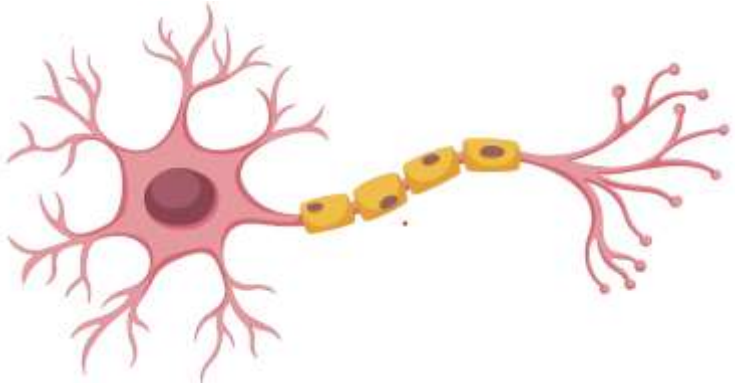
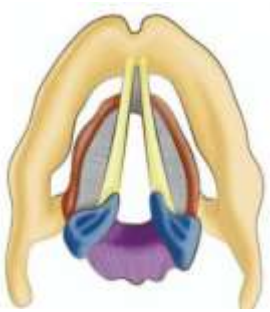
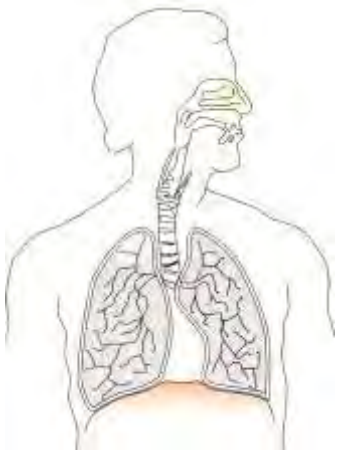
Neural and Skeletal Mobility in Vocal Function and Respiration

Eric Noll DPT. Cert. MDT







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No disclosures

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BS Biology 1992 Creighton University
Doctorate in Physical Therapy 1999 Creighton University
Publications

- J.H. Gilmore, V.J. Watts, C.P. Lawler, E.P. Noll, D.E. Nichols, R.B. Mailman. **"Full" dopamine D_1 agonists in human caudate: Biochemical properties and therapeutic implications.** Neuropharmacology Volume 34, Issue 5, May 1995, Pages 481-488
- E Noll , A Key, G Jensen. **Clinical reasoning of an experienced physiotherapist: insight into decision-making regarding low back pain** Physiother Res Int.

Credentialled McKenzie Method 2002
Extensive training in the Neuro-orthopedic Institute
Work Experience

- UNMC- spine specialist outpatient orthopedics 1999-2001
- HealthSouth- spine specialist orthopedic outpatient clinic 2001-2004
- Noll Spine Rehabilitation- sanitation specialist 2004 present

McKenzie Method

Dynamic assesement tool used originally to determine mechanical versus non-mechanical origin of symptoms.

Based on repeated movement stress testing to create correlation between movement and symptoms response.

Correlation coefficient .93 between McKenzie exam relative to .60 for MRI with respect to origin of pain.

Never applied to vocal function and respiration as functional outcomes measures

Classic disc model as an example.

Mechanical Therapy = Laws of physics applied to the body

Combination of skeletal mobility, soft tissue mobility, and neural mobility

Looking for deviation from accepted norms.

