

A clinician's guide to pediatric oral motor development

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ABSTRACT

Purpose: Collaboration between healthcare disciplines is the foundation of a wholistic approach to a child's optimal health. For example, chiropractors have linked temporomandibular joint dysfunction to postural strain. Forward head carriage and associated changes in the anterior to posterior curves of the spine can result in an alteration in muscle length and function shifting stress to the face and jaw resulting in headaches or facial pain. This is one of the reasons pediatric chiropractors emphasize development of postural stability and closely monitor development and attainment of motor milestones. The authors of this paper propose that the effect of oral motor function may directly influence posture and as a result, should also be taken into consideration when working with the pediatric patient. In clinical practice with infants and children, it is imperative that pediatric health care professionals are aware of the developmental milestones children should be meeting so that they are able to support and guide families to navigate what is "normal" when assessing and understanding their child's growth and development. This is especially important as it relates to oral development. This paper will attempt to provide practitioners some assistance and resources for parents of children with oral motor dysfunction with an emphasis on appropriate and timely collaborative referrals.

Key words: oral motor function, breastfeeding dysfunction, feeding disorder, pediatric, developmental milestones, chiropractic, oromyofunctional therapy

Background

In clinical practice with infants and children, it is important that pediatric health care professionals are aware of the developmental milestones children should be meeting so that they are more able to help families navigate what is "normal" when assessing and understanding their child's growth and development. It is also important, based on the failure to meet these developmental milestones, to make appropriate and timely collaborative referrals to other health care professionals.

This is crucial when it pertains to oral motor development. Many patients with tethered oral tissues or TOT's (restrictive tongue, lip or buccal fascial attachments) are having them "released" surgically (by scissor or laser) at an early age to promote feeding and oral development.¹ This is a significant intervention that has the potential to benefit the child in numerous ways ranging from feeding to speech. However, there is a significant trend towards intervening with surgery without the recognition that there can be neurologic, biomechanical and motoric reasons for feeding dysfunction or lack of oral development that should be

differentially diagnosed as a potential cause or comorbidity.

Children grow and develop rapidly. Neuroplasticity is the malleability of the brain that allows children to integrate these rapid changes. When anything challenges the maturation of their nervous system or interferes with the development of critical skills (like breathing or feeding), it can result in a compensatory strategy.² Compensation, by its very nature, alters the child's proprioceptive experience and as a result, changes the way children move their bodies which could ultimately impede further developmental milestone attainment. An adaptive posture is often one of the first signs of compensation seen by a chiropractor once the child becomes weightbearing.

An important diagnostic step, as well as a collaborative adjunct to this surgical release (which is often performed within, but not limited to, the first weeks to months of life) is a functional assessment. Biomechanical function, including the identification of neural deficit, postural faults, subluxation, restriction or muscular asymmetry, would be best addressed by the chiropractor,³ while a

functional assessment of the oral motor development would be performed by an IBCLC (International Board Certified Consultant),⁴ oromyofunctional therapist (or oromyologist)⁵ an occupational therapist⁶ or a speech and language pathologist.⁷ Based on these assessments, the appropriate education can be provided to caregivers concerning the child's compensations and how to recognize when the child's motor planning and aberrant function is compensatory instead of normal, efficient and developmentally appropriate movement. These assessments assure the best outcomes whether that be the outcome of an adjustment, an exercise program or surgery and its concomitant habilitation of the musculature.

Orofacial Myology is the study of typical and atypical patterns of oral motor development. The aim of treatment is to develop and normalize oral motor movement patterns and strengthen oral motor musculature. There are many factors that can contribute to poor oral motor development like hyper or hypotonia, altered ranges of motion and compensatory patterns of movement utilizing recruited muscles or altered postures. Orofacial Myology focuses on giving the right neural input to muscles in order to accomplish a nasal breathing pattern, good lip seal, appropriate tongue rest posture, ideal jaw movement and grading and increased oral motor strength.⁸

