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Management of the Hemiplegic Shoulder

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Learning Outcomes:

- After this course, participants will be able to cite current evidence for treatment techniques such as NMES, taping, and pain management.
- After this course, participants will be able to state how to increase occupational performance of patients with hemiplegia through addressing underlying performance skills and motor skills.
- After this course, participants will be able to list four educational topics to address with the patient and their caregivers.
Trunk Stability and Posture

Alignment of the trunk

- Foundation of all head, neck, and limb movement
- Optimal alignment
  - Anterior pelvic tilt
  - Lumbar extension
  - Thoracic extension

(Runyon, 2003; Bohman, 2003)

(*Q7 and Q8)

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Lower trunk stability

- Pelvic position
- Co-contraction of Muscles
  - Ant abdominals & Lumbar ext. → Thoracic ext
  - Right & Left Lateral abdominals (Bohman, 2003)
- Dynamic: Changes in base of support
  - Normal control requires the ability to dissociate (separate) different parts of the body from each other (Bohman, 2003)
  - Eccentric/Concentric muscle contraction

Trunk Malalignment vs. Alignment

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Effect of pelvis on upper extremity

- Posterior pelvic tilt → lumbar flexion → thoracic flexion → scapular abduction → humerus internal rotation
- Anterior pelvic tilt → lumbar extension → thoracic extension → scapular adduction → humerus external rotation

(Runyon, 2003)

(*Q3)

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Stretch for Thoracic/Lumbar Ext

- Wedge Stretch
  - Supine on large wedge
  - Two towel rolls in inverted “T” position
    - One in lumbar region
    - One along spine in thoracic region

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Wedge stretch

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Dynamic Trunk Control

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Taping

- Kinesio Tape
  - Flexible tape
  - Different Amount of Tension on Tape
    - (Jaraczewska & Long, 2006)

- McConnell Tape/ Leukotape
  - Very rigid
    - Needs 2 layers of tape to protect skin
    - Cover Roll Stretch
  - Consistent Amount of Tension on Tape
    - (Peters & Lee, 2003)

(*Q10)
Postural Training: Leukotape Video

Shoulder Anatomy and Biomechanics
Anatomy/ Biomechanics

- Joints/ articulation (Neumann, 2010)
- Glenohumeral
- Scapulothoracic
- Acromioclavicular
- Sternoclavicular – only bony attachment of upper limb to the axial skeleton

- High mobility, Low articulation/ stability
- Joint relies on muscle strength for stability
- Post neurological event stability is lost with muscle decreased function
  - Reason why upper limb more effected than lower limb

(*Q4)

Anatomy

- Key landmarks for the shoulder
  - Scapula: Acromion, root of the spine, inferior angle
  - Humerus: Humeral head
- Scapula has a concave/convex relationship with the rib cage
- Scapula is a curved surface that easily tilts and moves

(Runyon, 2003)
Alignment/Approximation

- Therapist sitting lateral to pt.
  - Front hand: Approximation of humeral head into glenoid fossa
  - Back hand: Approximation of scapula with inferior angle in forward direction
- “Rotate the globe”
  - (Runyon, 2003)

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Video: Scapular Approximation
Shoulder subluxation

- Palpable gap between the acromion and humeral head (Wiener et al., 2018)
- Subluxations occur within the acute hypotonic phase of hemiplegia (Wiener et al., 2018)
- Theory (Wiener et al., 2018)
  - “Occurs due to prolonged downward pull by gravity on the arm against which hypotonic muscles offer little resistance (Chaco and Wolf, 1971). Results in overstretching of the glenohumeral capsule (especially its superior aspect) and hypotonic supraspinatus and deltoid muscles” (Basmajian & Bazant, 1959; Shahani et al., 1981)
  - “The combination of flaccid supportive musculature (in particular, the supraspinatus muscle) and a downward rotated scapula was presumed to predispose the head of the humerus to undergo inferior subluxation relative to the glenoid fossa” (Basmajian & Bazant, 1959; Calliet, 1980)

Biomechanics of Subluxation

- Not a result of positioning of downward scapular rotation
  - Prevost et al., 1987
  - Culham et al., 1995
  - Price et al., 2001
  - “Scapular position was not an important factor” and “unrelated” in the occurrence of inferior subluxation in hemiplegia (Prevost et al., 1987; Price et al., 2001)
- Scapula does have influence because of alignment and biomechanical advantage in active ROM
Shoulder subluxation