Correlate deviations form norms to causing symptoms

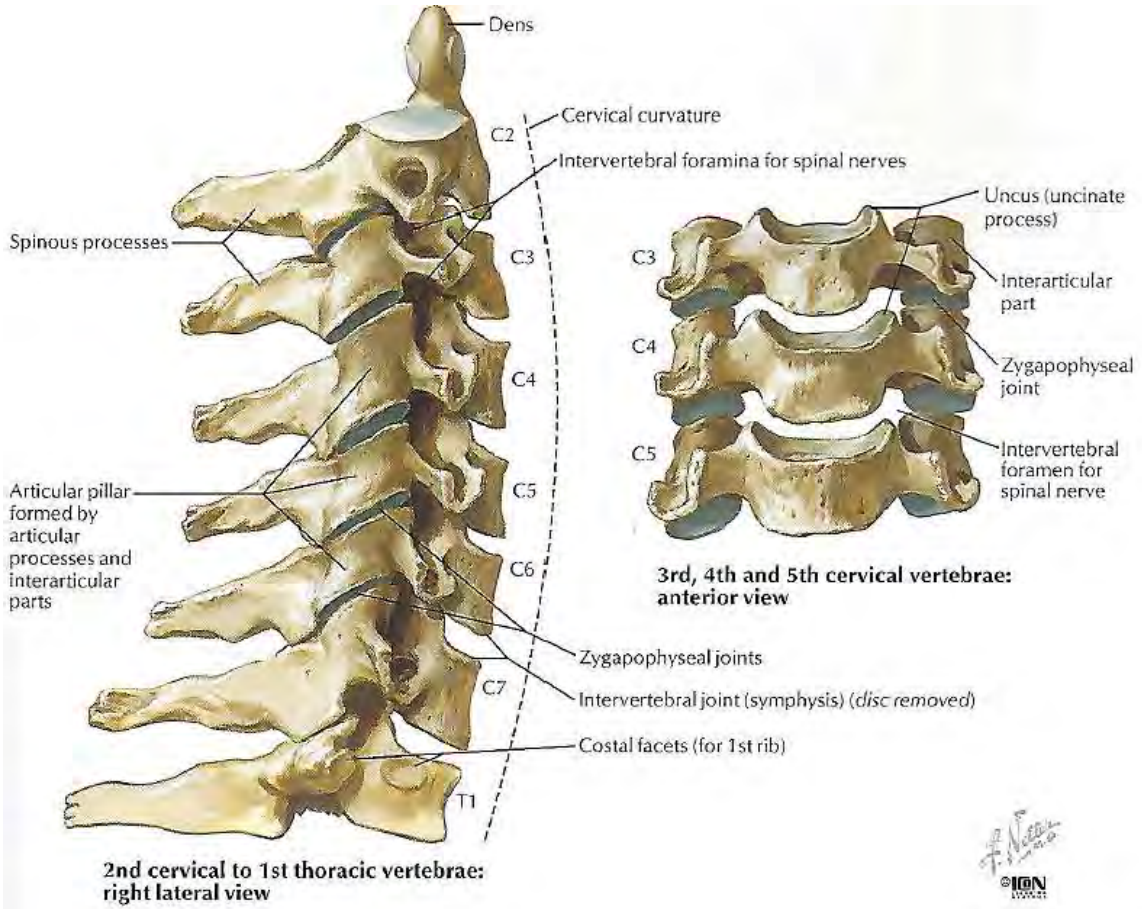
Apply force to the system and observe change.

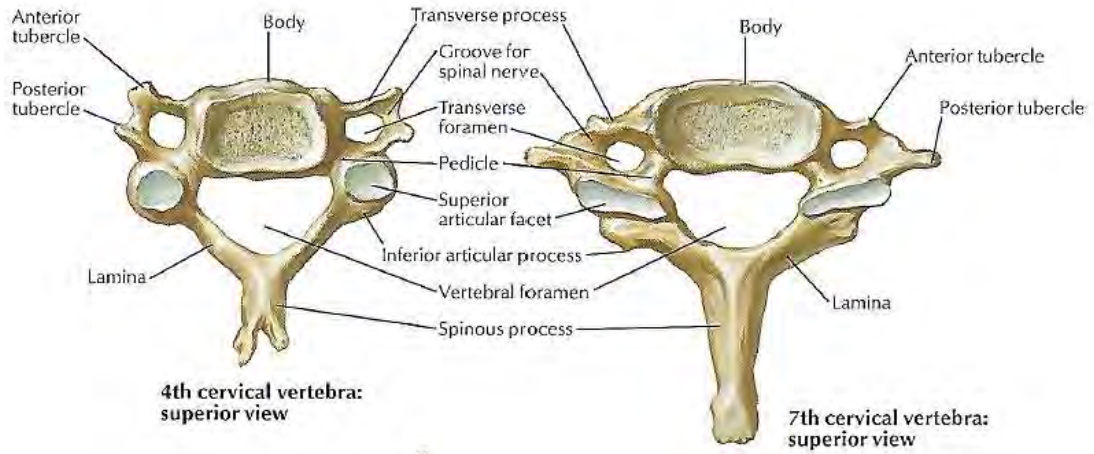
Change the deviations (Better or worse) and see if symptoms change.

