Functional Evaluation and Management of Shoulder Problems

What is the purpose of your approach?

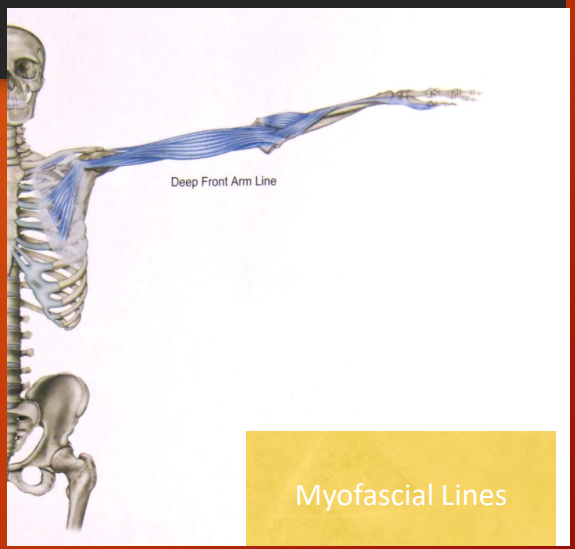
- To relieve pain?
- To prevent pain?
- To increase ROM?
- To establish proper biomechanics for an unstable shoulder?
- To restore or establish proper scapular mobility/stability?

Connections . . .

- Myofascial Slings
- Meridians
- Peripheral Nerves

Deep Front Line

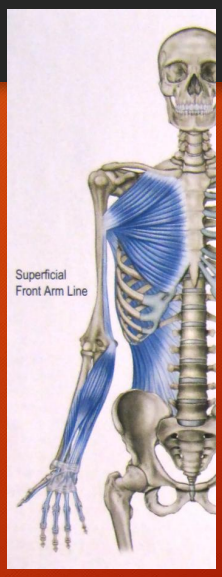
- Pectoralis Minor
- Biceps Brachii
- Radial Periosteum
- Radial Collateral Ligaments
- Thenar Muscles

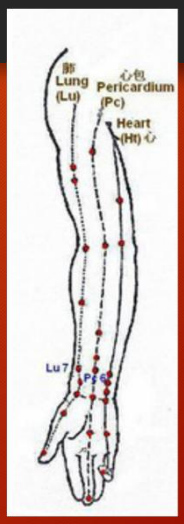


Myofascial Lines

Superficial Front Line

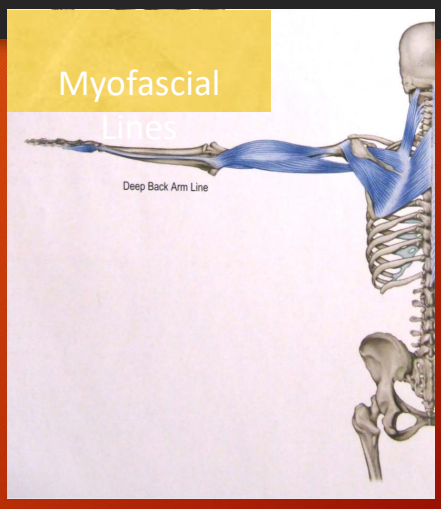
- Pectoralis Major
- Medial Intermuscular Septum
- Flexor Group (Wrist)
- Carpal Tunnel





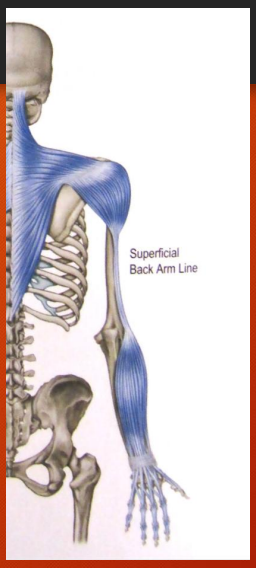
Deep Back Line

- Rhomboids/Levator Scapulae
- Rotator Cuff
- Tricps Brachii
- Ulnar Collateral Ligaments
- Hypothenar Muscles

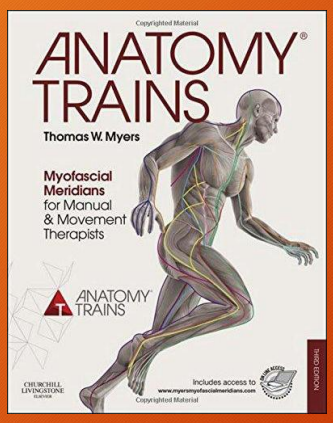


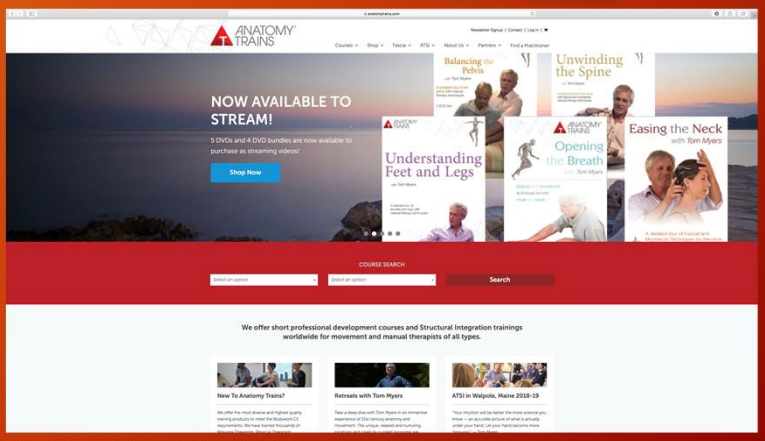
Superficial Back Line

- Trapezius
- Deltoid
- Lateral Intermuscular Septum
- Extensor Group (Wrist)



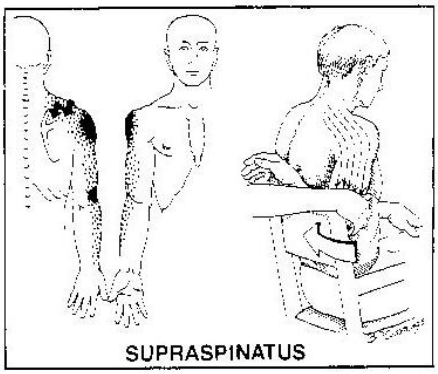
Anatomy Trains . . .

