Normalization of Muscle Function

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What is it?

- 3-dimensional approach to diagnosis & treatment
  - Considers agonist and antagonist neurological muscle balance
    - Utilizes a variety of muscle testing & structural diagnostic approaches
- Osteopathic Manipulative Medicine
  - Counterstrain
  - Muscle Energy Technique
  - Myofascial Release
- Comprehensive Approach
  - May incorporate injections, stretching and acupuncture
  - Utilizes the Exercise Rx
Pathogenesis of Muscle Dysfunction

**Trauma**
- Direct Trauma
  - Tissue Injury
- Indirect Trauma
  - Strained muscle (*spindle imbalance*)
  - Neurologically maintained
    - Somatosomatic reflex
    - Viscerosomatic reflex

**Postural**
- Neurological & Myofascial Imbalance
Tissue Injury

Damaged tissues

Mediators of Inflammation

Damaged myofibrils

Damaged Fascia

Damaged microcirculation

Nociception

$c = \text{characteristic}$

$p = \text{part}$

$r = \text{result}$

Chila, FOM3, 2010; p. 751
Nociception occurs in the brain

Neurologically mediated protection

Muscle Imbalance

Tenderpoint formation

Chila, FOM3, 2010; p. 751
Spindle

Stretch reflex

proprioception

Sense of where a body part is in space

posture

locomotion

c = characteristic
d = definition
r = role
Spindle During Motion/Posture

Proprioceptive balance

c = characteristic
p = part

Extended
Agonist
Antagonist

Flexed
Agonist
Antagonist

agonist
antagonist
Spindle Role During Muscle Imbalance

- Spindle
  - Proprioceptive Imbalance
    - Agonist
      - contracted
    - Antagonist
      - relaxed
    - Antagonist
      - contracted

c = characteristic
p = part
3-Dimensional Approach to Diagnosis & Treatment

Normalization of Muscle Function
A.T. Still, MD in regards to a 4 yo with flux

“While walking along I thought it strange that the back was so hot and the belly so cold; then the neck and back of his head were very warm, and the face, nose, and forehead cold...

As I began at the base of the brain, and thought by pressures and rubbings I could push some of the hot to the cold places, and in so doing I found rigid and loose places on the muscles and ligaments of the whole spine, while the lumbar was in a very congested condition...

She came early next morning with the news that her child was well.”

Autobiography of A.T. Still, Kirksville, MO 1899
“The fascia is the place to look for the cause of disease & the place to consult & begin the action of remedies in all diseases.”

- A.T. Still, MD
Zink’s Common Compensatory Patterns
Compensatory Patterns

**Common Compensatory**
- 80% of healthy people
- L/R/L/R

**Uncommon Compensatory**
- 20% of healthy people
- R/L/R/L

Un-Compensated Patterns

- Usually symptomatic
- Usually, a trauma is involved

One more type of pattern...ideal
Craniocervical Junction

Extreme Mobility

Hypertonus of Postural muscles

Disturbed Equilibrium

Locomotor Deficits

P = part
I = influences
-C = characteristic
-R = negative results

There is a myofascial arthrodial continuity throughout the body

“…Thus, perimysium (fascia) is anatomically continuous with peritendium, which is anatomically continuous with periosteum on bone. All of these structures lack the well-defined border such as exists at a myotendonous border or an endthesis where muscle joins bone, respectively.”
Continuity of Fascia head to toe

- Appendicular to Axial fascia
- Human dissection of fascia from plantar fascia to epicranial fascia

continuity
“For every tightness, there is a three-dimensionally related looseness. Commonly, the looseness is in exactly the opposite direction from the tightness.”

- Robert Ward, DO, FAAO

Fascia able to contract and relax?

- Presence of smooth muscle – like fibroblast (myofibroblast)
- Human Fascia: lumbodorsal, plantar and fascia lata
- Used monoclonal marker for $\alpha$ – smooth muscle actin
- Myofibroblast present in all tissues
- Mepyramine $\rightarrow$ Contraction lasting up to 2 hours
- Predict Tcontract Force >5N

Image: Schleip. R. and Lehman-Horn, F.


Slide originally made by & used with permission from Jesus Sanchez, DO, WUHS, COMP, NMM/OMM Department
Tight-Loose Relationship

Key
+ = tight
- = loose

Polymodal Innervation of Fascia

- Approximately 20% of cutaneous high-threshold mechanoreceptors supplying the skin also have receptive fields in the subcutaneous tissue...the loose fascia.

