Objectives

- Describe the relevant findings from the history and examination consistent with a contractile tissue source of symptoms
- Describe the relevant findings from the history and examination consistent with a non-contractile tissue source of symptoms
Objectives

- Describe the relevant findings from the history and examination consistent with stiffness as a primary impairment to movement.
- Describe the relevant findings from the history and examination consistent with instability/weakness as a primary impairment to movement.
CONTRACTILE TISSUE PATHOLOGY
Subjective Exam Findings

- **Demographics**
  - Age 6 to 40, Females (3:1)

- **Nature**
  - Deep aching, occasionally lancinating

- **Aggravating**
  - Cold
  - Psychological stressors
  - Anxiety
  - Sustained postures

- **Associated symptoms**
  - Paresthesias (nondermatomal)
Subjective Exam Findings–Location

Travell and Simons 1999
Subjective Exam Findings—Location

Travell and Simons 1999
Subjective Exam Findings—Location

Travell and Simons 1999
### Objective Exam Findings

<table>
<thead>
<tr>
<th>Test</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alignment</strong></td>
<td>P. min: Ant tilted scapula; Lat and P. maj: IR GHJ; Serr post: Leg length discrepancy</td>
</tr>
<tr>
<td><strong>ROM/Flexibility</strong></td>
<td>Restrictions noted primarily in GHJ and ST flexibility. Patient may demonstrate decreased rib expansion with Serr ant TrP</td>
</tr>
<tr>
<td><strong>Muscle Provocation Testing</strong></td>
<td>Painful, possibly weak (no atrophy)</td>
</tr>
</tbody>
</table>
| **Palpation**                     | 1) Focal tenderness with concordant sign reproduction (about 3kg of pressure)  
2) Twitch response  
3) Taut band  
4) Often referred pain (non dermatomal) on continued (~5sec) pressure  |
NON-CONTRACTILE TISSUE PATHOLOGY
Nerve

- T4 Syndrome
- Thoracic Outlet Syndrome
  - Scalenes
  - First rib/
    Costoclavicular space
  - Pec minor
T4 Subjective Exam Findings

- **Demographics**
  - Females 4:1, Age 30-50

- **Location**
  - Upper A/P thoracic spine
  - Unilateral to bilateral UEs
  - Craniofacial

- **Timing**
  - Night or early morning pain/paresthesia

- **Associated Symptoms**
  - Glove distribution of paresthesia into hands
  - Swelling of extremity
  - Weakness of grip
  - Difficulty breathing
TOS Subjective Exam Findings

- Demographics (neurogenic TOS)
  - Females 3-4:1

- Onset
  - History of neck trauma or work repetitive stress

- Aggravating Factors
  - Arms in elevated position**
  - Sustained postures

- Timing
  - Night or early morning pain/paresthesia (release phenomenon)

- Associated Symptoms
  - Paresthesias C8/T1**
# Objective Exam Findings

<table>
<thead>
<tr>
<th>Test</th>
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<tbody>
<tr>
<td>ROM</td>
<td>UE: Active and Passive ROM equal and painful in same direction; TOS: Cervical spine motion non-provocative except when scalene on stretch</td>
</tr>
<tr>
<td>Accessory mobility</td>
<td>T4: Concordant sign with T4 PA</td>
</tr>
<tr>
<td>Special Testing</td>
<td>TOS: Positive ROOS**; T4/TOS: Positive ULTT; TOS: Positive Adson’s</td>
</tr>
<tr>
<td>Neurological exam</td>
<td>TOS: Sensation, strength may be altered at C8/T1 T4: Sensation/Pain in non-dermatomal pattern</td>
</tr>
<tr>
<td>Palpation</td>
<td>TOS: Supraclavicular tenderness over brachial plexus**</td>
</tr>
</tbody>
</table>
Diagnostic Accuracy of Special Testing

- TOS provocation testing
  - ROOS, Supraclavicular pressure, Costoclavicular maneuver, Adson’s, Wright’s, Cyriax release, ULTT
  - ROOS
    - Most specific TOS test
    - LR+=1.2-5.2
  - Adson’s
    - Most sensitive TOS test
    - LR-=0.28
  - Hooper et al 2010
Joint/Disc

- **Thoracic Spine**
  - Difficult differential diagnosis
  - Rotation testing is key
  - Combined or coupled motions: Joint
  - Uniplanar motions: Disc

- **Thoracic Ribs**
  - Sidebending testing is key
  - Uniplanar motions: CV, CC, or CT joints
Subjective Exam Findings–Disc

- **Location**
  - Midline mid thoracic
  - Paravertebral T9 or lower
  - Band like lower chest wall pain

- **Onset (49%)**
  - Result of axial trauma
  - Lifting with twisting
    - Linscott and Heyborne 2007