If we can change it, we can fix it!

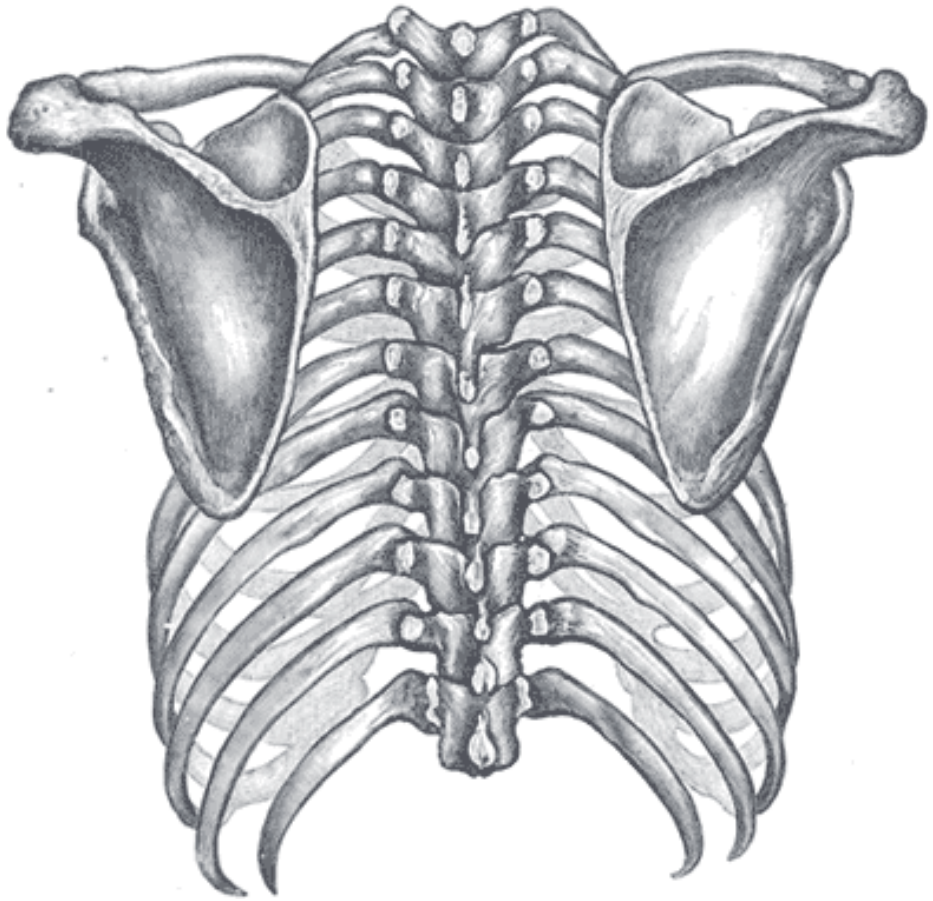
- Now we apply this same logic to a novel situation (ie dypsnea) see what happens. If it moves in a more efficient way, that should allow the system to move more freely, less restriction, less painful, more optimized.