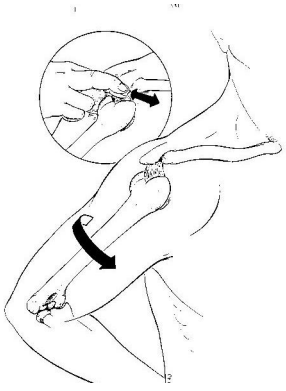


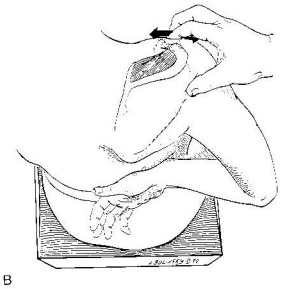


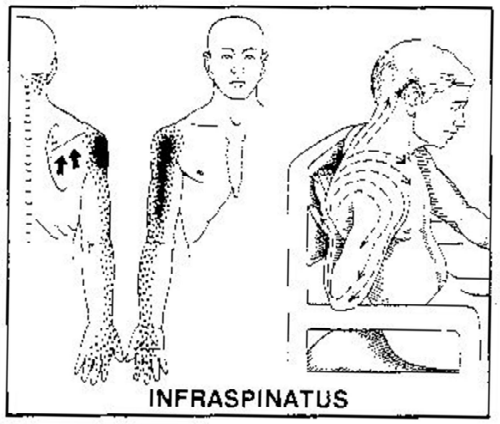
Pain Relief Using Manual Techniques

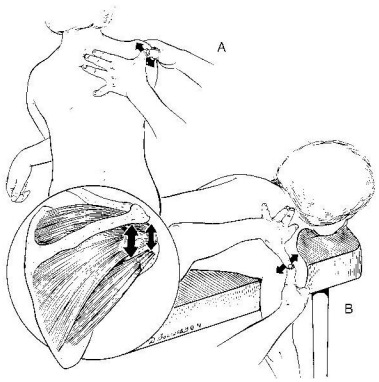
- Trigger Point Evaluation and Release
- End-Range Pain Release with PIR
- Cross-Friction for Tendon Iinsertion and Ligaments
- Eccentric Test for Relief
- Myofascial Scan and Release
  - Passive Approach
  - Active Approach with Muscle Function/Stretch
  - Provocative Movement Approach (FAKTR)

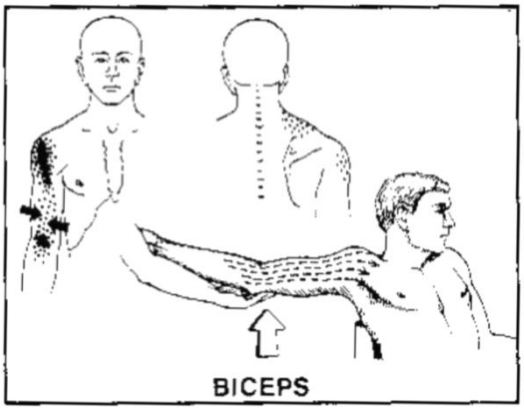







INFRASPINATUS


A
B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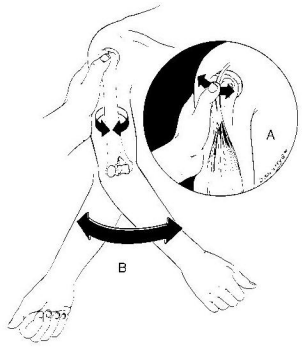
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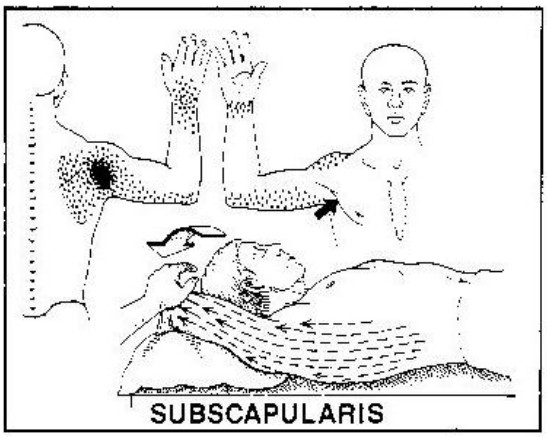


Eccentric Contraction Approach

- Begin with 15-30 seconds of stretch, 5 times
- Perform 3 sets of 10 per day starting with gravity or light weights
- Perform exercises slowly for 2 days; moderately fast for next 2 days, and fast for last 2-3 days
- After exercise, stretch for 15-30 seconds, 5 times
- Ice for 5-10 minutes
- Exercise should be painful only during final third set. If painful before, reduce reps or resistance.

