FAILURE TO TREAT TONGUE TIE:
IMPLICATIONS OVER THE LIFE CYCLE

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TASMANIA - AUSTRALIA
**TASMANIA**

- Roughly the size of West Virginia with only 500,000 population.
- Separated from Mainland Australia by 150 Miles of Water (Bass Strait)
- Next stop south is Antarctica, 1,242 Miles away
- Over half of Tasmania is dedicated World Heritage Area (532,600 square miles)
- Tasmania has the cleanest air & water in the world.
- A Huon Pine Tree in the South West World Heritage Area is the oldest living thing on Earth, estimated to be over 10,000 years old.
TASMANIA

• Some of the highest rates of chronic disease in Australia, or the world per capita: asthma, kidney disease, cardiovascular disease

• Highest proportion of people aged over 55 in 2012 of any state in Australia

• Largest population of low socio-economic bracket individuals and families in Australia (including Indigenous communities throughout Australia)

• Highest rate of progressive neurological diseases in Australia

• Highest rates of cancer in Australia

• Highest rates of cleft palate and other midline deficits

AIM OF PRESENTATION

• Outline how the tongue tie changes the dynamics of the swallow,

• The voice

• Coordination of speech

• Changes in breathing

• Changes in the whole person that result from untreated ties

• And the necessity of rehabilitation
CASE STUDY: 9YO MALE

- Secondary dentition beginning to show abnormal development

- Family hx of tongue tie. Unable to breastfeed. Father purchased lamb’s teats to enable his son to drink EBM.

- Started solids at 7mo, unable to eat textures beyond puree until 2years old (attempting rusk,bread, crackers and vegetables but choking and coughing on these).

- Speech difficulties: mild lisp, glide (w for r) and hesitations (dysfluency).

- Snoring. Complaining of dry mouth and bad breath in the mornings. Otherwise very high achieving family and young gentleman (many extracurricular activities, scholarship to a prestigious school), healthy, active, normal BMI.

- Tonsillectomy and adenoidectomy performed at 7yo

- Embarrassment as friends were teasing him about speech and snoring during school camps/sleepovers etc.

- Respiratory physician and pediatrician – no dx of TT but dx of airways disorder and obstructive sleep apnea.

- Upper lip tie and posterior tongue tie.
  - Functional restrictions severe.
  - Unable to touch tongue tip to papilla even with jaw closed. Unable to hold a bolus of fluid in mouth without base of tongue spillage and associated coughing.
  - Unable to form a cup/bowl with his tongue
  - TMJ clicking and popping (and reported sensation of grinding) during range of motion, chewing and swallowing tasks
  - Tongue thrust swallow
  - Diadokinetic rate impaired
SLEEP APNOEA

• What is sleep apnoea?
Cessation of airflow for >10sec with continued chest and abdominal effort

• Hypopnea
Decrease in the amount of air breathed with desaturation of >3%

(Dr Brian Palmer, DDS)

• Prof Graeme Jackson from Melbourne & Prof Terry O’Brien (RMH) – study released this month linking cerebral structural changes to chronic, long term sleep apnoea, thereby identifying a link between sleep apnoea, epilepsy and other degenerative brain disorders
SYMPTOMS OF SLEEP APNOEIA

Heavy snoring
Stop breathing during sleep
Excessive daytime sleepiness
High blood pressure
Morning headaches
Restless sleeps
Depression
Severe anxiety
Short term memory loss
Dry mouth on waking – altered oral flora and hygiene issues
Intellectual deterioration
Impotence
Mouth Breathing
Implications for daytime performance – job, relationships, health, concentration, school
OSA IN CHILDREN

Sleep disturbance has a large impact on development, concentration and ability to engage in life.
May contribute to increased URT infections.
Enlarged tonsils.
Oral hygiene imbalances.
Impact of behavioural disturbances associated with OSA on child, family, schooling, friendships etc.
Obesity, chronic health issues.
High correlation between snoring and ADHD (Chevrin et al).
Enuresis (bed wetting) – Linked to narrowed jaw and palate (relationship with ties) (Timms).
Night terrors.
WHY IS OSA RELATED TO TT?