Skeletal Mobility : Cervical Vertebrae Anatomy





Skeletal Mobility : Thoracic Spine and Ribs



Skeletal mobility – cervical, thoracic, and lumbar spines, sacroiliac joints, ribs, sternum

Characterized by free movement in all three planes without restriction
Restricted by ligaments and guarding behavior of muscles.
Improved by progression of force applied from patient continuing through to spinal manipulation
Amount of force necessary to cause change
How does the patient feel after changing skeletal mobility?
Is there a correlation between increased mobility and the reason the patient came to physical therapy?

How do you change skeletal mobility? Through soft tissue mobility, neural mobility, mental mobility, and …. skeletal mobility!

Skeletal Mobilization : Clinical Indicators

- Limited Range of motion in one or all planes
- Pain and end range or during motion
- Pain with sustained activity
- Pain at rest

Not exclusive to skeletal restrictions

Neural Mobility- Nerves need room to move, movement, and blood supply to be healthy

Spinal cord elasticity- 10 cm difference between erect and flexed(Brieg et al 1979)
Spinal nerves at the neural foramen- 3-5 mm movement
Peripheral nerves 2-3 mm movement **The Excursion of the Median Nerve during Nerve Gliding Exercise: An Observation with High-resolution Ultrasonography**

- Ayumu Echigo MS, OT, Mitsuhiro Aoki PhD, MD, Sumio Ishiai PhD, MD, Masato Yamaguchi, Mariko Nakamura PhD, OT, Yuji Sawada PhD, OT

Tensioners and Sliders (Mobilization of the Nervous System Butler et al)
“Farthest from the fire” first.
Peripheral neurogenic versus Central sensitization--- A Sensitive Nervous System!

Elasticity of the cord Increases spinal length with trunk flexion.

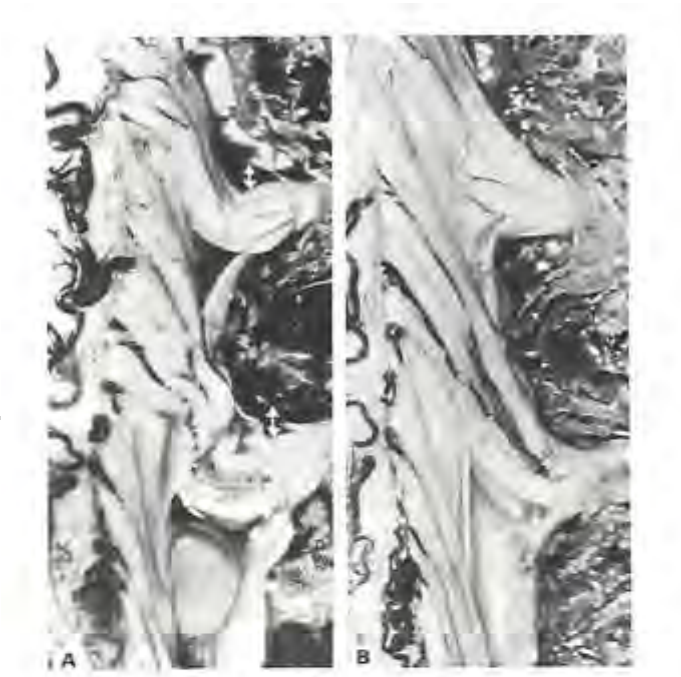


Fig. 2.8 Normal deformation of the dura, cord and nerve roots in the cervical canal in the cadaver due to full extension and flexion of the cervical spine. A total laminectomy has been performed and the dura opened and retracted although still able to transmit tension.
In A the cervical spine is in extension, the nervous system is slack, the root sleeves have lost contact with the pedicles (lower arrows) and the nerve roots with the inner surfaces of the sleeves (upper arrows).
In B the cervical spine has been flexed, the nervous system including the dura mater has been stretched and moved in relation to surrounding structures. Note that the root sleeves have come in contact with the pedicles and the nerve roots with the inner surface of the sleeves. Note also the change in shape of the blood vessels. From: Breig A 1978 Adverse mechanical tension in the central nervous system, Almqvist & Wiksell, Stockholm, with permission