Curwin and Stanish protocol

Spencer Technique

- Osteopathic approach which identifies restriction in a movement pattern
- The scapula is fixed to the thoracic wall
- Use isometric end-range contractions or by using reverse position testing to find positional release
- Seven positions suggested

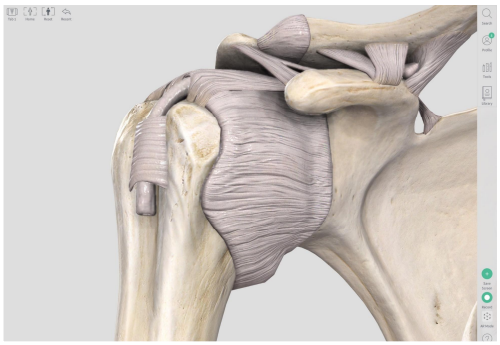
Figure 1. *The seven-step Spencer shoulder technique: Step 1—extension with elbow flexed; step 2—flexion with elbow extended; step 3—compression circumduction; step 4—circumduction with traction with elbow flexed; step 5—adduction with external rotation with elbow flexed; step 6—internal rotation; step 7—stretching tissues and pumping fluids with the arm extended.*

The Functional Examination Approach

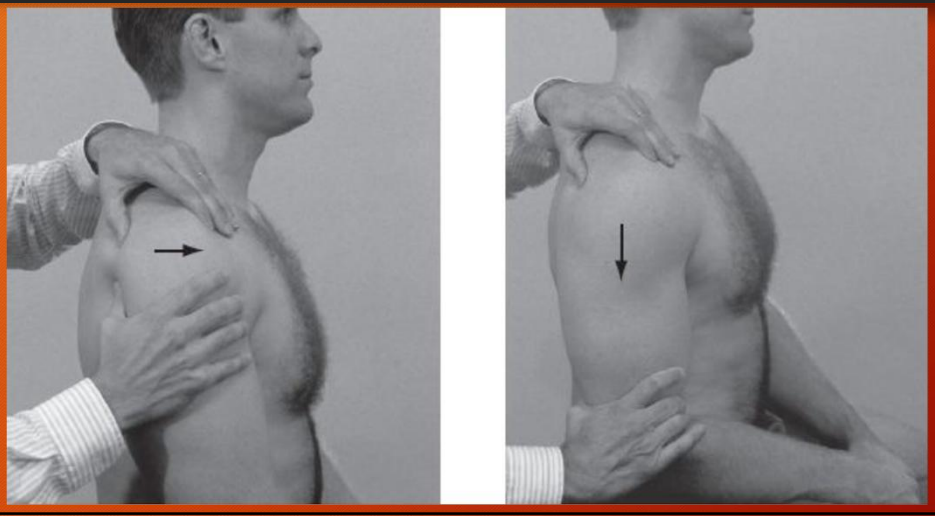
1. Joint Evaluation – guage tightness and looseness
2. Muscle Tightness – functionally determine the contributor to restrictions in end-range movement including overhead elevation
3. Muscle Function – contraction from stretched position, avoid recruitment, consider use (daily function versus sports-specific function)

Joint Evaluation . . .

- Load-and-Shift
- Capsular Stretch Test
- Spencer Technique

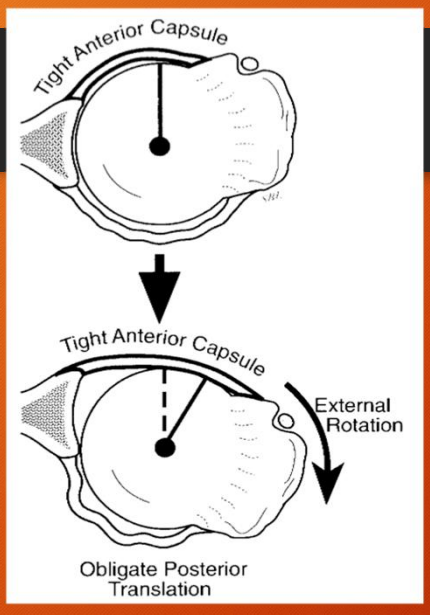


The Load and Shift Tests

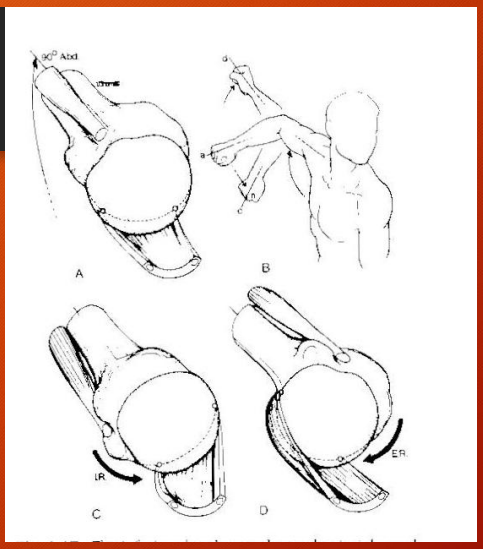


Capsular Tightness

- ✓Translation is a normal movement due to capsular tightening at end-range
- ✓Normal translation does not occur in lax and pathologic joints
- ✓Tightening of the capsule causes an increase in normal translation, usually on the opposite side: posterior tightness = increased anterior translation
- ✓Muscular contraction cannot prevent this excessive movement



Normal obligate motion posteriorly



(B & D) External rotation with abduction causes posterior migration due to anterior tightening

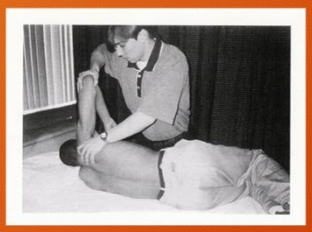
Impingement Relationship to Capsular Tightness

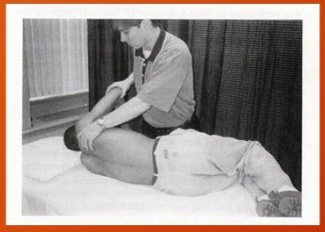
Patients with impingement of the non-dominant arm had posterior capsular tightness and restrictions in both internal and external rotation as compared to the control group

Patients with impingement of the dominant arm had posterior capsular tightness and limitation in internal rotation only as compared to the control group

Tyler TF, et al. Am J Sports Med: 28(5), 668-673, 2000

Posterior Capsular Stretch Test





Post-Isometric Relaxation Approach

Is There Evidence for Manipulation for Shoulder Pain?

