Secondary and Primary Impingement

FUNCTIONAL REHABILITATION
OF THE SHOULDER
Open Kinetic Chain Rehabilitation Challenge

• Mobility – range of motion
• Recruitment – neuromuscular control
• Stabilization – tri-plane functionality

Three Phases of Rehabilitation

• Pre-functional – Mobility
• Return to Function – Recruitment
• Return to Activity – Tri-Plane Stabilization
Related Shoulder Anatomy – Osteology

- Humerus – Tuberosity Insertion for Rotator Cuff
- Clavicle – Fulcrum for lateral motion
- Scapula – Attachment for 17 muscles, 4 ligaments

Related Anatomy - Arthrology

- Glenohumeral – Center core of motion
- Acromioclavicular – Frontal plane lateral motion
- Sternoclavicular – Synovial articulation to skeleton
- Scapulo-thoracic articulation – Not a true joint
  - Mobile structure stabilized by muscle

Related Shoulder Anatomy

Passive stabilization
- Labrum – Meniscus of the glenoid
- Ligaments – SGHL, MGHL, IGHL
- Capsule – Fibrous tissue
Rotator Cuff Syndrome (RCS)

RCS is defined as an inflammatory or degenerative disorder of the musculotendinous cuff of the shoulder joint, or the long head of the biceps and the associated bursae.

RCS can refer to:
1. Supraspinatus Syndrome
2. Subacromial Impingement Syndrome
3. Biceps Long Head Tendonitis
4. Calcified Tendonitis
5. Rotator Cuff Impingement

Primary Impingement Syndrome

- Structural/Biomedical Anatomical Crowding – Spurs/DJD
- Posterior Capsular Tightness
- Anterior Capsular (pect. wall) Tightness
- Excessive Superior Migration of the Humeral Head Secondary to Depressor Deficiency
  - Result: Sub-acromial Enroachment
Secondary Impingement Syndrome (SIS)

- Mechanical Instability
- Impairment of muscle coordination
  - Repetitive strain – decreased vascualization of the rotator cuff.
- Weakness of the Scapular Stabilizers (pivotors)
- Pathological Laxity/Translation of G-H joint


Internal Impingement

- Pathologic condition caused by excessive contact of the greater tuberosity of the humeral head with the posterosuperior aspect of the glenoid when the arm is Abducted and externally rotated
- Related pathology based on MRI findings reported in the literature
  - Articular-sided partial-thickness rotator cuff tears of the supraspinatus, infraspinatus or both
  - Posterior or superior labral lesions
  - Humeral head lesions or cysts
  - Posterior glenoid bony lesions


Internal Impingement

At Risk Sports

- Baseball and softball
- Other throwing athletes (waterpolo & football)
- Tennis and squash
- Racquetball
- Volleyball
Impingement

- Subjective Dysfunction including night pain.
- Pain Pattern: Deltoid Area – Lateral Arm
- Exam: Tenderness
  Impingement Sign
- Radiographs: Acromial Spur

Shoulder Pain: Subjective Functional Level Rating

- Reach back pocket
- Washing axilla
- Combing hair
- Dressing
- Hand over head
- Perineal care
- Sleeping on involved side
- Reaching out at shoulder level
- Carrying objects, 10-15 pounds
- Lifting weights

Reference: Wilk, K. 1996

Interactive Outcomes

- Pain report
- Mobility needs – ROM goals met
- Elevation control – muscle recruitment
- ADL dysfunction
Clinical Impingement Test

• NEER:
  – Elevation with internal rotation
  – Compression of rotator cuff against the coracoacromial arch

• Hawkins – Kennedy Test:
  – 90° forward elevation (scapular plane)
  – Internal Rotation Over Pressure

Reference: Ellenbecker, TS: Clinical Examination of the Shoulder, St. Louis, 2004, Elsevier Saunders (ch 10 and 11)

Clinical Examination Review

Rotator Cuff – Muscle Testing

• Supraspinatus – Full can vs. empty can
  • Drop arm test

• Infraspinatus/Teres Minor – External rotation lag

• Subscapularis:
  – Lift off test (lower)
  – Belly press test (upper)

Reference: Ellenbecker, TS: Clinical Examination of the Shoulder, St. Louis, 2004, Elsevier Saunders (ch 11)

Acromial Architecture

• Type I – Flat
• Type II – Curved
• Type III – Hooked (highest % of RCT)

Non-Operative Treatment

- Anti-inflammatory medication – Oral
- Injections
- Rehabilitative therapy:
  - Mobility – posterior capsular lengthening
  - Sleeper stretches – GIRD
  - Scapular stabilization
  - Rotator cuff decompression

Impingement Non-Operative Intervention (exercises)

- Scapula Stabilization – Retraction/Protraction
- Mobility – Scapula – Glenohumeral
  - Inferior & Posterior glides
  - Anterior Capsule – Pect Wall (Pectoralis)
  - Posterior Capsule – Modified Sleeper Stretch
- Rotator Cuff Strengthening
  - Posterior Cuff – Prone Series
  - Scaption
  - Sidelying external rotation
- Wall Push-ups – closed kinetic chain
Clinical Examination Review
Scapula-thoracic – Static examination
• Anterior tilting – Inferior angle
  • Kibler Type I
• Internal rotation – Medial border
  • Kibler Type II
• Elevation – Superior glide
  • Kibler Type III
Reference: Ellenbecker, TS: Clinical Examination of the Shoulder, St. Louis, 2004, Elsevier Saunders (ch 4)

Today’s Society
• Back-packing – toting
• Computer dependant world
• Head forward/kyphotic posture makes the scapula more likely to abduct and tilt anteriorly, closing down on the subacromial space
• May lead to spurs and soft tissue compression to failure
Reference: Baker BJ. Complex Forces. T&C 2009

Role of the Scapula
• Motion is critical for mobility of the upper extremity
• Link between trunk and UE
• Site of multiple muscle attachments
• Mobile base for glenohumeral stability
• Transmission of forces through the kinetic chain
  – “True core of the upper kinetic chain” – TTrundle (2009)
Scapular Kinematics in Shoulder Function

- Elevation overhead: motion is primarily upward rotation and secondarily posterior tilt. Rotation is minimal prior to 100° of elevation.
- Scapula motion in healthy subjects is primarily in the transverse plane.
- Elevation of the arm: SC joint rotates posteriorly, slightly retracts and minimal elevation. AC joint primarily tilts posteriorly, slightly rotates internally upwardly.