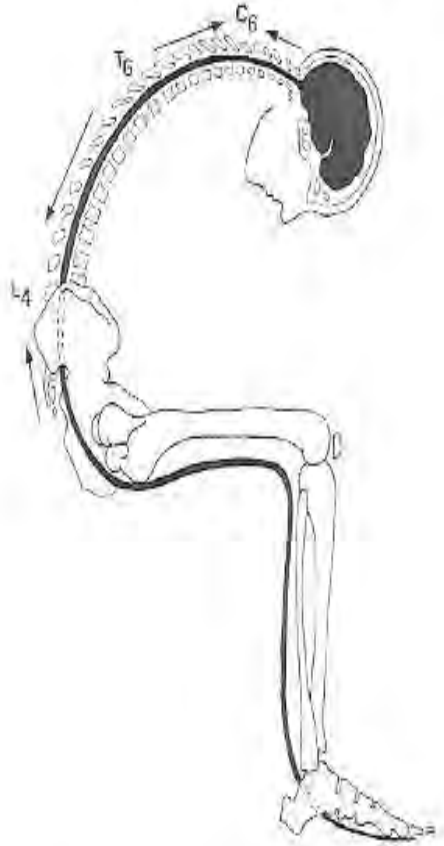


Fig. 2.9 Postulated neurobiomechanics from spinal extension to spinal flexion. The approximate points C6, T6 and L4 are where the neuraxis and meninges do not move in relation to the movements of the spinal canal. Adapted from Louis (1981)

Spinal root mobility in neural foramen with straight leg raise

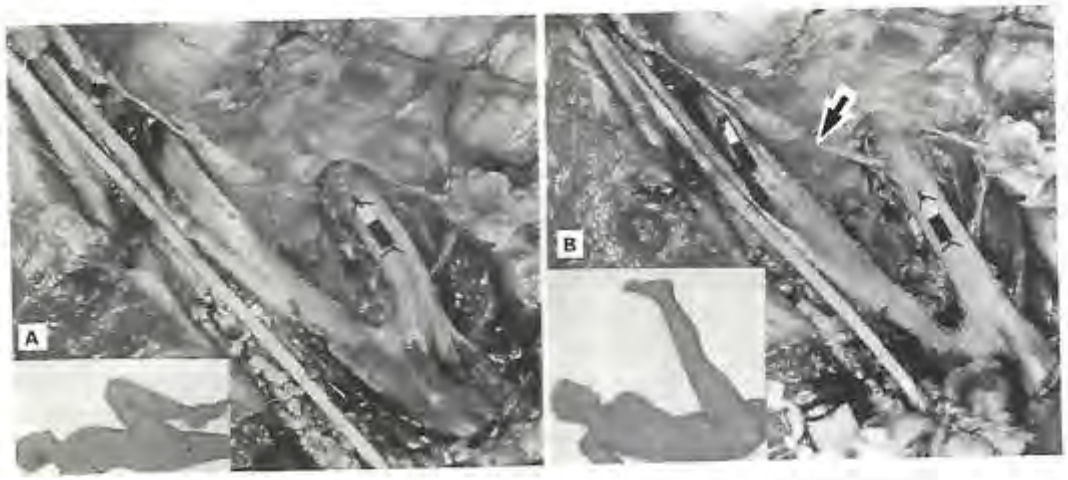


Fig. 2.10 The sacral plexus and the exits of the spinal nerves through the intervertebral foramina. Paper markers have been sutured to the nerves. In A, with the rest of the body in an 'anti-tension' position and the hip in some flexion, the nerve is drawn into the intervertebral foramina. In B, the effect of the Straight Leg Raise on the nerve is evident as the nerve is drawn out of the foramen. Note also the sympathetic trunk (arrow) tightening up during the SLR. From: Breig A 1978 Adverse mechanical tension in the central nervous system, Almqvist & Wiksell, Stockholm, with permission