Dr Brian Palmer summarised the Stanford Morphometric Model (used to predict incidence of OSA) beautifully:

“Anyone with a high palate, narrow dental arches, overjet, large neck, and/or large body mass, is at risk for sleep apnoea. If the individual does not have a large size or body mass, the predictive value of the formula is based on the height of the palate, arch wide, and overjet.”
The tongue’s mobility and patterning governs how our palate forms and shifts throughout our life. This is well referenced in both OM and SLP literature – patterns of tongue thrust swallow, thumb sucking (vagal stimulation) and absence of breastfeeding all have an impact on how the palate is shaped.
RESTRICTION OF THE PHARYNX/BASE OF TONGUE AND SNORING

How snoring occurs

When we are awake, the muscles of the throat hold the throat open, so that air passes smoothly as we breathe. During sleep, these muscles relax and the throat sags inward, causing air turbulence.
IMPACT OF RESTRICTION ON MANDIBULAR AND MAXILLARY FORM
TONGUE ANATOMY

Concept of restriction limiting elevation and posterior movement of the pharyngeal section of the tongue – far more functional implications than tongue tip restrictions
Superior mental spines

Genioglossus

Mylohyoid

Hyoid

Mylohyoid

Geniohyoid

Genioglossus
COMPLEX LAYERS – THE DYNAMIC RELATIONSHIP OF TONGUE MUSCLE FIBRES AND HYO-LARYNGEAL MOVEMENT
SENSORY FEEDBACK LOOPS

Sensory feedback loops and the importance of normal function stimulating normal nervous system morphology.
BREAKDOWN OF MOVEMENT RESTRICTIONS AND THE IMPACT OF THIS ON NORMAL FUNCTION OF THE LARYNX & PHARYNX

Immobilisation of the hyoid bone has flow on impact for constrictors which stimulate peristalsis, kick starting smooth muscle function and altering how food is moved through the pharynx.

Extra tension in the pharynx and larynx has an impact on the production of voice.
HOW WE MAKE VOICE
MUSCLE TENSION DYSPHONIA

• Inappropriate contraction of the vocal folds, or vocal abuse or misuse result in disturbances to breathing and speech.

• Other symptoms include hoarse voice, neck pain, muscle fatigue, even loss of voice.
INCREASED TENSION/RESTRICTION LEADS TO:

- Eye muscle difficulty
- Snoring
- Neck and shoulder pain
- Mouth breathing
- Muscle Tension voice disorders
- Swallowing problems
43 year old female

Medical History:

- Gastro-esophageal reflux
- Diagnosed as celiac from bloods but no further examination
- 12 years of articulation therapy as a child
- Chronic neck & shoulder pain (investigations inconclusive, managed conservatively through pain relief and osteopath input)
- Seasonal allergies
- Ovarian cysts
- Upper lip tie ripped at 6yo
- “Classical” tongue tie
CASE STUDY CONT (43YO FEMALE)

- Mild dysphagia for medications taken with water – getting worse as time goes on
- Noticing speech had deteriorated (no neurological cause)
- Recently promoted and very self conscious of speech etc
- Reflux getting worse – increased medication dose (Nexium)
- Orthodontic improvements from braces (age 14) beginning to deteriorate
CASE STUDY CONT (43YO FEMALE)

- Oral assessment results: severely impaired oral kinesthetic ability
- Tongue thrust swallow
- Poor laryngeal elevation and excursion
- Mastication impaired – non-rotational pattern
HOW DOES A TONGUE TIE ALTER SWALLOW?

• Mukai et al (1993) study demonstrated – altered position of the larynx and deviation of the epiglottis (corrected postoperatively)

• Geddes et al (2) Ultrasound study showed different tongue movement patterns (two different patterns) but NOT normal movement

• Abnormal movement alters airway protection ability
WHAT DOES A NORMAL SWALLOW LOOK LIKE?

Image from http://americandysphagianetwork.org/physician_education_course
A tongue thrust, or immature, swallowing pattern is part of a profile of disorders termed ‘orofacial myofunctional disorders’.

The pattern of tongue movement does not change to a normal, more adult pattern.

