & Garcia, 2000; Overland, 2010).

Intervention

The way food is placed in the mouth can also influence the motor skills required to masticate and manipulate the bolus. For example, placement of a strip of food on the back molars can encourage tongue lateralization (Colson, Meek, & Hawdon, 2008;

Iguchi et al., 2015, Overland, 2010). Incorrect intervention techniques can exacerbate the presence of tongue protrusion in individuals with OMD. Therefore, techniques must be carefully chosen.

Sensory

The sensory and motor systems cannot be separated. The orofacial complex is integrated by six of the twelve cranial nerves with both the motor and sensory components of the nerves. Using oral sensory input (e.g., temperature, texture, taste, etc.) can positively influence the child's pre-feeding and feeding skills for better treatment outcomes (Dahan et a., 2000; Lazarov, 2007; Overland & Merkel-Walsh, 2013; Winckel et al., 2012). Examples might include chilling a therapeutic spoon or adding high flavor to chosen foods.

IMPROVE SPEECH SOUND ARTICULATORY PLACEMENT

Differential diagnosis involves ruling out a speech sound disorder correlated with OMD. The coexistence of an abnormal lingual rest posture and atypical lingual positioning for swallowing can result in atypical placements for speech production. Poor oral resting postures and/or labial incompetency can also impact appropriate labial placements for speech.

Differentiation between developmental speech sound disorders (i.e., phonological processing), disorders of motor planning (i.e., Childhood Apraxia of Speech) and muscle-based speech sound disorders often present in OMD is critical. Differential diagnosis of a speech sound disorder should drive treatment methodology (Ray, 2003; Ray, 2002). Assessment should focus on the placement of the articulators as individuals with OMD's often exhibit compensatory articulatory placements.

Typical error patterns include:

- Incorrect lingual placements for /t, d, n, l/
- Lingual protrusion resulting in distorted productions of /s, z/ causing interdental or lateral lisps
- Abnormal lingual dental articulatory placement for /t, d, l, n, ʧ, ʤ, ʃ, ʒ/
- Poor back of tongue spread causing distortions of /r/
- Nasal quality of vowels (i.e., hypernasal or hyponasal)
- Poor labial closure for bilabial sounds /b, p, m/
- Distortion of velar sounds /k, g/and "ng"
- Poor lip protrusion resulting in distortions of /r, ʧ, ʤ, ʃ, ʒ/

Traditional articulation therapy with individuals presenting with OMDs is often ineffective. *Oral Placement Therapy* (Bahr & Rosenfeld-Johnson, 2010), a form on Phonetic Placement Therapy can be an effective treatment methodology for those who do not progress with other traditional or phonological approaches. Individuals with OMDs may also present with disorders of muscle tone, etc.

For patients who cannot respond accurately to *"look at me"* and *"say what I say,"* OPT utilizes specific therapy techniques and tools to attain articulatory placement for accurate speech sound production (Badin et al., 2002; Bahr & Rosenfeld-Johnson, 2010). OPT uses techniques to facilitate actual speech. It does not use feeding techniques or unrelated activities to facilitate speech. Speech, feeding, and unrelated activities (e.g., tongue wagging and cheek puffing) have unique motor. While these activities may use the same muscles, the motor plans for speech, eating, drinking, and other oral activities are unique to those activities (Kent, 2015).

See ASHA's Practice Portal page on Orofacial Myofunctional Disorders-Articulation for more information.

ORAL REST POSTURE

A primary goal of orofacial myofunctional therapy is to establish a lips-together, tongue to palate resting posture using routine nasal breathing. Individuals who demonstrate difficulties with the patency of their nasal airway often remain oral mouth breathers, and this further affects normal resting postures of the tongue, jaw, and lips (Cappellette et al., 2017; Harari, Redlich, Miri, Hamud, & Gross, 2010).

The etiology of open mouth posture is critical in proper diagnosis and treatment of OMD. The position of the lips relative to healthy nasal respiration (versus oral breathing patterns). Medical information obtained in the case history is considered in conjunction with this problem. (Krakauer & Guilherme, 2000).

Lips together, jaw slightly parted where teeth are not in contact, tongue tip on the alveolar ridge, and tongue resting gently against the hard palate is a normal resting posture. In addition, the position of the tongue in relationship to the dental arches should be considered. A forward tongue resting position can impede normal teeth eruption and result in anterior open bite (Bernthal, Bankson & Flipsen, 2009; Moschik, Pichelmayer, Coulson & Wendl, 2015).

See ASHA's Practice Portal page on Orofacial Myofunctional Disorders -Rest Posture for more information.

NEUROMUSCULAR RE-EDUCATION

OMT and *Oral Sensory-Motor Treatment* are forms of neuromuscular reeducation (Bahr and Rosenfeld-Johnson, 2010; Merkel-Walsh, 2015; Overland, 2010). These are appropriate treatment

methods for individuals who present with disorders of muscle strength and tone, oral-phase feeding and swallowing deficits, and speech disorders resulting from OMDs.

They include treatment of feeding, oral-phase swallowing, oral resting posture, drooling, overall appearance of the oral-facial musculature, and speech (as appropriate). Oral sensory-motor treatment and orofacial myofunctional encompass activities targeting adequately improved muscle strength and tone; dissociation, grading, and direction of movement; as well as regulation of the oral sensory-motor system (Burkhead, Sapienza, & Rosenbek, 2007; Byeon, 2016; Gosa, Carden, Jacks, Threadgill, & Sidlovsky, 2017; Manno, Fox, Eicher, & Kerwin, 2005).

Oral sensory-motor/myofunctional therapy includes:

- Neuromuscular re-education activities to appropriate dissociate jaw, lip, and tongue movements for the functions of eating, drinking, and speaking
- Isotonic and isometric exercises to reduce snoring (Camacho et al., 2015)
- Self-monitoring exercises to improve oral resting posture
- Therapeutic feeding activities to improve the oral phase of swallowing
  Oral placement therapy to improve the placement of the articulators for speech (Ruark & Moore, 1997)

  See ASHA's Practice Portal page on Orofacial Myofunctional Disorders- Neuromuscular Reeducation for more information.

SERVICE DELIVERY

Where can Oromyofunctional Therapy be Applied?

- NICUs and infant feeding environments
- Early intervention programs
- Pediatric feeding clinics
- Schools – public and private
- Private practices
- Hospitals and clinics
- Rehabilitation and skilled nursing facilities
- Home health

FORMAT

Oromyofunctional therapy (OMT) can be taught in all settings.

PROVIDER

OMT should be provided only by highly qualified providers, including SLPs with advanced education and training.

DOSAGE

Treatment is often 30-45 minutes (depending on age and other associative disorders), weekly until generalization, with long term followup.

SETTING

Orofacial myofunctional therapy may take place in any clinical setting:

RESOURCES

ASHA RESOURCES

Orofacial Myofunctional Disorders public page

Assessment Tools, Techniques, and Data Sources

NON-ASHA RESOURCES

International Association of Orofacial Myology (IAOM)

Cincinnati Childrens – Orofacial Myology Disorder Page

CINAHL Clinical Review of Orofacial Myofunctional Disorders

Oral Motor Institute - OMI

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