

Four Levels – EMG Activity Based on MVIC

- Level One: 20% of MVIC – low
- Level Two: 21% to 40% of MVIC – Moderate
- Level Three: 41% to 60% of MVIC – High
- Level Four: More than 60% of MVIC – Very High

Precaution Concerning Rehabilitation

Therapeutic value of EMG Based Recruitment is a Dynamic Activity Level and Not a Measurement of Tendon Stress.

Reference: DiGiovine NM, Jobe FW, Pink M, Peppy J. An Electromyographic Analysis of the Upper Extremity in Pitching. J Shoulder Elbow Surg 1992;1(1):15-25.

Levels of EMG Based Exercises for the Shoulder

- Level One – Low EMG
 - Therapist Assisted Forward Elevation
 - Pendulum (Codman)
 - Weight Shifts on Table (CKC)
 - Gravity Eliminated Forward Elevation
- Level Two – Moderate EMG
 - Wall Push-ups
 - Thera-Band® - Short Arc – Low Color (yellow)
 - Low Weight PRE
 - Sidelying Internal Rotation

Levels of EMG Based Exercises for the Shoulder

- Level Three – High EMG
 - Sidelying External Rotation
 - Scaption – Thumb-up Elevation
 - Thera-Band® Standing Rotation (Red-Green)
 - Prone Extension to Hip
 - Prone Scaption
- Level Four – Very High EMG
 - Scaption to 120° and Higher
 - Press-up – Chair Dips
 - Prone Horizontal – Abduction – Ext. Rot.
 - Bench Press

CLOSED KINETIC CHAIN RECRUITMENT

- Push-up on uneven surface – ball on the wall
- Wall push-ups while standing on uneven surface – balance pad or BOSU
- Hands on Stepper – straight/flexed elbow

References:

1. Ellenbecker TS, Davies GJ: *Closed Kinetic Chain Exercises: A Comprehensive Guide to Multiple – Joint Exercise.* *Human kinetics: 2001.* . 87-98.
2. Uhl TL, Carver TJ, Matacola CG, Mair SD, Nitz AJ, *Shoulder Musculature Activation During Upper Extremity Weight Bearing Exercise.* *Jour. Ortho Sports Physical Therapy.* Vol 33, No 3, March 2003, pp. 109-117
3. Pontillo M, Orishimo KF, et al: *Shoulder Musculature Activity and Stabilization During Upper Extremity Weight Bearing Activities.* No. *Am. Journal Sports Phys Ther: 2007* Vol 2, No 2, pp.90-96.

Geriatric Perspectives

- General Clinical Considerations for Exercises
 - The ability to generate contraction force appear to decline .75% to 1.0% per year between ages of 30 to 50 years.
 - More accelerated decline in later years 15% per decade between 50 to 70 years, 30% loss between 70 and 80 years.
 - Loss of muscle strength is associated with decrease of total muscle mass
 - Decrease in size and number of muscle fibers

Reference: LaForest S, St-Pierre DMM, Cyr J, et al. Effects of Age and Regular Exercise on Muscle Strength and Endurance. Eur J Appl Physiol. 1990; 60:104-111.

Text Book Recommendation: Bandy WD, Sanders B. Therapeutic Exercise for Physical Therapist Assistants. 2nd Ed. Baltimore: Lippincott Williams & Wilkins: 2006.

Geriatric Perspectives

- Closed Kinetic Chain Loading (CKC)
 - Functional mode of contraction – extremity
 - Co-contraction
 - Dynamic multi-joint motion
 - Concentric – Eccentric – Isometric
 - Promotes proprioception (neuromuscular control)
 - CKC – distal fixation – dynamic stabilization – upper extremity
 - Clinical Applications:
 1. Wall Push-ups – Axial Compression against wall or table (early phase)
 2. Single Arm Wall Push-ups (add resistance)
 3. Supine Scapular Protraction – manual resistance applied distally – serratus anterior
 4. Push-up against a ball on the wall
 - Goal of the Therapeutic Value: Shoulder Functional ADL
 - Dressing / Toileting
 - Controlled Elevation

Reference: Scott KF. Closed Kinetic Chain Assessment: Rehabilitation of Improved Function in the Older Patient. Top Geriatr Rehabil. 1995;11:1-5.