- **Nature**
  - Aching

- **Aggravating**
  - Prolonged flexion/stooping
  - Coughing, sneezing, deep breathing
  - Lifting

- **Easing**
  - Recumbency

- **Associated symptoms**
  - Paresthesias, weakness
Subjective Exam Findings–Joint

- **Location**
  - Typically unilateral, not midline
  - Occasional radiation to anterior chest wall (CV/CT)
  - 2\textsuperscript{nd}/3\textsuperscript{rd} ribs anterior (CC)

- **Aggravating factors (Ribs)**
  - Deep breathing
  - Coughing/sneezing
Subjective Exam Findings - Costotransverse Joint Location

- Young et al, BMC Musc Disorders, 2008
Subjective Exam Findings- Zygopophysseal Joint Location

Dreyfuss et al 1994; Fukui et al 1997
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<tr>
<td>ROM</td>
<td>Active and Passive ROM painful in same direction; CV/CT: Ipsilateral sidebending, Flexion; 1st rib: Cervical rotation ipsilateral, SB contralateral; Disc: Flexion, Rotation; ZJ: Flexion, Rotation, Sidebending</td>
</tr>
<tr>
<td>Special Testing</td>
<td>Disc: Positive dural tension thoracic slump; Rib: Pain with thorax compression</td>
</tr>
<tr>
<td>Palpation</td>
<td>CV/CT: Tender CT joint and rib angle</td>
</tr>
</tbody>
</table>
PRIMARY STIFFNESS IMPAIRMENT
Objective Exam Findings

- Same underlying ROM characteristics as cervical hypomobility
- Other unique impairments
  - Rib positional faults
  - Positive CRLF (Lindgren) test for first rib stiffness
    - Interrater reliability $K = 1$
    - Correlation with radiologic findings $K = 0.84$
      - (Lindgren et al 1989)
Patterns of Motion Loss

- **Z Joints**
  - T1-4 follows opening/closing patterns of Cervical spine
  - Mid thoracic patterns inconsistent due to coupling characteristics

- **Ribs (CV)**
  - Inhalation restriction
  - Exhalation restriction
Reliability of Motion Testing

- **Physiological**
  - Mobility $K = .27-.65$ for T5-7
    - Brismee et al, J Manip PT, 2006

- **Accessory**
  - Mobility $K = .2-.4$ for Thoracic
    - Haas et al, Chiropr Tech, 1995
  - Pain $K = .12$ for T7-10
    - Horneij et al, J Rehabil Med, 2002
Reliability of Palpation Testing

- Palpation for position
  - SPs primarily affected by pull of large, powerful trunk muscles
  - Thoracic spine common site for normal variations in skeletal anatomy
Rib Mobility Assessment

- **Ankylosing Spondylitis**
  - Chest expansion
    - Circumferential measurement at axilla, 4th intercostal space, nipple line, 10th rib taken at maximal exhalation and inhalation
    - Less than 2.5cm difference is 94% specific for AS (Rigby and Wood 1993)
Common Motor Patterns

- Ventral hyperactive musculature
  - Pec minor
  - Biceps

- Dorsal hyperactive musculature
  - Middle and upper trapezius
  - Levator scapulae
Flexibility Testing

- **Pec minor**
  - Position: Supine hooklying, low back flat; Arms at side, elbows flexed, hands on abdomen
  - Normal: Posterior acromion ≤ one inch from table

- **Short head of biceps**
  - Increased stiffness with elbow extended
Flexibility Testing

- Latissimus dorsi
  - Position: Subject raises arm in flexion overhead
  - Normal: 180° of flexion with back flat and arms close to head
  - Considerations: Kyphosis, tight pec minor
PRIMARY WEAKNESS IMPAIRMENT
Subjective Exam Findings

- Same underlying characteristics as cervical instability
- Other factors to consider
  - Systemic hypermobility
  - Post MVA
  - Post thoracotomy or laminectomy
Objective Exam Findings

- Same underlying ROM characteristics as cervical instability
- Other possible impairments
  - Excessive/Reduced kyphosis
  - Rotational positional fault/scoliosis
  - Weakness of longissimus (erector spinae)
  - Atrophy of multifidus
  - Weakness of abdominals
Strength Testing

- Multifidus active with contralateral rotation
- Longissimus active with ipsilateral rotation
- Both active with ipsilateral sidebending/extension
  - Lee et al, J Electromyography and Kinesiology, 2009
Strength Testing

- Thoracic extensors
- Grading
  - 5 = hands behind head, clears ribs
  - 4 = hands at side, clears ribs
  - 3 = hands at side, clears sternum
  - 2 = hands at side, clears head
Strength Testing

- Rectus and obliques
- Grading
  - 5 = hands behind head, clears scapulae
  - 4 = hands across chest, clears scapulae
  - 3 = hands at side, clears scapulae
  - 2 = hands at side, partial lift-off