A Systematic Review by the Research Commission of the Council on Chiropractic Guidelines and Practice Parameters

***LITERATURE SYNTHESIS: CHIROPRACTIC MANAGEMENT OF UPPER EXTREMITY PAIN**

www.ccgpp.org

Manipulation of the Shoulder

RATING: of B - for mobilization and for HVLA adjustments to the shoulder

There is **moderate** evidence that manipulation (i.e. mobilization not including grade 5 Maitland [cavitation]) may be of short-term benefit, and limited evidence for long-term benefit for patients with shoulder pain.

There is **fair evidence** for the use of HVLA adjusting of the shoulder girdle

LITERATURE REVIEW

MANIPULATIVE THERAPY FOR SHOULDER PAIN AND DISORDERS: EXPANSION OF A SYSTEMATIC REVIEW

James W. Brantingham, DC, PhD,[a] Tammy Kay Cassa, DC,[b] Debra Bonnefin, DC, MAppSc,[c] Muffit Jensen, DC,[d] Gary Globe, DC, MBA, PhD,[e] Marian Hicks, MSLS,[f] and Charmaine Korporaal, MTech Chiropractic[g]

ABSTRACT

Objective: The purpose of this study was to conduct a systematic review on manual and manipulative therapy

Conclusions: This study found a level of B or fair evidence for MMT of the shoulder, shoulder girdle, and/or the FKC combined with multimodal or exercise therapy for rotator cuff injuries/disorders, disease, or dysfunction. There is a fair or B level of evidence for MMT of the shoulder/shoulder girdle and FKC combined with a multimodal treatment approach for shoulder complaints, dysfunction, disorders, and/or pain. (J Manipulative Physiol Ther 2011;34:314-346)

diagnosis. Articles were assessed primarily using the Physiotherapy Evidence Database scale in conjunction with modified guidelines and systems. After synthesis and considered judgment scoring were complete, with subsequent participant review and agreement, evidence grades of A, B, C, and I were applied.

Results: A total of 211 citations were retrieved, and 35 articles were deemed useful. There is fair evidence (B) for the treatment of a variety of common rotator cuff disorders, shoulder disorders, adhesive capsulitis, and soft tissue disorders using MMT to the shoulder, shoulder girdle, and/or the full kinetic chain (FKC) combined with or without exercise and/or multimodal therapy. There is limited (C) and insufficient (I) evidence for MMT treatment of minor neurogenic shoulder pain and shoulder osteoarthritis, respectively.

Conclusions: This study found a level of B or fair evidence for MMT of the shoulder, shoulder girdle, and/or the FKC combined with multimodal or exercise therapy for rotator cuff injuries/disorders, disease, or dysfunction. There is a fair or B level of evidence for MMT of the shoulder/shoulder girdle and FKC combined with a multimodal treatment approach for shoulder complaints, dysfunction, disorders, and/or pain. (J Manipulative Physiol Ther 2011;34:314-346)

Key Indexing Terms: *Chiropractic; Manipulation; Shoulder; Shoulder Pain; Randomized Controlled Trials*

RCT of 150 patients with shoulder symptoms

Treatment group received 6 treatments in a 12- week period which involved

spinal manipulation and/or mobilization of the cervical and thoracic spine

43% of the intervention group and 21% of the control group reported full recovery after the 12-weeks

Bergman, G. J., Winters, J. C., Groenier, K. H., et al. Manipulative therapy in addition to usual medical care for patients with shoulder dysfunction and pain: a randomized, controlled trial. Arch Int Med 2004;141:432-439.

- 198 patients with shoulder complaints from general practices in the Netherlands divided into diagnostic groups; a shoulder girdle group (n = 58) and a synovial group (n = 114)
- Patients were randomized to manipulation or physiotherapy, and patients in the synovial group were randomized to corticosteroid injection, manipulation, or physiotherapy. Outcomes measured at 2, 6, and 11 weeks

In the shoulder girdle group, at five weeks, 70% of the manipulation group considered themselves cured compared to only 10% of the physiotherapy group.

Winters, J. C., Jorritsma, W., Groenier, K. et al. Treatment of shoulder complaints in general practice: long term results of a randomised, single blind study comparing physiotherapy, manipulation, and corticosteroid injection. BMJ 1999;318:1395-1396.

Munday S, Jones A, Brantingham J, Globe G, Jensen M, Price J. A randomized, single-blinded, placebo-controlled trial to evaluate the efficacy of chiropractic shoulder girdle adjustment in the treatment of shoulder impingement syndrome. ***J Am Chiro Assoc.*** **2007;44(8):6-15.**

A small randomized, single-blinded, placebo-controlled trial of 30 participants was conducted to determine the effect of shoulder adjusting (high-velocity, low-amplitude) on patients with a diagnosis of shoulder impingement syndrome.

Patients were randomized to either a detuned ultrasound group or shoulder adjustment group.