- Subluxation is a result of weak rotator cuff muscles
  - Rotator cuff seats the head of the humerus into the glenoid fossa
    - (Wiener et al., 2018)

- Remember Anatomy when considering tx methods
  - Rotator cuff (Internal muscle layer) and Deltoid (external muscle layer)
  - Focus on positioning and stability of scapula first

Subluxation Patterns

- Inferior
  - (Paci et al., 2005)

- Anterior
  - (Ryerson & Levit, 1997, as cited in Paci et al., 2005)
  - Biceps Tendonitis

- Superior
  - (Hall et al., 1995)

- Assessment of subluxation clinically
  - Palpation of subacromial space is most reliable form
  - Finger widths for measurement
    - (Paci et al., 2005)
Prevention of Pain & Complications

- Scapulohumeral Rhythm
  - In a normal shoulder has 2:1 ratio
    - 2 parts humeral movement to 1 part scapular movement
      (Inman et al., 1944, as cited in Neumann, 2010)

Abnormal scapulohumeral rhythm

- Scapulohumeral Rhythm with hemiplegia
  - At most effected state neither portion actively moves

- With a Non moving scapula & Passively moving humerus
  - Subacromial trauma occurs at 90° shoulder flexion and abduction
    (Kumar, et al 1990)

- Video of Hand Demonstration of Subacromial Trauma

*Q1*
Subacromial Trauma

- Impingement of supraspinatus under coricoacromial arch
  - Rotator Cuff Injury
  - Impingement Syndrome
- Increased pressure on subdeltoid bursa
- Impingement of brachial plexus
  - Brachial Plexus Injury
- Impingement arterial and venous supply
- Overstretching of glenohumeral capsule
  (Griffin, 1968; Peat, 1968; Gillen, 2011)

Subacromial Trauma

- DO NOT perform
  - over head arm raises
  - PROM up to or greater than 90 degrees of shoulder flexion or abduction without regards to the scapula

(Kumar et al., 1990)
Neuropathic Pain (Braus, Krauss, & Strobel, 1994)

- Neuropathic pain is caused by an orthopedic secondary complication in the hemiplegic shoulder
  - Peripheral Injury
- 2 Part study: 1) Autopsy data, 2) Prevention
- Autopsy data
  - Individuals with neuropathic pain in the hemiplegic arm had micro-bleeding in the area of the suprhumeral joint
  - Subacromial trauma

Prevention

- Education to prevent injury to the affected limb
- Any position or activity that causes pain in changed immediately
- Mobilization of the scapula before movements of the shoulder
- No infusions into the hemiplegic hand

Significant decreased of Neuropathic pain from 27% to 8%
Subacromial trauma is preventable!!

- Education is key
  - Patient, therapist, staff, family
- Proper Handling
  - During ADL’s and transfers
  - Avoid inappropriate treatment choice
- Positioning
  - Let Active ROM determine a patient’s Passive ROM limitation
- Safe PROM
  (Davies, 2004; Gillen, 2011)

Intervention for the Hemiplegic Shoulder
Biomechanically safe PROM

- Completed by therapist or caregiver after training
  - Range scapula with approximation of scapular humeral joint (Runyon, 2003)
  - Range glenohumeral joint with regard of scapula

- Can be completed by patient

Range scapula with approximation of scapular humeral joint: Elevation

- Approximate scapula and humerus
- Perform scapular elevation with inferior angle between therapist’s thenar and hypothenar eminence of hand
  - Therapist can support own elbow with knee
- Have pt. move into posterior pelvic tilt
  - “Roll your belly back” “Hide your belly button” “Slouch and touch your chin to your chest”
- Stretching Latissimus Dorsi
  - (Runyon, 2003)
Video: Scapular Elevation

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Range scapula with approximation of scapular humeral joint

- Depression
  - Approximate scapula and humerus
  - Therapist places finger tips on pt’s spine of scapula
  - Have pt move head in lateral direction away from you. Ear on non-involved side to shoulder on non-involved side
- Patient controls stretch
- Stretching upper trap
  (Runyon, 2003)