It changes oral posture for breathing, speech and swallowing.
SIGNS OF DYSPHAGIA

• Choking or coughing while eating
  • Choking or coughing when eating solid foods or swallowing liquids
• Weight loss/skipped meals
  • Loss of weight because eating is now difficult or unpleasant
  • Not eating because it is less enjoyable than it used to be
• Ineffective swallowing
  • Difficulty swallowing medications
  • Difficulty swallowing a specific food or liquid
  • Getting the feeling that food is stuck in the throat
  • Having trouble clearing food from the mouth in one swallow
• Airway issues
  • Food going down the "wrong pipe"
  • Voice sounds "gurgly" or wet when eating
  • Having repeated episodes of pneumonia and/or respiratory illness
A DYNAMIC, ELASTIC SWALLOW

Video from http://www.youtube.com/watch?v=4FMnXz6o2vI
NORMAL SWALLOW VIDEOFLOUROSCOPY
<table>
<thead>
<tr>
<th>Medications Associated with Swallowing Disorders</th>
<th>Effect on the Swallowing Process$^{3, 4}$</th>
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<tbody>
<tr>
<td>Anticholinergics/Antimuscarinic</td>
<td>Affects smooth muscle function and coordination of the esophagus</td>
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<tr>
<td>Angiotensin-converting enzyme (ACE) inhibitors</td>
<td>Causes xerostomia (dry mouth), thus impairing food transport</td>
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<td>Antiarrhythmics</td>
<td>Causes a loss of sensory afferent input which results in a feeling of impaired or uncontrolled swallowing</td>
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<td>Calcium Channel Blockers</td>
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<td>Diuretics</td>
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<td>Antiemetics</td>
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<td>Antihistamines and Decongestants</td>
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<td>Selective Serotonin Reuptake Inhibitors (SSRIs)</td>
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<td>Tricyclic Antidepressants</td>
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<td>Local Anesthetics</td>
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<td>Antipsychotic/Neuroleptics</td>
<td>Blocks dopaminergic transmission which can result in extrapyramidal syndrome similar to Parkinsonism; over time the resultant dopamine supersensitivity may lead to irreversible tardive dyskinesia in 20% of persons taking for 1+ years. The orofacial and lingual muscle syndrome may progress until the patient is unable to chew or swallow.</td>
</tr>
<tr>
<td>Antineoplastics/Immunosuppressants</td>
<td>Chemotherapy injures the esophageal mucosa due to cytotoxic effects. Prolonged use of immunosuppressants predisposes to viral and fungal infections of the esophagus.</td>
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<td>High Dose Corticosteroids</td>
<td>Over long periods of time, can cause esophageal muscle wasting</td>
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<tr>
<td>Benzodiazepines</td>
<td>Depresses the CNS, causes drowsiness or confusion and decreased voluntary muscle control, making it difficult to initiate swallowing</td>
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<td>Narcotics</td>
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<td>Skeletal muscle relaxants</td>
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<tr>
<td>Aspirin</td>
<td>Causes local irritation of the esophageal mucosa within 4-12 hours of ingestion</td>
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<td>Non-steroidal anti-inflammatory drugs (NSAIDs)</td>
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<td>Biphosphates</td>
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<td>Antibiotics - Acid Containing</td>
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<td>Iron-containing products</td>
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<tr>
<td>Vitamin C (ascorbic acid) products</td>
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<tr>
<td>Antiarhythmics</td>
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"THE CONSEQUENCES OF DYSPHAGIA VARY FROM SOCIAL ISOLATION TO THE EMBARRASSMENT OF CHOKING OR COUGHING AT MEALTIME, TO PHYSICAL DISCOMFORT, AND TO POTENTIALLY LIFE-THREATENING CONDITIONS. BOTH OVERT ASPIRATION AND SILENT ASPIRATION MAY LEAD TO PNEUMONIA, EXACERBATION OF CHRONIC LUNG DISEASE, OR EVEN ASPHYXIATION AND DEATH."