At one-month follow-up, there were significant positive treatment effects with regard to a visual analog scale and Short-Form McGill Pain Questionnaire

General Adjusting Cautions

- Never adjust superiorly when mechanical impingement is present
- Never adjust anteriorly or inferiorly when anterior instability is present
- Do not use aggressive adjusting maneuvers with adhesive capsulitis or other acute inflammatory conditions

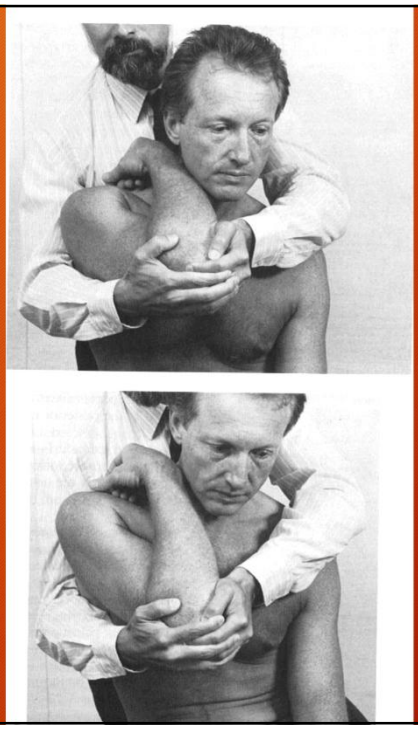
General Adjusting Principles

- When possible, add a distractive component to the adjustment
- Adjust into minor end-play restrictions
- Use short-lever approaches
- Use the least amount of movement and force necessary to accomplish the job

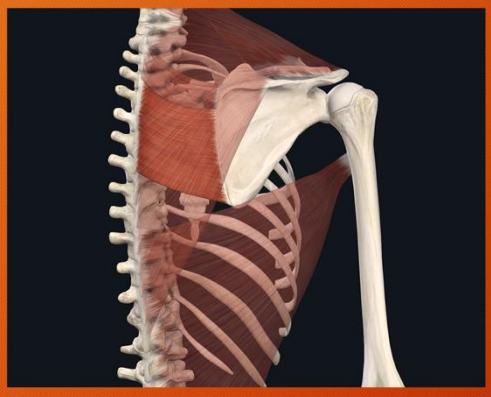
Contraindications to Shoulder Adjusting/Manipulation

- For all patients who have had recent (e.g. 12 months) surgery, or who have fracture, suspected fracture, disclocation, severe generalized or local osteoporosis, infection, tumor, or infection HVSA manipulation is contraindicated.
- For all patients, an evaluation for joint stability must be performed. Based on the findings, it is recommended that no HVSA manipulation be used for patients with medical subluxation, hypermobility syndromes (e.g. Marfan's, Ehlers-Danlos syndrome), or gross looseness indicating multidirectional instability.

- Mobilization such as applying a load-and-shift or Maitland grade 1-4 type of translational movement may be appropriate in these case settings.
- For patients with adhesive capsulitis or any acute inflammatory condition such as rheumatoid arthritis, active hemarthrosis or extensive swelling, rheumatoid variant disease, crystalline disease (e.g. gout), or acute bursitis it is recommended not to use HVSA



Muscle Tightness Pattern Evaluation



- Passive vs Active
- Response to PIR
- DDX of limiters to shoulder elevation

Upper Crossed Syndrome

- Tightness in:
  - Upper trapezius
  - Levator scapulae, Scalenes, SCM
  - Pectoralis major and minor
- Inhibition of:
  - Deep neck flexors
  - Lower stabilizers of scapulae

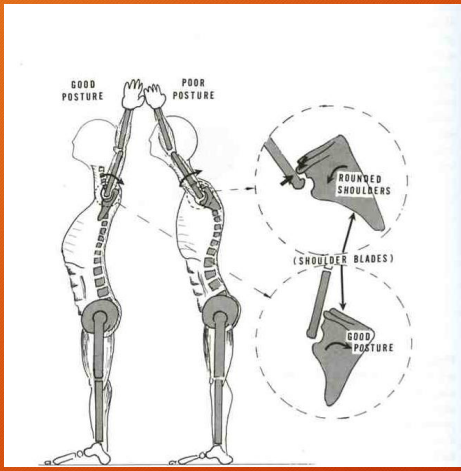
Evaluation of Muscular Imbalance - Vladimir Janda

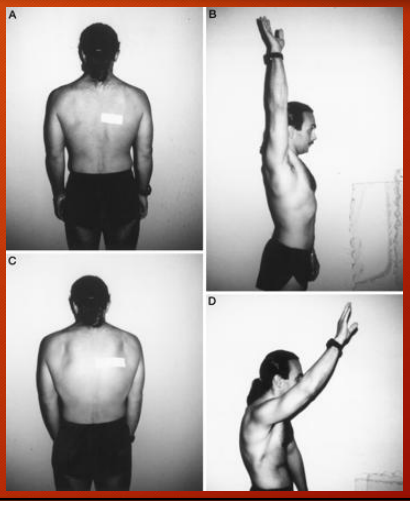
Rehabilitation of the Spine - Ch. 6

Limiters to elevation . . .

- Restriction to interpretation due to pain provocation
- Determine contribution of latissimus dorsi through back positioning
- Determine degree of limitation in internal and external rotation
- Determine contribution of thoracic kyphosis and forward head posture

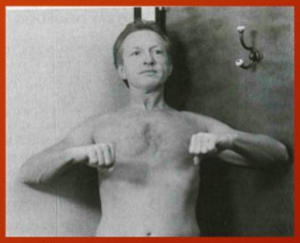
Head Position and Shoulder Range of Motion





Stretch in corner first keeping back straight (20-30 sec.)