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Video: Scapular Depression

Range scapula with approximation of scapular humeral joint

- Adduction
  - Approximate scapula and humerus
  - Therapist has pt’s axillary in web space
  - Perform adduction and maintain hold
  - Ask pt. to slowly turn head in opposite direction
  - For additional stretch ask pt to place opposite hand on opposite hip with thumb pointing down
- Stretching pecs
  - (Runyon, 2003)
Range scapula with approximation of scapular humeral joint

- Abduction
  - Approximate scapula and humerus
  - Therapist places PIP’s onto pt’s medial border
  - Perform Abduction and maintain
  - Ask pt. to slowly turn head toward therapist and reach for therapist’s shoulder
  - Stretching Mid Trap and Rhomboid
- (Runyon, 2003)
Scapulothoracic Mobilization: Upward Rotation

- Pt in side lying on unaffected side
  - Approximate scapula and humerus and support upper limb
  - Therapist places PIP’s on medial border by inferior angle
  - Perform upward rotation and maintain
    - (Dale, 2005)
Video: Scapular Upward Rotation

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PROM to the shoulder with regard to the scapula

- Support the scapula in protraction and upward rotation

- Externally rotated humerus
  - Elbow crease facing up
    (Halar and Bell, 1993, as cited in Gillen, 2011)

- Range to 140 degrees of shoulder flexion and abduction
  (Kumar et al., 1990)

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Video: PROM to the shoulder with regard to the scapula

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Case Study: Which scapular mobilizations are appropriate?

("Q6)
Biomechanically safe PROM completed by patient

- Scapular abduction/ adduction with trunk rotation. Cradle arm with trunk rotation (Gillen, 2011)

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Active Scapular Stability

- Bilateral Scapular Elevation  
  - “Shrug your shoulders”
- Bilateral Scapular Adduction/ Retraction  
  - “Squeeze your shoulder blades together”
- Bilateral Posterior Shoulder Rolls  
  - “Roll your shoulders backwards”
Biomechanically safe PROM completed by patient

- Lack of G-H joint ext. rotation is associated with pain
  - (Bohanon et al., 1986; Zorrowitz et al., 1995)

- Stretch for External Rotation
  - Lay supine with 45° shoulder abduction
  - Gently rotate to ext. rotation
  - Lay forearm on pillow for prolonged stretch
  - 30 minutes
  - (Ada et al., 2005)

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Shoulder Subluxation & NMES

- Surface NMES
  - Muscles stimulated
    - Posterior deltoid
    - Supraspinatus

- Prevents and reduces subluxation
  - (Faghri et al., 1994; Chantraine et al., 1999)

- Recommended Protocol
  - 6 hours daily, five days a week for 6 weeks (Paci et al., 2005)
Shoulder Subluxation - NMES

- Rationale
  - Re-education of glenohumeral joint muscles
  - Repositioning of humeral head
  - Improved joint alignment can provide stable base for improved functional use of upper limb
- Evidence: NMES for shoulder subluxation
  - “There is strong (Level 1a) evidence that that electrical stimulation helps to prevent the development of shoulder subluxation, does reduce shoulder subluxation” (Wiener, 2018)
  - “There is strong (Level 1a) evidence that electrical stimulation does not reduce hemiplegic shoulder pain following stroke”. (Wiener, 2018)

Taping & Hemiplegic Shoulder

- Conflicting evidence that taping reduces pain
  - Ancliffe, 1992
  - Hanger et al., 2000
  - Griffin & Bernhardt, 2006
- Inner layer vs. outer layer
  - “There is Level 1a evidence that shoulder strapping/taping reduces hemiplegic shoulder pain; however it may not improve spasticity, disability, range of motion, or motor function.” (Wiener, 2018)
Taping and Hemiplegic Shoulder

- Postural retraining
- Approximation during AROM
  - Need to have muscle activity around joint you are taping to be affective

Leukotape for Postural Training

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Video: Leukotape Anterior Hyperlaxity & Inferior Hyperlaxity

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Active Motion – Gravity Eliminated AAROM

- Stability of scapula on thoracic wall with emphasis on upward rotation (Gillen, 2011)
- Goal is to increase scapulohumeral rhythm, improve shoulder function, and decrease a subluxation

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Questions?

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- References available upon request