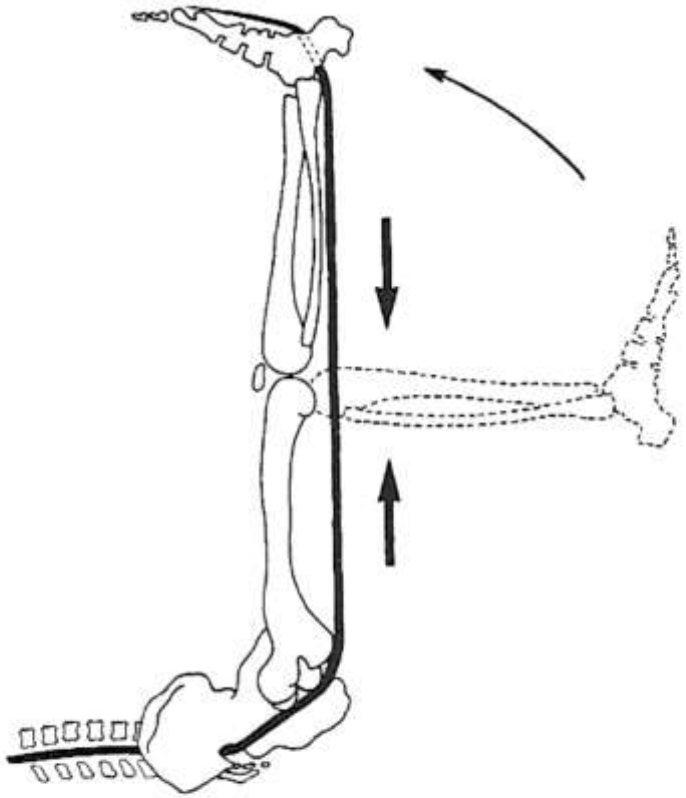


Fig. 2.11 Postulated neurobiomechanics during knee extension in hip flexion. The nervous system proximal to the knee is drawn caudal in relation to the interface and the nervous system distal to the knee moves rostral. At the point of movement, there is no movement of the nervous system in relation to the surrounding interfacing structures. Adapted from Smith (1956)

Neural Mobilization : Clinical Indicators

- Positive straight leg raise reduced with cervical flexion
- Symptoms in variable locations
- Headaches and gut symptoms
- Temporomandibular joint dysfunction
- Emotional volatility

Again, not exclusive to restriction in neural mobility.

The eggs to go with my chicken, or vice versa!

Soft tissue Mobility- distensibility and contractility of muscles, mobility of fascial planes

Relevance of balance between groups(front to back, triplanar, force couples)

Circulation and waste removal essential for homeostasis

Sarcomere allowing full joint mobility versus contracture

Palpation of spinal and soft tissue has low reliability (Chiropr Man Therap. 2021; 29: 33.)

Mental Mobility

Believe you can be better, or not.

Phantom Limb Pain model of recovery (Ramachadran et al.,)

Stress causes increase/decrease in soft tissue mobility

Visualization for sports and performance enhancement

Special morsels to chew on with the molars of your mind!

Having developed a method that appears to work rather well…..(McKenzie, 1981)
Passive accessory motion of joints (ie Chiropractic)
Strengthening makes muscles “looser” (intrafusal fibers, hypertonicity)
Relevance of the sympathetic nervous system on tightness.
Progression of forces - the least amount of force to achieve the desired result.
“End range is where the truth is”. Robin McKenzie
Learning from the shadows per Lorimer Moseley

Head scratcher moments

1997 Dr. Ray and injecting saphenous nerve for relief of medial knee pain
2011 Achilles tendonitis/plantar fasciitis abolished with neural mobilization
Performance enhancement with neural mobilization
John V. upper limb tension testing and change in neurogenic cough
Mary S. vocal cord paralysis change in one visit with long sit stretch.