Turn around and contract the muscles between your shoulder blades causing the chest to push forward

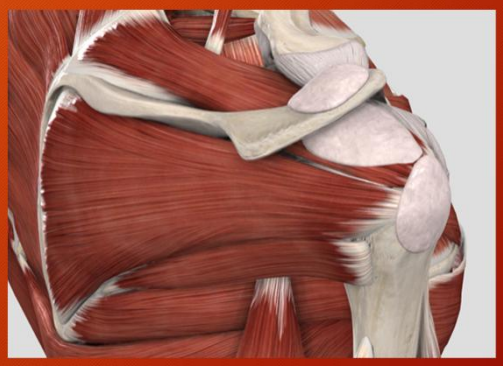


Post-Isometric Stretching

- Stretch to end-range
- Resist into agonist limitation direction
- Use 25% of maximum effort
- Hold for 5-7 seconds
- Stretch into new position passively
- Repeat 5-7 times

Functional Movement Evaluation

- Contract from a stretched position
- Eliminate recruitment patterns
- Consider spinal component



Muscles . . . the confusion is . . .

- Discussed as “one function” (same in all positions)
- Discussed as synergists, antagonists, and agonists
- Discussed in relation to myofascial lines and slings
- Discussed in reference to trigger point referral

Training questions . . .

- Muscles are “on demand” structures that both have a neural and functional element that must be placed in context
- If muscles are agonists and synergists, does training one of them train all of them?
- If a muscle is tight posturally, is it also “tight” functionally?
- Is isolation possible or even necessary for either strengthening or stretching?

Approaches . . .

- Stretch tight structures and strengthen weak structures; may follow a crossed pattern
- Avoid positions of risk for stability
- Avoid positions of risk for subacromial impingement

The Scapulae: Indirect and Direct Biiomechanics

Sequence of Shoulder Elevation

Phase 1 –

- the setting phase in the first 30-60 degrees of elevation
- As conoid becomes tight it unites the clavicle and scapula together for further coupled movement

Phase 2 –

- Scapuloclavicle linkage rotates around an axis (line drawn through SC joint and medial scapule); this phase ends with tightening of the costoclaivcular ligament cause rotation of the clavicle with the scapula following

Sequence of Shoulder Elevation

Phase 3 –

- The scapula rotates around an axis extending through the AC joint

Phase 4 –

- The trapezoid ligament becomes taut re-establishing claviscapular linkage

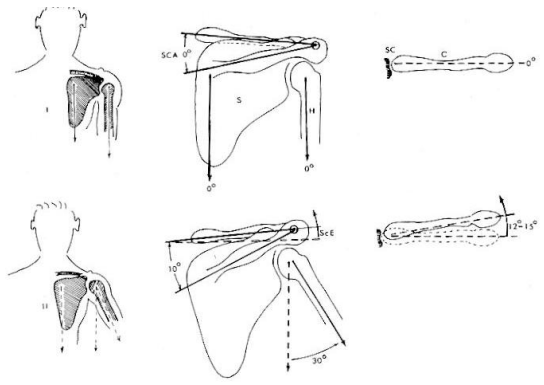


Fig. 2-22. Accessory movement of the scapulohumeral rhythm other than the glenohumeral movement. Movement of the arm through all phases of abduction involves all joints of the shoulder girdle in a synchronous manner.

Phase I: The resting arm: 0 degrees scapular rotation *(S)*; 0 degrees spinoclavicular angle *(SCA)*; 0 degrees movement at the sternoclavicular joint *(SC)*; no elevation of the outer end of the clavicle *(C)*; no abduction of the humerus *(H)*.

Phase II: Humerus abducted 3 degrees: the outer end of the clavicle is elevated 12 to 15 degrees with no rotation of the clavicle; elevation occurs at the sternoclavicular joint; some movement occurs at the acromioclavicular joint as seen by an increase of 10 degrees of the *SCA* formed by the clavicle and the scapular spine. *(Figure continues.)*

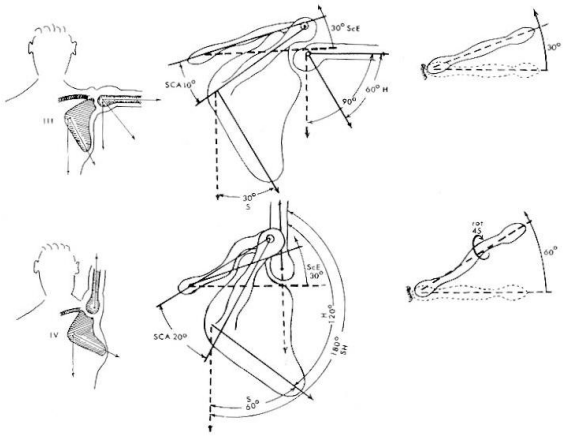


Fig. 2-22. *(continued).*

Phase III: Humerus *(H)* abducted to 90 degrees (60 degrees glenohumeral, 30 degrees scapular): the clavicle is elevated to its final position, 30 degrees; no rotation of clavicle has occurred (all movement is at the sternoclavicular joint); no change in the *SCA*.

Phase IV: Full overhead elevation (SH = 180 degrees; *H* = 120 degrees; *S* = 60 degrees): outer end of the clavicle has not elevated further (at the sternoclavicular joint), but the *SCA* has increased (to 20 degrees). Because of the clavicle's rotation and its "cranklike" form, the clavicle elevates an additional 30 degrees. The humerus through this phase has rotated, but this has not influenced the above degrees of movement. (From Calliett,[68] with permission.)

