Guiding Optimal Development: Early Signs of Soft Tissue Dysfunction

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Financial/Nonfinancial Disclosure Statement

Amanda is the owner & director of The Speech Network Pediatric Feeding & Orofacial Myology Clinic. She will be discussing her place of employment and actual case studies. She is receiving travel accommodations for this presentation. She is a member of the KSHA. She is a member of the board of directors for the IAOM. She has family members affected by the topic of her presentation.

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Think about the human body as a biomechanical structure made up of these 3 systems:

- **Neural** - brain, spinal cord, peripheral nerves/receptors
- **Skeletal** - spine, bones, joints
- **Myofascial** - muscles, tendons, connective tissues (binding agents of the body...holds us together)

These 3 systems are integrated, work together, depend on each other for functioning!
Soft tissue dysfunction:
- Adaptive shortening (contracture) of soft tissues
- Lack of normal mobility
- Muscle weakness
- Joint dysfunction
- Adhesion (scar tissue)
- Reflex muscle guarding (protecting injured tissue, local or referred)
- Myofascial implications

Hunter’s model of specific soft tissue mobilization discusses the tensile properties of soft tissues and their response to manual input.

Soft tissues go through the following stages in healing:
1. Lag phase/Inflammatory phase - high level of inflammation, thin fibrous bond
2. Regeneration phase/Proliferation phase - increase in tensile strength, collagen synthesis (random), can be guided by input
3. Remodeling phase/Maturation phase - improved stability, possible stiffness, manual input can help guide collagen fibers to support increased movements

"At this stage, however, it is necessary to establish beyond a reasonable doubt that soft tissues of the musculoskeletal system, when subjected to acute or chronic embarrassment, will change and adapt themselves in a predictable manner. This adaptation will be seen almost always to be at the expense of optimum functional ability. Such changes will also be seen to be the on-going source of further physiological embarrassment."
Leon Chaitow, ND, DO

Know normal to be able to identify abnormal
Know typical infant development of orofacial complex structure and function in order to appropriately treat infants, older children, and adults.

Each patient being seen for OM evaluation comes with a history that likely includes early soft tissue dysfunction that was not addressed.

4th week GA = migration of cells develop facial prominences
9th week GA = cartilaginous facial skeleton
12th week GA = ossification begins (maxilla, mandible, cranial vault)
3rd – 5th month GA = normal oral function is organized for suck/swallow
Continual and increased intake of amniotic fluid provides suck/swallow muscle activation supporting oral cavity development until birth
Maximum head & face growth occurs between birth & 2 years
Maxilla and mandible are pulled down and forward by SOFT TISSUES/muscle movement

Guilleminault, Huang 2017
Normal Infant Soft Tissue Function

- Labial seal
- Habitual nasal breathing
- Lingualpalatal seal at rest
- Normal tone of oral tissues
- Balanced muscle activation
- Up and back swallow pattern with anterior inhalation
- Full ROM of the tongue, cheek without an echolalia of tone
- Excitatory mediation
- Specified elevation of the soft palate
- Anterior diaphragm for inspiration
- Downward and lateral movement pattern

Links between early dysfunction and later orofacial myofunctional disorders for infants/children/teens/adults

- Open lips posture
- Low and forward tongue posture
- Mouth breathing
- Drooling
- Lack of lingual cupping
- Lack of lingualpalatal seal
- Forward movement of the tongue for swallows
- Exacerbated by repeated incorrect soft tissue function over time

Why do some babies have soft tissue dysfunction at birth?

- Early experiences represent critical points for future structural and functional development
- Epigenetic factors/toxin exposures
- Intrauterine constraint
- Birth trauma
- Intubation
- Separation
- Sleep positioning
- Reflux positioning
- Nasal and tracheal
- Hyper/hypotonia
- Restricted jaw

Functional Deficit Categories: Infant

- Oral Rest Posture
- Suck
- Swallow
- Sensory Integration
- Digestion

Functional Deficit Categories: Toddler

- Oral Rest Posture
- Suck
- Swallow function/transit
- Digestion
Build a foundation

- Positive breathing & feeding experiences with optimal oral motor function in infancy support development of:
  - Airway
  - Palate
  - Face
  - Oral movement patterning
  - Systemic impacts

Importance of Optimal Early Feeding Patterns

- Tongue is lead muscle in oral-facial development
- Long term Bfd children are much less likely to need orthodontia. (Palmer, 1998)
- Even 3 months of Bfd makes orthodontic difference. (Pottenger & Krohn in Montagu, 1977)
- Frequent peristaltic pressure of tongue to palate helps to widen & mold palate to fullest genetic potential. (Straub W, in Garliner D, 1971)
- Short lingual and labial frenums impact ability to Bfd successfully
- Mastication beginning with introduction to solids around 4-6 months adds stimulus for growth

Correlations with Airway

Orofacial development

Persistent airway challenges result in compensatory patterns

Tonsil Grading System

Mallampati Score

Nasal and Oral Interactions: Implications of Obstructions

Orofacial Development:
- Jaw position
- Tongue position/tone
- Facial muscle tone
- BIG risk for obstructive sleep apnea (OSA) or upper airway resistance syndrome (UARS)

Activities of Daily Living:
- Breathing
- Eating/Swallowing
- Sleeping
Restorative sleep across the lifespan...