* Robbins et al
CASE STUDY: 78YO FEMALE

Referred to SLP after investigations with ENT and gastroenterologist failed to reveal causal factor for swallowing and voice problems. History of dysphagia dating back to 1974 (first videofluoroscopy) – managed through positioning and diet modifications. Now presenting with extreme weight loss, malnutrition risk, involved with dietitian support for last 12 years but supplementation now failing to keep weight stable. Unable to manage more than puree at the time of assessment. Diagnosed with achalasia and cricoesophageal dysfunction.

Mild TIA in 2008 with no obvious residual problems or changes in swallowing or voice presentation.

Also diagnosed with presbyesophagus and "age related" voice disorder.

38 years on mashed and pureed foods... 41,610 pureed meals
ACHALASIA &/OR ESOPHAGEAL DYSMOTILITY

• Reported in nearly all patients seen with tongue tie over the age of 35 – gastric reflux and in many older patients, Achalasia

• Significant health risks associated with untreated GORD

• Likewise significant health risks associated with long term medication used to control GORD

• What is achalasia?
  • Esophageal Achalasia is "Failure of normal relaxation of the lower esophageal sphincter associated with uncoordinated contractions of the thoracic esophagus, resulting in functional obstruction and difficulty swallowing."
  
  Also known as cardiospasm or esophageal aperistalsis.
ACHALASIA (CONT)

The **oesophagus**, also known as the **gullet** or **swallowing tube** is the tube that connects the throat (pharynx) with the stomach, it is located between the windpipe (trachea) and the spine. It goes down the neck and joins the upper (cardiac) end of the stomach.

An adult oesophagus is approximately 10 inches (25 cms) long. When we swallow, the muscles within the oesophagus walls contract and push the food or liquid down into the stomach. Glands within the oesophagus produce mucus, which facilitates swallowing.
ACHALASIA (CONT)

Cause of achalasia is unknown.
There is incomplete lower oesophageal sphincter relaxation and increased tone. The smooth muscle inside the oesophagus cannot move food down properly - known as aperistalsis of the oesophagus.

Typically, the patient may experience only minor problems and ignores them. Eventually, however, swallowing of food and liquid becomes harder to do.

Long term uncontrolled achalasia results in changes to ganglion receptors in the lower oesophagus
Places people at risk of Barrett's oesophagus (and associated Ca)
SYMPTOMS OF ACHALASIA

- Dysphagia - difficulty in swallowing
- Regurgitation of undigested food
- As symptoms worsen regurgitation involves liquids as well as foods
- Some may experience weight loss
- Coughing, especially when lying down
- Chest pain, often perceived as heartburn. In some cases the patient may think he/she is having a heart attack
- Aspiration - food, liquid and saliva which is retained in the esophagus can be inhaled into the lungs
- Symptoms are usually mild and ignored at first, but typically get progressively worse.
IS ACHALASIA LINKED TO TT?

No clear link in literature.

Almost all adult patients with TT + dysphagia have Sx of achalasia or oesophageal dysmotility

In all patients treated with frenectomy + rehabilitation through our clinic to date (n=23), the symptoms of achalasia &/or GORD reduced or reversed

As we see with all chronic changes in physiology resulting from untreated TT – achalasia and GORD both alter the body’s normal state over time by changing nerve feedback and brain morphology
POTENTIAL REASONS FOR TT + ACHALASIA?

TT causes disruption to the normal action of smooth and volitional musculature involved in swallowing.

Achalasia develops as a disruption to normal smooth muscle movement.

Over the course of a lifetime, if you disrupt the correct neurological triggers and pathways to the gut through impaired swallowing, could this not conceivably have a ‘flow on’ effect to the smooth muscles adjoining the tongue that are governed by tongue motion?
SPEECH DISTURBANCES IN TT

• In traditional SLP literature there is little link to tongue tie being directly associated with articulation deficits.

• Restrict one of the primary articulators in speech, and you alter the dynamics and features of articulation.

• Normal function – but is it optimal function for that individual?
HOW DO WE ARTICULATE?
(OR AS A DOCTOR ONCE ASKED ME - WHY WOULD YOUR TONGUE MATTER WHEN YOU TALK?)