- Stretch receptors for muscles
  - Only 25% in the muscle
  - 75% consists of free endings in fascia

- 80% of the C fibers are polymodal

- Liquid crystal-like properties
  - Piezoelectricity

Pseudoparesis

Postural Muscles

Facilitation

Shortening

Hypertonicity

Movement Muscles

Inhibited

Hypotonicity

Stretched
Sherrington’s Law: When a muscle receives a nerve impulse to contract, its antagonists, receive, simultaneously, an impulse to relax.
Hip Region Pseudoparesis

Postural Muscles *hypertonic*

Movement Muscles *weak*

- Iliopsoas
- Piriformis
- Adductors
- TFL
- Gluteus Medius
- Gluteus Maximus
Lower Trapezius

Shoulder Region Pseudoparesis

Supraspinatus

Movement Muscles weak

Infraspinatus

Deltoid

Rhomboids

Upper Trapezius

Pectorals

Levator Scapula

Postural Muscles hypertonic
Results of Pseudoparesis

- Hypertrophy and retraction unfavorably influences the contractile ability of the muscle fibers.
- In addition, it may lead to impaired circulation producing ischemia and thus accelerating degeneration.
- Ultimately, the whole process results in a “functional disability”
Osteopathic Manipulative Treatment

Normalization of Muscle Function
OMT Aimed at Muscles

- Counterstrain
- Muscle Energy Technique
- Myofascial Release
Comprehensive Approach

Normalization of Muscle Function
'Patients come into your practice & it’s raining on them. It’s up to you to find the sun that is shining just beyond the clouds’

-Rolin Becker, DO
Applied Anatomy

- **Origin**: from between the anterior & posterior gluteal lines on the external surface of the ilium.
- **Insertion**: upon the lateral surface of the greater trochanter of the femur; the tendon is separated from the femur by a bursa.
- **Innervation**: superior gluteal nerve (L5 & S1).
- **Action**: abducts & medially rotates the thigh; stabilizes the pelvis during gait.
- **Functional Unit**: synergistic with the gluteus minimus, tensor fasciae latae, sartorius, piriformis, the iliopsoas & the gluteus maximus muscles for *thigh abduction*; antagonists are the adductor group
Pain Referral Patterns/Symptoms

- **TrP pain** that can be both persistent & severe, as pictured at left.
- **Anterior TrPs** refer pain to the lower buttocks; the lateral aspect of the thigh, knee, & along the length of the peroneal muscles.
- **Posterior TrPs** refer pain to the lower medial aspect of the buttock & along the posterior aspect of the thigh & calf (lateral gastrocnemius area).
- **Pain during the gait cycle, especially in the hip**
- **Difficulty sleeping on their side & any position that directly compresses the TrPs**
- **Discomfort when sitting** due to compression of the TrP/s
- **Difficulty in rising from the seated position**
Activating/Aggravating Factors & Differential Diagnosis

**Activating/Aggravating Factors**

- **Acute overload**, as what may occur in a fall or when trying to protect oneself from a near fall.
- **Overuse**, weekend warrior syndrome (playing or working in an activity that is not done often); playing or working past fatigue/exhaustion (running, aerobics, long walks); standing or sitting too long in one position.
- **Walking favoring one leg**: As what occurs on uneven surfaces (when walking/running on a beach or road), with a cast or limp.
- **Sleeping in the lateral recumbent position** can overstretch the muscle when it is done for prolonged periods on one side & **in the supine position** for prolonged periods, which puts the muscle in a shortened position.
- **Iatrogenic**: from the trauma that results by the injection of an irritant. This muscle is much more likely to develop TrPs from an injection than other gluteal muscles.

**Differential Diagnosis**

- **TrPs** from gluteus medius, tensor fascia lata: TrP location, taut fiber direction, depth, & history aid in DDx.
- **L4, L5 or S1 radiculopathy**
- **Trochanteric bursitis**: symptoms include intense local pain that radiates to the lateral thigh, aggravated by walking & better with rest; pressure on the greater trochanter reproduces the pain.
- **Somatic dysfunction of the SI, Inominate &/or the lumbars.** Part of a syndrome associated with SI somatic dysfunction.
- **Chronic pain following spinal surgery for low back pain**
Manual Diagnostic Testing
OMT Aimed at Muscles

- Counterstrain
- Muscle Energy Technique
- Myofascial Release
Injections & Acupuncture
Cool & Stretch
Patient Instructions: Do’s & Don’t’s

★ **Do not** carry heavy bags on the affected side or light bags for prolonged periods
★ **Avoid** activities that involve turning the head in one direction for long periods
  ✓ **Do not** use a computer with the monitor angled to one side
  ✓ **Avoid** watching a sporting event or movie from the corner or front row
★ **Do not** use a cane that is too long

★ **Do not** use a phone cocked to the ear (try a headset)
★ **Avoid** sleeping in uncomfortable positions, as in a plane or car (try a neck rest)
★ **Avoid** exposure to a cool drafts on the back of the neck (don’t be shy to move or put on a turtle neck)
★ **Strengthen** latissimus dorsi and pectoralis muscles to neurologically turn off and stretch the levator scapula
Self-awareness

- One of the hallmarks of musculoskeletal pain is a loss of control.
- This exercise is designed to help patients regain control.
- Most people under stress tense their shoulders.
- To re-assert control a patient can raise their shoulders even higher, as in figure A, and then drop them, figure B.
Acupressure

- The patient uses her fingers to apply a deep pressure into the muscle.
- The pressure needs to be to the “feather’s edge” of discomfort.
- As the discomfort diminishes, apply more pressure until you reach the point that there is no longer any discomfort.
Self-stretch
Strengthening: Shoulder Shrugs
Strengthening: Shoulder Shrugs

A

B