Scapular Dyskinesis

- Normal position of the scapula is to be symmetrical mounted on the ribcage
- Alteration of normal position or motion directly affect the glenohumeral joint and shoulder positioning is referred to as Dyskinesis
Scapular Stabilization – Trapezius
EMG Based Values

- Prone Extension and prone horizontal abduction with external rotation exercises promote early activation of the middle and lower Trapezius in relationship to the scapular and glenohumeral prime movers.


Scapula Control

Protraction – Serratus Anterior

- Press-up plus – ceiling punch
- Standing scaption to 120°
- Wall push-ups plus
- Push-ups plus – floor
- Dynamic hug

• Prone extension: teres minor and deltoid (post) > 60% MVIC
• Standing extension with forward step for core stabilization: trunk/scapular/cuff musculature

Ref: Uhl, T. 2009
Muscle Activation and Perceived Loading During Rehabilitation Exercises: Comparison of Dumbbells and Elastic Resistance

- Sixteen female workers (aged 26 – 55 years) without serious musculoskeletal diseases
- Electromyographic (EMG) activity was measured in 5 selected muscles during the exercises of lateral raise, wrist extension, and shoulder external rotation during graded loadings with dumbbells (2-7.5 kg) and elastic tubing (Thera-Bande, red to silver resistance).

Muscle Activation and Perceived Loading During Rehabilitation Exercises: Comparison of Dumbbells and Elastic Resistance

- Resistance exercise with dumbbells as well as elastic tubing showed increasing EMG amplitude and perceived loading with increasing resistance. At the individually maximal level of resistance for each exercise – defined as the 3 repetitions maximum – normalized EMG activity of the prime muscles was not significantly different between dumbbells (59%-87%) and elastic tubing (64%-86%). Perceived loading was moderately to very strongly related to normalized EMG activity (r=.59-.92).
- Therapeutic Value: The authors conclude that comparably high levels of muscle activation were obtained during resistance exercises with dumbbells and elastic tubing.

Ref: Anderson L, et al. Phys Ther 2010

Isotonic vs Elastic Resistance - EMG

- Tubing Exercises
  - Diagonal – PNF
  - Standing – Rotation
- Isotonic Exercises
  - Prone Series

Impingement

- Exercises for the Older Patient
  - Seated Scapular Row Retraction Progress to Standing
  - Manual Placed Isometric Protraction/Press-up(+)
  - Isometric Rotation - Progress to Thera-Band® Short-Arc (low resistance color)
    - Advanced Patient – sidelying Ext Rotation
  - Standing Extension to Hip
    - Thera-Band® or Resistance cable exercise
    - Advanced patient – prone extension to hip
  - Seated or standing scaption for elevation
    - CKC – Stabilization – Wall Push-ups
  - Double Arm to Single Arm
    - Rhythmic Stabilization – Short lever arm
Impingement

Additional Exercise Intervention:
• Advanced Scapular Stabilization
• Oscillatory Training – BodyBlade® – 3 Planes
• Chair Dips (Press-ups)
• Manual PNF Exercises
• Plyo-toss – Retro-toss
• Advanced Closed Kinetic Chain Exercises

Impingement

Treatment – Operative for Primary Impingement

• Decompression – S.A.D.
  • Bevelling - Acromion
  • Detachment - Coraco-Acromion Ligament
  • Distal Clavical Excision

Operative Intervention for Internal Impingement

• Rotator cuff repairs – articular side
• Labral tear stabilization
• Capsular plication – capsulolabral reconstruction
• Posterior capsular release
• SAD – subacromial bursectomy
Impingement

- Subacromial Decompression (SAD-DCE)
  - Post operative Intervention Phase I – Pre-functional
- Manual mobility – Scapula/GH joints
  - Distraction, posterior & Inferior glides
  - Posterior capsular stretch
  - Anterior capsular stretch
- Scapula Stabilization – retraction sets progression
- Closed Kinetic chain exercises
  - Ball on Wall
  - Wall Pushups
- Rotator cuff Isometrics – Progress to Short arc Active Strengthening
  - T-Band Series
- Elbow, wrist & hand strengthening as needed
- UBE
Impingement

SAD – DCE – Phase II – Return to Function

- Mobility as needed
- Rotator cuff strengthening
  - Scaption
  - Prone series
  - Sidelying external rotation
- Oscillatory Training – Bodyblade®
- Advanced scapula - Stabilization
Impingement

SAD – DCE – Phase III – Return to Activity
- Progressive strengthening
  - High reps – PRE
- Press-ups (chair dips)
- Advanced Manual PNF with resistance
- Advanced Closed Kinetic Chain exercises
- Plyo-toss
- Sports Specific Activities
Vital Five Exercise Program
Impingement

• Scapula Stabilization (advanced)
  – Prone Retraction
  – Scaption 120°
• Sidelying External Rotation
• Prone Series
• Scaption Standing
• Single Arm wall push-up
  – transverse plane
  – Progress to uneven surface

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Secondary and Primary Impingement
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