Many different factors can contribute to atypical oral motor patterns as outlined in Table 1.^{9,10,11,12,13} The purpose of this paper is not to highlight the aforementioned pathologies but to help practitioners differentiate when common dysfunctional oral motor patterns are compensatory or to recognize abnormal movement or other significant red flags that would indicate an immediate referral to a specialized health care provider. This referral may refine the diagnosis and provide further support with a therapeutic intervention such as those offered by a medical providers (like an ENT, pediatric surgeon or dentist or orthodontist) or an IBCLC (when breastfeeding is involved), a chiropractor, orofacial myologist, physical, occupational or speech therapist, when theirs would be the appropriate interventive protocol.^{13,14}

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| <ul style="list-style-type: none"> • Airway obstruction • Cleft palate • Tethered oral tissues (TOTS) • Hypertonia or hypotonia • Poor motor planning or delayed motor development • Cerebral palsy or other neurologic disorder • Biomechanical dysfunction, cranial faults or restricted range of motion • Assymetry in muscular development (example: torticollis) |
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Table 1: Factors that can attribute to atypical oral motor patterns.

The goal is to help children continue to develop typical oral motor strength and function during growth phases. As children grow and develop, their oral motor skills will become more refined. Along the way they may encounter challenges which can be remedied through remedial exercise, positioning or adjunctive therapeutics.

The aim of this paper is to help practitioners learn the signs of poor oral motor function beyond breastfeeding and give a roadmap for early oral motor development. In addition, it highlights interventions that may be implemented at home by parents or caregivers or supported by a treatment plan devised by a health care practitioner which could potentially include orthodontic or surgical intervention.

Much has been studied about the value of breastfeeding physiologically and immunologically, but it is also very important in neurologic development, both cognitively and children's readiness to transition to solid foods.^{15,16} This readiness includes oral motor development.

How to introduce solids

When the signs of readiness for eating are present (Table 2), the introduction of first foods should be fun and playful. Eating is important for many aspects of development including socializing. Children should eat with the family at mealtimes. They are eager to participate in activities that their family is doing. Eating at the table teaches the importance of a shared meal and encourages curiosity in foods all while developing oral, motor and social skills.

Baby led weaning is a practice that introduces children to solids typically after 6 months of age.¹⁷ It is preceded by

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| <ul style="list-style-type: none"> • Babies should have enough core strength to move themselves into a seated position independently before introducing foods. • Choose a highchair that has a footrest. Knees and hips should be at a 90 degree angle and feet should be planted flat on the foot rest. • Bottom and pelvis position should be positioned under the shoulders. • The child should be able to maintain an upright position when eating. • Baby is opening their mouths and moving their tongue (when they see you eating) and reaching for their parents' food and utensils. • Baby is grasping things with their hands and bringing them to their mouths. The pincer grasp is not usually developed until 8-10 months, so movements will be with the whole hand. |
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Table 2: Signs of feeding readiness.

the ability to move into a seated position and maintain a seated posture in a high chair. In baby-led weaning the child's main source of nutrition continues to be breastmilk or formula with gentle introduction of whole foods. The parent slowly introduces foods that are least likely to cause food intolerance and that develops the skills of a child who can self-feed.¹⁶

But what if a parent expresses concern that their baby is not very interested in solids at six months? Is this an indication of oral motor dysfunction or a neurodevelopmental delay?

The World Health Organization states: "Breastfeeding is an unequalled way of providing ideal food for the healthy growth and development of infants... Review of evidence has shown that, on a population basis, exclusive breastfeeding for six months is the optimal way of feeding infants. Thereafter infants should receive complementary foods with continued breastfeeding up to 2 years of age or beyond."¹⁸

For infants who demonstrate little or no interest in solid foods, the nutrients from breastmilk alone can and will suffice until 9-12 months or later. As long as the infant is meeting growth and gestationally corrected developmental milestones, their nutritional needs are being adequately met. There is concern that after six months, infants will gradually begin to need more iron and zinc than that provided by breastmilk alone — at that point, additional nutrients can be obtained from small amounts of introduced, carefully selected solid foods or liquid supplements if necessary. If an infant continues to exclusively breastfeed, monitoring growth and iron status should suffice until the infant is ready. Exclusive breastfeeding will provide the majority of the required nutrition through the end of the first year of life.¹⁹