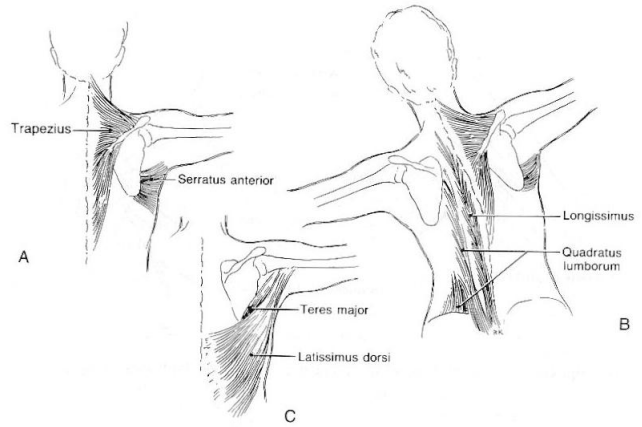


Fig. 2-29. Three different ways in which muscles produce elevation of the scapula. **(A)** Pure elevation of the scapula in the scapular plane, as might be performed in a throwing motion. **(B)** In throwing a heavier object, to allow the glenoid to bear extra weight more elevation of the scapula is necessary. Because the muscles of the shoulder are already operating at optimum points of their length-tension curve, further elevation must be obtained by using the contralateral flexion of the spine. **(C)** An upward moment on the upper limb, as in the iron cross maneuver, must be resisted by a greater force in the latissimus dorsi. The resultant caudad-directed joint reaction vector must meet the bone of the glenoid. This scapular elevation is produced by the teres major. (From Jobe,[64] with permission.)

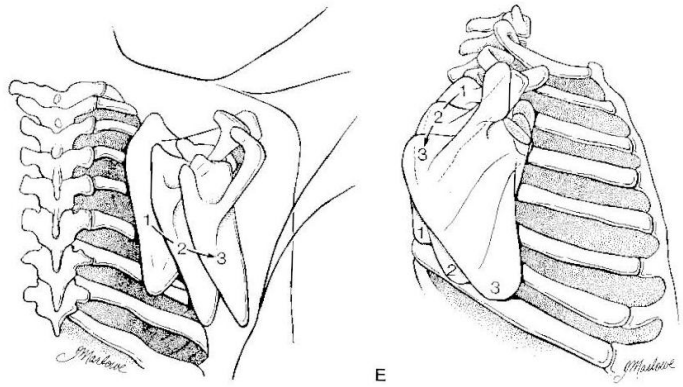
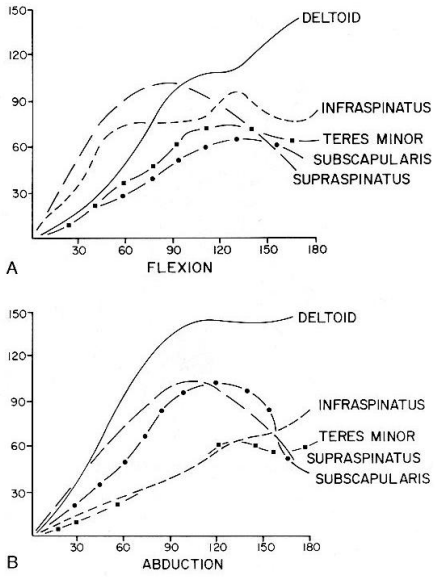


Figure 10-17 *(Continued)* **(D & E)** Emphasizes the three-dimensional movement of the scapula around the thorax.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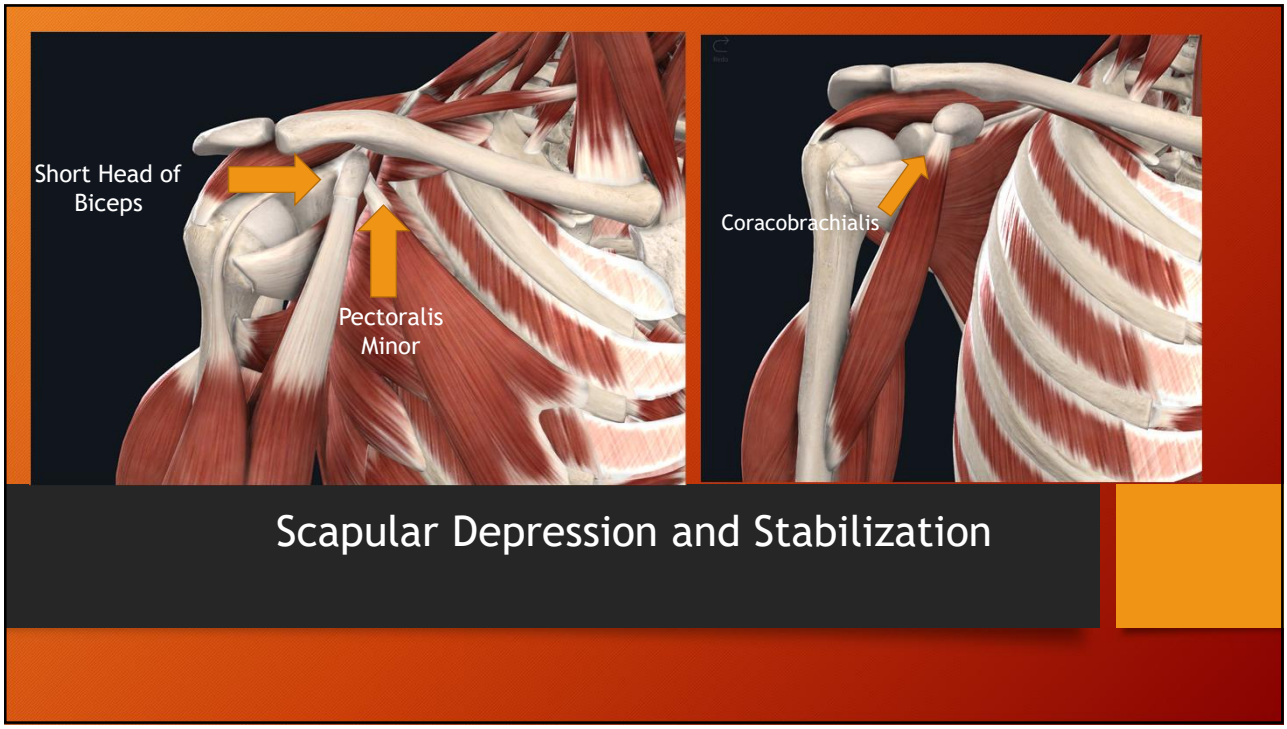
SUBSCAPULARIS
30 60 90 120 150 180
B
ABDUCTION


