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# Management of the Hemiplegic Shoulder

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## Learning Objectives

After this course, participants will be able to:

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

# Trunk Stability and Posture

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## Alignment of the trunk

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



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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
  - Require more demand with concentric/eccentric control
  - Runyon, 2003

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## Body Positioning

- Functional Influence
  - Jebsen Taylor Hand Function Test
    - Higher functional scores when patient sitting in neutral position vs. flexed or laterally flexed position  
(Gillen et al., 2007)
- Position of feet – EMG studies
  - Knee Flexion → Increased muscle activity in trunk
  - Knee Extension → Decreased muscle activity in trunk  
(Anderson & Ortengren, 1974)
  - When feet under knees, anterior pelvic tilt and trunk extension are enhanced

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## Trunk Malalignment vs. Alignment

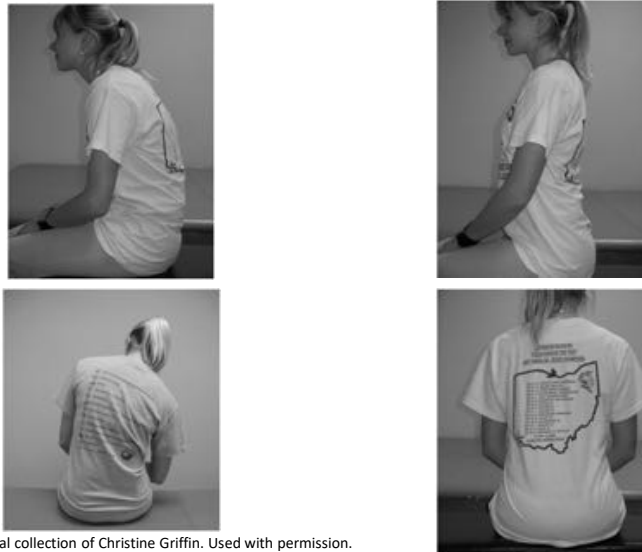


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## Effect of pelvis on upper extremity

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

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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
  - Light flexible tape
  - Removes congestion (edema)
  - Corrects joints
- McConnell Tape/Leukotape
  - Very rigid, needs 2 layers of tape to protect skin
  - Stabilizes
  - Re-aligns

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## Postural Training: Leukotape Video

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## Shoulder Anatomy and Biomechanics

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## Anatomy/Biomechanics

- Joints/articulation
  - 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

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## 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.

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## 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

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## Shoulder subluxation

- Palpable gap between the acromion and humeral head
- Subluxations occur within the acute hypotonic phase of hemiplegia
- Theory
  - 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 and 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 and Bazant 1959 & Calliet 1980)

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## 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

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## Shoulder subluxation

- Subluxation is a result of weak rotator cuff muscles
  - Rotator cuff seats the head of the humerus into the glenoid fossa
- Remember Anatomy when considering tx. methods
  - Rotator cuff (internal muscle layer) and Deltoid (external muscle layer)
  - Focus on positioning and stability of scapula first

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## Subluxation Patterns

- Inferior
- Anterior
- Superior

(Ryerson & Levit, 1998)

- Assessment of subluxation clinically
  - Palpation of subacromial space is most reliable form
  - Finger widths for measurement
    - (Hall et al, 1995 & Prevost et al., 1987)

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## Prevention of Pain & Complications

- Scapulohumeral Rhythm
- In a normal shoulder has 2:1 ratio
  - 2 parts humeral movement to 1 part scapular movement

(Clarkson & Gilewich, 1989)



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## Abnormal scapulohumeral rhythm

- Scapulohumeral rhythm with hemiplegia
  - At most effected state neither portion actively moves
- Video of Hand Demonstration of Subacromial Trauma
- With a non moving scapula & passively moving humerus
  - Subacromial trauma occurs at 90° shoulder flexion and abduction  
Kumar, et al. (1990)

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## Subacromial Trauma

- DO NOT perform
  - Over head arm raises
  - PROM up to or greater than 90° shld. flex. or abd.  
Kumar, et al. (1990)
- Will cause subacromial trauma
  - Impingement of supraspinatus under coracoacromial arch
  - Increased pressure on subdeltoid bursa
  - Impingement of brachial plexus
  - Impingement arterial and venous supply
  - Stretching of glenohumeral capsule  
(Griffin, 1968; Peat, 1968)

