Updated Treatment Approach of the Shoulder Girdle Complex as it Relates to Regional Interdependence with the Cervical Spine

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Objectives

• Participants will understand regional interdependence concepts for the upper quarter.
• Participants will identify evaluation techniques to rule in/out cervical involvement or origin of symptoms as it relates to shoulder girdle symptoms.
• Participants will take the differential diagnosis knowledge and apply it to treatment strategies with incorporating overflow concepts.
• Participants will learn basic exercise dosage principles and qualities based on deficits identified.
Regional Interdependence

- What is it?
  - "Refers to the concept that seemingly unrelated impairments in a remote anatomical region may contribute to, or be associated with, the patient’s primary complaint" (Wainner et al. 2007)
  - Biomechanical model of assessment and treatment
  - Test-treat-retest approach

Types of Pain

- Referred pain: Pain that is perceived in a location other than the actual site of stimulus or the tissue symptom generator
- Radicular pain: Pain that originates from the spinal nerve and symptoms are experienced remotely along the nerve root distribution.
- Somatovisceral pain: May be a source of referred pain or mimic musculoskeletal pain

Visceral & Radicular Pain
Example of Cervical Pain Patterns

Biomechanical Model

- Hypomobility vs. hypermobility
- Alignment/Posture
- Tissue trauma
- Meniscoid entrapment
- Steindler (1955) proposed 'Kinetic Chain' and described movement at one joint can affect joints above or below it. Decreased DF at the talocrural joint may produce biomechanical compensation in the knee and hip
- Pitfalls to this approach: only transient biomechanical effects are supported in the literature with studies that quantify motion, not lasting positional changes; biomechanical assessment is not reliable; joint biased techniques are dissipated over large area; forces between clinicians are not reproducible, etc

Controversy

- Bialosky et al. (2009) questioned the underlying mechanisms of RI in a commentary to Wainner et al. article (2007)
- Suggested the biomechanical model did not explain the mechanisms behind the relationships within the musculoskeletal system
- Original RI defined musculoskeletal system as primary source and manifestations of impairments
- RI concepts may have underlying neurophysiological basis and or the combination of the two (biomechanical and neurophysiological)
- Importance of combining theories may yield dose dependent neurophysiological responses
Neurophysiological Model

- Facilitated segment
- Central sensitization
- Nerve root entrapment or compression
- CRPS

Pitfalls: nerve biased techniques are not specific to a single nerve
- Responses are based on those originating from peripheral mechanisms, spinal cord mechanisms, and/or supraspinal mechanisms
- Fernandez-de-las-Penas et al (2007) conducted a study with results supporting activation of central structures since unilateral manipulation at C5-C6 produced bilateral response at the elbows for increase in PPT in healthy subjects

RI redefined

- "The concept that a patient’s primary musculoskeletal system(s) may be directly or indirectly related or influenced by impairments from various body regions and systems regardless of proximity to the primary symptom(s)"
- Functional movement patterns originate from more than one joint/region, so why not target asymptomatic regions for relief at the primary site of pain?
Case Study

• Prolonged sitting or physical inactivity is an epidemic and are identified as risk factors for work related symptoms
• Example: Stephen-35 y/o who presents with script of left shoulder impingement; insidious onset of pain x 3 months
• Symptoms: 8/10 pain, radicular N/T/pain along ulnar nerve distribution, patient frequently observed to stretch his neck
• MMT: Shoulder: WNL all planes. Weak Csp SB and rotation in sidelying; ext & L SB aggravate L shoulder symptoms

Link Between Cervical Spine & Shoulder

• Sobel et al (1996): more than 40% of patients with shoulder complaints have impairments of the cervicothoracic spine and adjacent ribs
Link Between Cervical Spine & Elbow

- Vicenzino et al. (1996) revealed increased pain-free grip strength, pressure pain threshold, and increased shoulder abduction during a neurodynamic test of the radial nerve, and pain scores after manipulative therapy to the C5-C6 level. (15 subjects)
- Vicenzino and Wright (1996): 90% of subjects with lateral elbow pain had segmental hypomobility in the lower cervical spine


- Examined cervical and thoracic manipulation and effect on pain pressure threshold, reported neck pain, and cervical ROM in subjects w/ bilateral chronic mechanical neck pain. One treatment was assessed.
- PPT was assessed bilaterally at the C5-C6 zygapophyseal joint, lateral epicondyle, and tibialis anterior
- Results: Effects of cervical and thoracic manipulation were similar when looking at above symptoms
- Differed from Fernandez-Carnero et al study (2011) where they found cervical manipulation produced greater increases in PPT at the lateral epicondyle as compared with thoracic. Their study recruited subjects that had lateral epicondylalgia rather than neck pain, which may account for differences