Red Flags

When children do not feel well or when they sustain an injury (a fall on the bottom while learning to walk, tripping and falling or failure to stay upright with their first try on a new two-wheeler!) they often hold their bodies in a position of "ease" or a position of comfort. This position of comfort is often one parents have "seen before" and possibly even sought treatment for (like a head tilt or torticollis). This posture or position was typically developed as a muscular compensation in response to a problem. The original problem or "dysfunction" could have been biomechanical, neurologic or physiologic and the plasticity of the brain and the proprioceptive input from the neuroreceptors in the fascia²⁰ and joints supports "survival" by creating compensatory motor plans to accomplish the desired end goal.²¹ Both preclinical and human studies indicate that specific neural plasticity and behavioral changes are dependent upon specific learning experiences.²² The more

specific the practice, the more neuroplastic connections are induced and cortical space dedicated to the task.²³

If a child exhibits red flag symptoms (Table 3), this indicates that he/she may be demonstrating compensatory behaviors, for example, due to "retained" reflexes. These primitive infant reflexes were initially required for survival but should integrate and dampen or disappear as the brain matures and replaces them with other functional responses. When these reflexes fail to fully integrate, the retained reflex can cause dysfunction in areas of the brain that control the development of gross motor, fine motor, sensory, cognitive and social, receptive and expressive (language, emotional and behavioral) skills.²⁴

- Open mouth posture; this includes daytime and/or during sleep.
- Decreased ROM of head, neck or other areas of the body.
- Snoring, grinding their teeth or drooling.
- Sleeping with knees tucked and buttocks in the air.
- Sleeping with head or neck in extension and excessive movement during sleep.
- New or increased night waking.
- Night Terrors.
- Apnea
- Waking cranky and tired, never rejuvenated after a full nights sleep.
- Hyperactive. Activity level higher than others at same age.
- Breathing through mouth.

Table 3: Red flag symptoms of compensatory oral motor strategies

If any red flags are identified by parents, a couple of visits with chiropractor or other health care provider might be necessary to overcome some physical obstacles, but a most effective tool in addition to the correction of any biomechanical problems is to facilitate habilitation of the oral musculature with a home exercise program (HEP).

Parents can be empowered by instructing them in an HEP to perform between visits. These simple tools can help support neural integration and get a child back on track using the ideal muscle correctly without compensating. If these do not help to restore appropriate movement, then further treatment with a qualified healthcare provider is recommended.

The Home Exercise Program

Rhythmic Movement Training is a movement-based

primitive (infant or neonatal) reflex integration program developed on the basis of the spontaneous rhythmic movements that infants normally do.²⁵ Spontaneous rhythmic baby movements are foundational to the development of motor abilities and other faculties e.g. speech, emotions and vision, and are necessary for the maturation of the infant's brain. When Rhythmic Movement Training is used with children with challenges, there is demonstrable improvement in motor abilities and control such as coordination, muscle tone as well as the integration of primitive reflexes. Additionally, many families have observed improvement in different areas such as feeding, speech, vision as well as difficulties with attention, hyperactivity, and reading and writing in older children. Rhythmic movement protocols are easily implemented by parents and caregivers but to be effective, the rhythmic exercises need to be done regularly (at least five days a week). Depending on the progress of the child, the exercises need to be updated and advanced to include follow up movements on a regular basis.²⁶

For infants old enough to imitate or mimic, parents can encourage the use a wide variety of facial expressions to develop the muscles of the mouth and face, no matter how young. For toddlers and older children, the parents can download a copy of a program like "The Story of Mr. Tongue" which guides the child through different oral motor movements: "The Story of Mr. Tongue. Here is Mr. Tongue. Mr. Tongue lives in a house, which is your mouth! Your teeth are his windows and your lips are his doors. Stick your tongue out. One day Mr. Tongue came out of his house. Point your tongue up. He looked up at the sky. Point your tongue down."²⁷ There are many more resources for oral motor movements to download from the internet to spark the imagination and expand a child's developmental program.

Singing is an excellent activity to encourage fluid and relaxed movement in the oral motor cavity.²⁸

Chronology of oral motor development

Between three to seven months, the infant will have developed oral motor patterns that include munching, lateral and diagonal jaw and lateral tongue movement patterns. If by six months the infant is sitting unassisted and has developed munching patterns, jaw movements and tongue lateralization, they should be successful with the thin and thick purees, foods that melt in their mouth and soft foods such as banana, sweet potato and avocado.