• Speech does not start in the lungs. It starts in the brain
• After the message is formed, we produce physical sequences necessary to form speech.
• Air is directed upwards from the lungs, through the trachea and the oral and nasal cavities.
• Involves four processes: Initiation, phonation, oro-nasal process and articulation.
THE IMPACT ON VOWELS

Back Vowels

/u/    /u/
/o/    /o/
/a/
“CLASSICAL” ARTICULATORY ERRORS ASSOCIATED WITH TT

- Gliding
- Lisping
- Difficulty with oral kinesthetic awareness contributing to phonological processes (such as fronting ‘t’ for ‘k’ or backing ‘g’ for ‘d’)
- Resistant to generalizing artic therapy principles into conversation
- Tongue tip sounds - /l/, /d/, /z/, /s/ - usually only impaired with anterior tongue ties. Often are not affected in PTT.
LESS OBVIOUS (BUT MORE FREQUENT) ARTICULATION PROBLEMS

- Salivary control (spitting when talking)
- Stumbling over words when emotional
- Problems coordinating speech when under pressure
- Impairment during times of fatigue
- “Psuedo” Verbal and Oral Dyspraxia
FLUENCY DISTURBANCES

- Articulation requires rapid shaping and precise movement of the tongue.
- Fluency requires coordination and feedback online (listening to your own speech and adjusting it).
- High emotions mean increased tension = less ability to coordinate precise movements.
- Not a true stutter – situation specific and can be controlled easily.
REHABILITATION, FRENNECTOMY AND ‘FUNCTIONAL’ TIES

• Work with the individual to ascertain how much their tongue or lip tie is impacting on their function
• Facilitate decision making around options for treatment
• Empower the family/person with knowledge
• Emerging evidence base – so relate back to individuals situation and symptoms
Once you are aware of how the restriction changes the body, you can look at the likely trajectory of the individual.

Clinical experience & emerging data shows us that early intervention can prevent functional difficulties – therefore allows more normal neurological development.

But once we are living with these difficulties?
- Assess all aspects of the person’s presentation
- Voice, swallowing, speech, digestion, gut function, muscle tension, respiration, posture/other structural aspects.
THE GOOD NEWS

• Rehabilitation makes a difference

• Neuroplasticity throughout the lifecycle means that with the right re-training, we can re-model our brains to work better
Remember – the TT/ULT are the symptoms of the genetics of that individual.

Treating the tie is not a silver bullet – but a great start!

Holistic approach needed with input from MDT
• TT changes the position of the larynx. Changes the dynamics of the swallow
• TT restricts planes of motion – particularly lingual elevation and BOT to PPW function
• This then creates oral posture issues – heightened risk of mouth breathing, tongue thrust swallow, sleep apnoea, altered articulation and decreased tone
• This then implies that a person with TT is unable to develop a normal, mature swallowing pattern (but it also alters normal infant/immature swallow pattern)

• In turn, it also alters laryngeal function (high risk/incidence of voice disorders especially voice tension disorders)

• Individuals even with severe TTs may achieve acceptably ‘normal’ speech – but lingual fine motor coordination and advanced function are altered. This is usually evident in connected speech.
SUMMARY

Because of the complex nature of how a tie ‘winds’ a body around itself, in both form and function, we must expect that a multi-disciplinary team is required to bring the skills required for proper rehabilitation.

We must accept that if you alter a person’s usual anatomy, you also alter their physiology – and even their brain morphology.

When we perform surgery, we are counting on neuroplasticity… but we know recovery needs help to happen without the occurrence of new maladaptive behaviors.
SUMMARY

• Thereby under principles of rehabilitation, we must recognise that to optimize function, we must assist the person to obtain a new pattern function to reflect their new, more optimal physiology post frenectomy.

• Rehabilitation must focus on maximizing function rather than just ROM and healing post-frenectomy – but must eliminate old, poor habits for posture, breathing, voice, speech and swallowing.
We must acknowledge how deeply an untreated tie alters physiology, neurology and morphology before we can adequately help the individual to ‘unwind’.
Thankyou.

Come and visit us down in paradise anytime 😊
...you can’t miss us – last stop before the ice!
REFERENCES


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http://www.jeffersondental.com/assets/docs/mouthBreathing.pdf