Skeletal mobilization

Hands Off! McKenzie Rule to only use force necessary to effect change.

- Cervical retraction, retraction with extension
- Lateral flexion/rotation as needed
- Cervical flexion

Hands On??? Are you prepared for that level of commitment

- Mulligan Mobilization with Movement
- McKenzie traction with retraction and extension with rotation
- Lots of philosophies with manual therapy (Australian, Norwegian, etc.)

Self-manipulation

- Mulligan Self-Snags
- Lateral flexion manipulation
- Fist Traction

Neural Mobilization

Assess for sensitivity, apply principle of distal to proximal

- Long sit stretch plus cervical ROM
- ‘Full Forward Fold’
- Straight Leg Raise+ dorsiflexion
- X-leg SLR + inversion
- ‘Plow’
- Upper limb tension testing x3

Case Example: Vocal Cord Paralysis

Mary S. 59 year old female referred for left vocal cord paralysis. Onset 3 months after cough then laryngitis. Primary symptoms are right neck and scapula pain, raspy and gravely voice requiring higher pitch in order to speak, with limited right cervical rotation. Worse with speaking and better with playing tennis!

- Clinical presentation consistent with patient reports. Baseline symptom of gravely voice and 25% limited right rotation serve as barometer of change.
- Long sit stretch decreased gravely nature and lowered pitch, cervical retraction decreased gravely sound without changing pitch
- Supine Straight leg raise demonstrated positive adverse neural tension. After neural mobilization increased vocal function and increased ROM.
- **She was encouraged to return to Dr. Dowdall to repeat scope and see if any change in vocal fold paralysis and found improvements noted after first visit resulted in movements in vocal cord. On final visit noted increased vocal strength and quicker recovery after long speaking events.

Case example: Neurogenic Cough

John, a pediatrician with longstanding greater than 5 years persistent cough. Seen in speech therapy elsewhere and suggested he lower his pitch and enunciate to decrease stress on vocal cords. Symptoms include scratchy throat and uncontrollable cough. 61-year old male. Personal friend and patient of Dr. Bingcang self-referred for treatment.

- John presents with frequent disruptive cough for 5-10 seconds then calm for 30 seconds. With lower pitch able to speak without coughing.
- John's ROM within normal limits for all planes. Long sit stretch no effect on symptoms. Upper limb tension median nerve bias instantaneous abolition of cough. Return to neutral position cough returns. With long sit position plus Upper limb tension position abolish cough and remain better as a result. Longstanding recovery to normal vocal function without symptoms and if symptoms return performs exercises to abolish and remain better.

Case Example: Dyspnea

Angie C. referred by Dr. Dowdall for dyspnea. Her symptoms are shortness of breath at rest and very light exertion, chest tightness, and substernal discomfort. Onset of symptoms insidious a few years ago. Very skeptical of what we have to offer.

- Clinical presentation- shallow inspiration with passive accessory breathing, tightness in chest at rest.
- Long sit stretch sustained decreased symptoms in chest and increased volume of breathing instantly, not better as a result.
- Straight leg raise with dorsiflexion showed positive adverse neural tension, better as a result with decreased chest tightness and increased inspiration volume.
- *Patient noted lateral thorax moving with inspiration, something she noted Amber had mentioned as a goal for speech therapy. The look in her eye was priceless!

Case Example: Snoring??

Michael 58 year old snorer. Wife wears earplugs . 30 minutes deep sleep nightly. After one treatment of neural mobilization before bed, 94 minutes of deep sleep and wife said no snoring. Maybe be worthy to investigate further for relevance on sleep apnea, etc.

- 9 patients who have undergone treatment have wives describe their husbands as no longer snoring.