If any of the following red flags occur, it is important to refer to collaborate with a specialized health care provider (HCP). Some of these red flags are alerting us to a child who may not be able to breathe through their nose and or does not have full range of motion of their tongue:

- a. a pattern of swallowing with a tongue thrust pattern lasts beyond the six month mark,
- b. an open mouth posture ,
- c. persistence of the tongue at rest on the floor of their mouth,
- d. during swallow, the tongue thrusting forward or laterally against the molar ridge.

Between seven and nine months of age, more infants are moving into unsupported sitting, quadruped and crawling. This development supports jaw stability, breath support and fine motor development for self-feeding skills. Infants at this age now begin to be able to successfully manage "lumpy" purees. They are able to bite and munch "meltable" (a hard textured food that once in the mouth, melts) and begin to experiment with softer foods with parental observation and assistance. This is also when the development of rotary chewing begins. At this age children should be able to perform the following:

- Lip closure
- Scraping food off spoon with upper lip (head stays in neutral position and upper lip clears the spoon).
- Movement of food from side to side between the gums and into the cheek
- Increased tongue lateralization

If these skills are not present by nine months, consider referring your patient to a provider who specializes in feeding.

Rotary patterns begin emerging around nine to ten months of age. The child at this time has developed dissociation of his head from his body. This supports increased independence with biting pieces of food, lateralization of a bolus across the midline, and decreased spillage from the lateral sides of the mouth.

By 12 months of age, the child has developed the oral motor basics to support feeding. As time goes on, the child will practice these skills resulting in less messy eating and the ability to handle more challenging foods. At this age, a child should be able to manage foods with juice, and chew and swallow firmer foods such as cheese, soft fruits, vegetables, pasta and some meats.

Between 16 and 36 months of age, the child continues to develop their jaw strength, management of a bolus, chewing with a closed mouth, sweeping of small pieces of food into a bolus, and chewing 'harder' textured foods such as raw vegetables and meat. A full circular rotary chew should also be developed at this time to support eating all varieties of foods.²⁹

Table 4 outlines red flags that might be observed in a child with a feeding disorder. Some of these red flags can be addressed with patience and education, giving the child

time to integrate new skills. The most significant symptoms, though, are in bold lettering. If parents report or the chiropractor sees these red flag symptoms, they should have the child evaluated by a qualified HCP in a timely manner.

Conclusion

Clinical functional assessment skills are required across different professions that interface with pediatric patients who might present with these complaints. Collaborative assessment will result in the most complete differential

diagnosis of sole or comorbid causes of persistent joint dysfunction and postural alterations, oral motor dysfunction or feeding disorders. Cross professional education is critical to provide appropriate and timely care to children with oral motor dysfunction. It is in the best interest of the patient and practitioner to collaborate with other professionals to achieve the best outcome as the problems are often multifaceted and require a multimodal approach. There is a critical need for cross professional studies to further evaluate the efficacy of collaborative treatment protocols.

- **Arching or stiffening of the body during feeding**
- **Coughing or choking during feeding**
- **Being very irritable/fussy during or after feeding**
- Taking a really long time to feed/eat (more than 30-45 minutes)
- Frequent spitting up
- **Getting sick often with pneumonia or chest infections**
- **Gurgly, hoarse, or breathy voice**
- Less than normal weight gain or growth
- **Lots of leakage of food or liquid from the mouth**
- **Coughing, gagging or throwing up during or after meals**
- Stuffing mouth with food
- Holding food inside pockets in mouth for long periods
- Difficulty accepting new textures of food, avoidance behaviours to specific foods and textures (gagging, vomiting, blocking the spoon with hands or closed lips, crying, pushing food away, etc.)
- Abnormal bowel movements that last longer than a few days such as diarrhea, constipation or loose stool.
- **Skin reactions to foods (dry patches, hives, rashes)**

Note: If your child seems to be having a severe allergic reaction to food (difficulty breathing, turning red, developing hives or rash on the face/chest), you should seek medical help immediately.

Table 4: Eating red flags.

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