Cervical vs. Thoracic Spine Manual Therapy

- Cleland et al (2005)- Tsp manip and neck pain: Study was a RCT with 36 symptomatic patients with mechanical neck pain. 2 groups: 1 placebo manip, other supine Tsp manip at restricted levels. Patients receiving Tsp manip had immediate improvements in pain as compared w placebo group. Results do not suggest avoiding Csp manip, but offers good alternative w Tsp manip.
- Gonzalez-Iglesias et al (2009)-Tsp manip and neck pain
- Many therapists prefer thoracic manipulation over cervical due to small risks involved
- Benefit vs. risk analysis
Norlander et al studies-Upper Quarter Relationship

• Correlation between mobility at CT junction and thoracic spine with neck-shoulder pain
• Utilized cross sectional study (142 male & 139 female workers) revealed hypomobility at C7-T1 and T1-T2 significantly predicted neck-shoulder pain and symptom weakness in the hands
• Positive predictive value of 84% (prospective 2 yr study)

Link Between Thoracic Spine & Shoulder

• Sueki and Chaconas (2011)-Tsp manip and shdr function
• Winters et al (1997)-shdr pain was attributable to dysfunctions in Csp, upper Tsp, or ribs
• McCormack (2012)-a single case report w patient that had adhesive capsulitis and benefited from added Tsp manip
• Crosbie et al (2008) completed a study of healthy individuals revealing thoracic spine motion with unilateral or bilateral shoulder elevation
• Case study-6 anchor repair-47 y/o male
Haik et al (2014)  
- Examined scapular kinematics and pain levels pre and post thoracic spinal manipulation with individuals with and without shoulder impingement symptoms  
- Compares thoracic manipulation to sham manipulation  
- Results: Pain immediately decreased during arm elevation and lowering following single session to mid thoracic spine in subjects with SIS (60% w thoracic vs 36% w sham manipulation)  
- Immediate effects of upward rotation independent of shoulder symptoms following thoracic manipulation

Strunce et al study (2009)  
- 21 participants with primary complaints of shoulder pain  
- 1 of 4 techniques used based on assessment and identified restrictions: Seated distraction CT manipulation, supine unilateral rib manipulation, supine flexion manipulation, or prone extension manipulation  
- Physical exam: 71% had CT restrictions, 100% had upper thoracic flexion restrictions, 7% had thoracic extension restrictions, 79% had unilateral rib restrictions  
- Results: Statistically and clinical improvements in entire group regarding shoulder ROM and VAS scores: Flexion: 106.8 (145.2), abduction: 98 (135.7), rotation: 128.3 (157.8); VAS 63.1 (31.2)  
- Why?: Biomechanical changes allowing for greater shoulder ROM with OH motions, restoration of normal neuromuscular motor control of the shoulder girdle, or hypoalgesic effect of manipulation may decrease overall pain and allow for greater ROM

- 36 subjects with signs of RTC pathology  
- Humeral elevation was loaded (weight determined by body weight) and assessed in relation to the thoracic sensors and is referred to as “humero-thoracic elevation”  
- Subjects received mid thoracic and CT junction manipulation in seated position  
- Significant decrease in scapular upward rotation noted following manipulation and increase in middle trap activity  
- Significant improvement in pain with performance of provocative tests and RTC pathology and with loaded elevation following manipulation  
- No other changes in scapular kinematics were noted; no change in humerothoracic elevation  
- Improved shoulder function at follow-up 7-10 days after the manipulation
Boyles et al (2009) study: SIS Treated w Mid Thoracic & CT Manipulation

- 56 subjects with SIS, all received mid thoracic HVLA in addition to CT junction in seated position. Subjects with rib angle tenderness also received a rib manipulation in supine at the level of tenderness.
- No control group or randomization of subjects
- Results: Thoracic manipulation treatment is correlated with significant changes in pain and disability at the 48 hour follow-up

Bergman et al study (2004): Usual Medical Care & Manipulative Therapy

- Randomly assigned subjects with primary reports of shoulder pain into 2 groups
- 1st group received usual medical care from PCP
- 2nd group received usual medical care + manipulative therapy directed at CT spine and adjacent rib cage
- Results: no difference between groups at the 6 week mark, however, the 2nd group demonstrated significantly higher rates of full recovery and more improvement in the severity of primary complaints and disability at the 12, 26, and 52 week follow-up
- Is there a subgroup of patients that benefit to these interventions?