Geriatric Perspective

- Exercise Training
 - Sub-max Exercise guideline
 - Two to three sets of 8 to 12 repetitions increase of resistance based on tolerance
 - Resistance training does result in strength gains in older adults
 - Use of slower to moderate velocities of movements with slow graded resistance is recommended.

Reference: Welle S. Resistance Training in Older Persons. *Clin Geriatr* 1998;6:1-9.

McClure J. Understanding the Relationship Between Strength and Mobility in Frail Older Persons: A Review of the Literature. *Top Geriatr Rehabil* 1996;11:20-27.

Impingement

- Exercises for the Older Patient
 - Vital Five Based on Therapeutic Value
 - 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
 - CKC – Stabilization – Wall Push-ups
 - Double Arm to Single Arm
 - OKC – Rhythmic Stabilization – Short lever arm
 - Prone Extension to Hip
 - Seated or standing scaption for elevation

Rotator Cuff Repair

Partial Thickness Lesions – Older Patients

- Pre-Functional Phase
- Mobility: Manual Control R.O.M.
 - Elevation – Horizontal Disting – Very Low EMG Activity
 - Pulley – Scaption Only – Sub-level EMG Activity, but does increase EMG demand on Supraspinatus
- Recruitment:
 - Scapular Retraction – seated to standing
 - Short lever arm rhythmic stabilization
 - Supine elevation – progress to Thera-Band®
 - Scapular protraction – supine position
 - Hand resistance (ckc) to press-up(+)
 - Standing extension to hip

References: Gaunt BW, Uhl TL, Humphrey L, Calico RM, McCluskey GM. Electromyography of Shoulder and Scapular Musculature During an Elevation Strengthening Progression. *J Shoulder Elbow Surg* 2004;13(5):E2-3.

Geriatric Perspective

Muscle Recruitment

- Isometric muscle recruitment progress to synergistic recruitment of agonist – antagonist
 - Rhythmic stabilization is an effective means of functional based strengthening
- Placement Eccentric
 - Isometric to eccentric isotonic activity is more likely to create functional carryover
 - Holding isometric to muscle lengthening (Eccentric) leads to controlled mobility
 - The goal for the older patient is to develop automatic controlled mobility during functional performance

Reference: Hertling D. Management of Common Musculoskeletal Disorders: Physical Therapy Principles and Methods. 3rd Ed. Philadelphia: Lippincott-Raven;2005.

Rotator Cuff Repair Partial Thickness Lesions

- Return to Function Phase – Older Patient
- OKC – Recruitment:
 - Supine Elevations – Thera-Band®
 - Low level (red) low EMG –supraspinatus, slightly higher EMG deltoids
 - Short-arc Thera-Band® Rotation
 - PRE Protraction/Retraction
 - Prone Extension to hip
 - Scaption – Seated to standing
 - Sidelying ER to Neutral
- CKC – Stabilization
 - Wall push-ups – double/single arm

Goal: ADL – Return to Function Based on Outcome Interview of Subjective Function

Rotator Cuff Repair

Full Thickness Tears

- Pre-Functional Phase – Older Patient
 - Mobility – Dusting Exercise
 - Assisted Elevation – short lever arm
 - Strengthening
 - Isometric deltoids – post/mid/ant
 - Isometric – sub-max – rotators
 - Standing extension to hip
 - Low level short lever arm – rhythmic stabilization
 - Ball on the table then to the wall
 - Double arm wall push-ups

Rotator Cuff Repairs
Full Thickness Tears

- Return to Function Phase – Older Patient
- Strengthening: OKC
 - Supine Elevation – Thera-Band® to PRE
 - Weighted Ball to dumbbell weights
 - Seated Scaption
 - Positional Recruitment
 - Prone Extension to Hip
 - Sidelying Ext. Rot. with trunk support
 - Single arm retraction with weights
 - Scaption – PRE – light weights – 3 sets of 10
- Strengthening CKC
 - Single Arm wall push-up

Rotator Cuff Repairs
Full Thickness Tears

Return to Activity Phase – Older Patient

- Basically and extension of the Return to Function Phase
- Selected Exercises based on ADL Goals
- PRE Positional Strengthening
- Stronger Resistance color Thera-Band® for Rotation, Supine Elevation, and Standing Extension

Exercise Machine Recommendations:

1. Arm curls: Triceps/Biceps
2. Seated Rows
3. Seated Bench
4. Lat. Pull Down