- For children:
  - Deep sleep accounts for 40-50% of sleep
  - SDB:
    - Childhood obesity
    - Learning disorders
    - Behavioral disorders
    - Failure to thrive
    - Hormone disorders
    - Metabolic disorders

- Takacs (Power Principles for Success)

Sleep disordered breathing is linked to early onset dementia, Alzheimer’s, obesity, diabetes, cardiovascular disease, high blood pressure, general inflammation, reflux, and fetal cancer (Gelb & Hindin, 2016).

Mouth breathing children presented pathologic adaptations in the postural and morphological characteristics of the stomatognathic system. This suggests the importance of early diagnosis in order to avoid orofacial alterations.

- Characteristics of the stomatognathic system of mouth breathing children: anthroposcopic approach.

Mouth breathing and forward head posture: effects on respiratory biomechanics and exercise capacity in children. 2011

- OKuru, Morcillo, Ribeiro, Sakano, Conti, Ribeiro

"Respiratory biomechanics and exercise capacity were negatively affected by mouth breathing (MB). The presence of moderate forward head posture (FHP) acted as a compensatory mechanism in order to improve respiratory muscle function."


Changes in hormone levels

- Genetic (up to 50%)
- Non-genetic (up to 70%)
- Diet, hormonal change, environmental factors

Eruption of dentition

- Develops until age 4 years; then stabilizes

Facial soft tissue growth is influenced by developmental processes:

- Facial soft tissue depth is stable in adulthood; may decrease with age

Soft tissue of the lips specifically follows the underlying bony structure while other soft tissue depth was not as specifically correlated.


Causes of nasal airway obstruction:

- Lymphoid tissue hypertrophy
- Growth discrepancy
- Swelling
- Deviated septum
- Birth trauma
- Injury
- Genetic influence
- Overgrowth/alteration
- Allergic rhinitis
- Polyps

Causes of nasal airway obstruction: Figure 1: Bilateral deviated nasal septum. The image shows the septum deviated to the right side of the nasal cavity. This can cause nasal airflow obstruction, leading to breathing difficulties.
Bitar et al. found a correlation between adenoid size and shortest distance to soft palate.

Macari, Haddad 2016; Souki et al. 2014

Hard tissue responses to soft tissue dysfunction:

- Longer facial height
- Steeper mandibular plane angle
- Retrognathic mandible
- Retroclined mandibular incisors
- Anteriorly positioned maxillary incisors
- Decreased overbite
- Increased overjet
- Lateral crossbite
- Shorter mandibular arches
- Narrow maxillary arches
- Class II molar relationship
- Open bite
- Anterior cross bite

“Adenoid facies” and “Long face syndrome” referenced in literature 100+ years ago

Dysmorphic growth patterns as early as 2 years of age

Soft tissue response to mouth breathing:

Upper lip protrusion
- Thinner upper lip base
- Shorter lower lip
- Protruded lower lip
- Smaller nasolabial angle
- Smaller nasal prominence
- Smaller thickness of chin

Souki, Lopes, Veloso, Avelino, Pereira, Souza, Franco, Becker 2014 (showed differences in 11/16 soft tissue patterns between nose and mouth breathing subjects)

“...it appears that during MB, the lower arch soft tissue does not develop as much as in NB because the necessity of keeping the lips open may limit functional muscular activity.”


Negative impacts on growth and development: Mouth Breathing

Mouth breathing as the result of hypertrophied tonsils/adenoids has direct causal relationship with anteroposterior position of the maxilla

Reduced airflow through the nasal cavity contributes to structural development

Nasal hypoplasia develops and impacts vertical growth pattern

Tongue presses against palate less than expected if in a normal environment

Soft tissue change in face and mouth with alterations in normal muscle function

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Growth of the hard palate in infants with Down syndrome compared with healthy infants: a retrospective case control study.

Short Lingual Frenulum and Obstructive Sleep Apnea in Children
Huang, Quo, Berkowski, Guilleminault
International Journal of Pediatric Research 2015

Retrospective study looking at prepubertal children suspected to have OSA found 27 with non-syndromic short lingual frenums. Results showed untreated short frenulum developed abnormal tongue function early in life and had impacted orofacial growth and sleep disordered breathing (SDB). Frenectomy should be performed at birth to avoid negative impacts on soft and hard tissues.

Tethered Oral Tissues

• The tongue balances forces between soft and hard tissues
• Guides growth patterns of the palate/dental arches
• Arkyloglossia restricts lingual elevation to palate for expected/optimal impact on growth
• 302 participants 6-67 years old from ortho practice
• Used Kellow’s free tongue measurement or Tongue Range of Motion Ratio (TRMR) comparing
• Maximum intercisal mouth opening with tip up to incisive papilla versus down
• TRMR and Kellow scores showing reduced lingual mobility were associated with
  - Decreased ratio of maxillary intercanine arch width and canine arch length-maxillary hypoplasia
  - Increased soft palate length-width ratio for maxillary collapse
  - High arch palate with transverse deficiency

Research looking at ADHD and SDB link back to early soft tissue dysfunction and it’s impact on growth patterns leaving long term negative impacts.
Why intervene in infancy?

- Identify early
- Intervene early
- Guide optimal functioning
- Support normal growth patterns
- Prevent abnormal growth patterns
- Prevent need for longer more intensive interventions at a later age

Guided Oral Movements with Active Patterning (GoMAP)

- Early intervention to guide specific movements and assist in activating independent patterns
- Specifically trained skill set
- Embedded orofacial myofunctional treatment concepts
- Leads to overall improvements in feeding, breathing, and later supports speech sound development

Proactive versus Reactive

- Identify dysfunction early
- Provide supports based on your scope of practice (manual therapy, referrals to professionals with appropriate scope of practice to intervene)
- Create change in the system