Mintken et al study (2010): Are there prognostic factors to identify patients with shoulder pain who would benefit from thrust and non-thrust manipulation?

- Treatment outcome was the reference criterion, so all subjects (80 in total) received the same treatment regardless of exam findings-1 non-thrust mobilization directed at lower cervical spine (C5-C7 in neutral and slight flexion) and 5 different thrust techniques at the thoracic spine (received thrust techniques twice)
- Results: 61% experienced a successful outcome by 3rd session
- 5 prognostic variables: pain-free shoulder flexion <127 degrees, shoulder IR <53 degrees, (-) Neer test, not taking medications of any kind for shoulder pain, and duration of symptoms <90 days
- If 3 of 5 variables present, likelihood of success was 89% and if 4 of 5 variables were present the likelihood of success was 100%
Link Between Thoracic Spine & Elbow

- Berglund et al (2008): Purpose of the study was to determine the prevalence of cervical and/or thoracic pain in subjects with and without lateral elbow pain.
- 70% of subjects in the experimental group with lateral elbow pain had cervical and/or thoracic pain as compared with 16% in the control group
- Frequency of positive responses to provocative tests of cervical and thoracic spine were significantly higher
- Frequency of positive responses to neurodynamic tests of the radial nerve
- Cervical AROM into flexion and extension were significantly lower compared with control group

Examination Techniques To Rule In/Out Cervical Spine

- Cluster of tests to implicate cervical radiculopathy: ULTT A (median nerve bias), Spurling test, Distraction test, cervical rotation <60 degrees to the ipsilateral side
- Examine segmental mobility of the cervical and thoracic spines
- Test recruitment patterns and endurance of deep cervical flexor muscles with supine cervical flexion test and supine break test, deep cervical flexor endurance test, resisted MMT in all planes for cervical spine in 3 positions
- Go thru full screen with evaluation

Examination

- Initial observation
- History and interview
- Structural inspection
- AROM
- PROM
- Resisted movements
- Palpation
- Neurology
- Special tests
- Mobilty testing
- Review of diagnostics
Treatment Strategies & Overflow Concepts

• Research has yet to define optimal dosing, treatment techniques or patient populations to apply the RI approach to
• Treatment must consider passive restraints as well as neuromuscular control- i.e. hypermobility vs. instability vs. hypomobility
• Combination of biomechanical and neurophysiological
• Resolve adjacent hypomobilities in the presence of hypermobilities to allow for proper afferent feedback and motor facilitation to resolve impaired motor patterns-manual therapy followed by exercise

General vs. Specific Training

• Multi-resistance training: Patient position, gravitational forces, type of resistance (pulleys, bands, hand weights), isometric vs dynamic movements, direction of force

Manual Therapy Lesion

• 1. Collagen Trauma
• 2. Receptor Damage
• 3. Reduced Muscle Fiber Recruitment
• 4. Tonic Fiber Atrophy
• 5. Reduced Anti-Gravity Stability
• 6. Motion Around Non-Physiological Axis
• 7. Trauma/Acute Locking/Degeneration
• 8. Pain/Guarding
Exercise Dosing Principles

- Bialosky et al (2009) refers to neurophysiological responses being dose dependent
- Goals of treatment: Provide optimal stimulus for tissue repair, eliminate impairments, restore function
- Address postural alignment, restore ROM around a physiological axis, restore coordination/motor control, improved endurance and strength
- Target correct plane of motion, key muscles, dosage for desired outcome, and address angle of motion for optimal recruitment

Shoulder Flexion Is Not Treated Equally

Exercise Dosing

- Mobilization: assisted to <50% 1 RM, 1-3 sets
- Vascularity: 55-65% 1 RM, 1-3 sets, 25-30 reps
- Coordination: <50% 1 RM, 2-5 sets, 30-50 reps, daily
- Endurance: 60% 1 RM, 1-3 sets, 24-30 reps
- Strength: 60-80% 1 RM, 1-3 sets, 6-12 reps
- Volume (hypertrophy): 70% 1 RM, 12-15 reps
- Power: >80%, 1-3 sets, 3-6 reps, 1x/week
Take Home Message

- Consider joints adjacent to reported symptoms as well as other systems to be source generator during assessment.
- Seek to identify the pathoanatomical tissues that may be the source generator.
- RI model should be viewed as holistic approach to assessment and treatment, combining models of pathology for improved outcomes.
- Regional exam and treatment approach in addition to local treatment may lead to more efficient and effective treatment and outcomes.
- Why does any of this matter? Cost of healthcare, less visits approved, better outcomes.

Thank You