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## Superimposed Orthopedic Injuries

- Lesions of the Rotator Cuff
- Lesions of the Biceps tendon
- Adhesive Capsulitis
- Brachial Plexus Traction Injury
- Impingement Syndromes

(Gillen, 2011)

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## Brauss, Krauss, & Strobel, 1994

- Suggests that pain from SHS/CRPS I is initiated by a peripheral lesion (tissue or nerve)
- Autopsy data
  - Confirmed micro-bleeding of the suprahumeral joint of the affected side.
  - Subacromial trauma
- If cause is peripheral, then prevention program would be effective.

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## Braus, et al., 1994

- Implemented Prevention Protocol:
  - Education to prevent peripheral injury
  - No PROM before scapula mobilization
  - No pain during exercise/activity
  - No infusions into affected hands
- Incidence of pain from SHS decreased from 27% to 8%

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## Subacromial trauma is preventable!!

- Education is key
    - Patient, therapist, staff, family
    - <https://patienteducation.osumc.edu/Documents/protect-shoulder.pdf>
  - Proper Handling
    - During ADLs and transfers
    - Avoid inappropriate treatment choice
  - Positioning
  - Let *active* ROM determine a patient's passive ROM limitation
  - Safe PROM
- (Davies, 2004) (Gillen, 2011)

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## Intervention for the Hemiplegic Shoulder

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## Biomechanically safe PROM

- Completed by therapist or caregiver after training
  - Range scapula with approximation of scapular humeral joint (Runyon, 2003)
- Can be completed by patient

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## 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
    - Have pt. move into posterior pelvic tilt
      - "Roll your belly back"
      - "Hide your belly button"
      - "Slouch and touch your chin to your chest"
- (Runyon, 2003)



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## 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
- (Runyon, 2003)



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## Video: Scapular Depression

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## 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
- (Runyon, 2003)



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## Video: Scapular Adduction/Retraction

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## Range scapula with approximation of scapular humeral joint

- Abduction
  - Approximate scapula and humerus
  - Therapist places PIPs onto pt's medial border
  - Perform abduction and maintain
  - Ask pt. to slowly turn head toward therapist and reach for therapist's shoulder
- (Runyon, 2003)



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## Video: Scapular Abduction/Protraction

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## Scapulothoracic Mobilization: Upward Rotation

- Pt in side lying on unaffected side
  - Approximate scapula and humerus and support upper limb
  - Therapist places PIPs on medial border by inferior angle
  - Perform upward rotation and maintain  
(Dale, 2005)



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## Video: Scapular Upward Rotation

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## Case Study: Which scapular mobilizations are appropriate?



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## Biomechanically safe PROM completed by patient

- “Rock the baby” Cradle arm with trunk rotation to 60° shoulder abd.

(Gillen, 2011)



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## Active Scapular Stability



OSU source

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## Biomechanically safe PROM completed by patient

- Lack of G-H joint ext. rotation is associated with pain

(Bohanon et al., 1986, and Zorowitz 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
- (Gillen, 2011)



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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)

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## 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
  - There is strong (Level 1a) evidence that electrical stimulation does not reduce hemiplegic shoulder pain following stroke. (Teasell, 2012)

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## Taping & Hemiplegic Shoulder

- Conflicting evidence that taping reduces pain
  - Ancliffe, 1992
  - Hanger et al, 2000
  - Griffin & Bernhardt, 2006
- Inner layer vs. outer layer
- “Moderate evidence that strapping (taping) does not improve upper limb function or ROM” with a subluxation  
Ebrsr.com, 2016

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## Taping and Hemiplegic Shoulder

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

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## Leukotape for Postural Training



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## Video: Leukotape Anterior Hyperlaxity & Inferior Hyperlaxity

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## 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
- Improves shoulder function
  - Scapulohumeral rhythm
  - Activation of rotator cuff muscles



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## Questions?

- References available upon request
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