Short Head of Biceps
Pectoralis Minor
Coracobrachialis
Scapular Depression and Stabilization

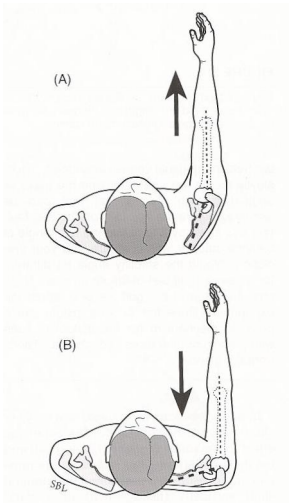


FIGURE 3–10.

Essentially identical humerothoracic positions can be achieved using different humeroscapular positions, which, in turn, have different implications for the balance mechanism. *A*, The humerus is elevated so that it is closely aligned with the glenoid center line. This should be the most stable position. *B*, The same humerothoracic position is achieved with the humerus almost perpendicular to the glenoid center line, challenging the balance stability of the joint.

Figure 6 Normal scapular control in shoulder flexion. Check control in both ascending and descending positions.

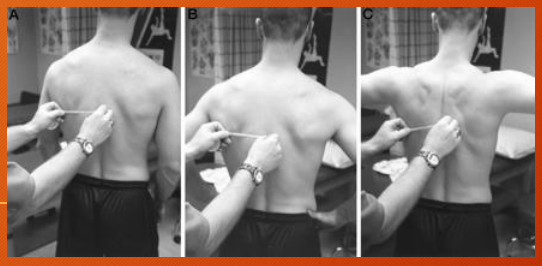


Figure 7 Lateral scapular slide measurement. A, the first position, with arms at side; B, the second position, with hands on hips; C, the third position, with arms at or below 90° abduction, with glenohumeral internal rotation.

Which Exercises Should I Give the Patient?

Exercise for Shoulder Pain

- Ludwig et al.randomized 67 male workers diagnosed with impingement syndrome into either an at-home exercise group or a no treatment control group (Quality Rating = 78).

The intervention group showed significantly greater improvements in the Shoulder Rating Questionnaire and shoulder satisfaction score compared to the control

Ludwig R, Mariotti G, Schlumpf U. [Prognosis of shoulder calcifications after irrigation treatment and roentgen findings. A prospective study and literature review]. *Schweiz Rundsch Med Prax.* Apr 16 1996;85(16):526-533.

Two RCTs by Ginn et al. indicate some benefit to exercise or equal benefit compared to other treatments such as corticosteroid injection (Quality Rating = 95)

Ginn KA, Cohen ML. Exercise therapy for shoulder pain aimed at restoring neuromuscular control: a randomized comparative clinical trial. *Journal of Rehabilitation Medicine.* 2005;37(2):115.

Ginn KA, Herbert RD, Khouw W, Lee R. A randomized, controlled clinical trial of a treatment for shoulder pain. *Phys Ther.* Vol 77; 1997:802-809; discussion 810-801.

Exercise

- An RCT by Haahr et al. 90 consecutive patients diagnosed with impingement syndrome were randomized into a subacromial decompression (surgery) group or an exercise group (Quality Rating = 75).
- The exercise prescription for each patient was directed toward strengthening and decompression of the shoulder with emphasis on periscapular muscles and rotator cuff muscles.
- The frequency was 3 times for the first two weeks, 2 times a week for the next three weeks, and 1 time per week for the remaining seven weeks. Outcomes were measured using the Constant score and a pain and dysfunction score

Haahr JP, Ostergaard S, Dalsgaard J, et al. Exercises versus arthroscopic decompression in patients with subacromial impingement: a randomised, controlled study in 90 cases with a one year follow up. *Ann Rheum Dis.* May 2005;64(5):760-764.

- At 12 months the score improved to 57.0 and 52.7 respectively; the difference not being significant.
- No group difference in mean pain and dysfunction improvement scores was found

The authors conclude that subacromial decompression *was not* shown to be superior to physiotherapy with exercise

Questions . . .

- In strengthening, is it necessary to position to avoid over-toning tight synergists?
- Do the rotator cuff function as internal or external rotators while functioning as compressors (stabilizers)?
- What effect does postural correction have on rehabilitation/prevention approaches?

Impingement Cautions

- A study using a suprascapular nerve block was designed to determine if weakness in the supraspinatus or infraspinatus would effect subacromial pressure: it did not
- Secondly it was recommended from the results that abduction, internal rotation, and flexion be avoided if concerned about increased subacromial pressure
- External rotation does not need to be limited

Werner CM, Blumenthal S, Curt A, Gerber C. Subacromial pressures in vivo and effects of selective experimental suprascapular nerve block. *J Shoulder Elbow Surg.* May-Jun 2006;15(3):319-323.

Dynamic Stability of the Shoulder

- Protectors - rotator cuff
- Pivoters - scapula positioning (mainly via trapezius and serratus anterior)
- Positioners - humeral positioning (mainly deltoid/supraspinatus)
- Propellers - mainly large muscles (pectoralis major and latissimus dorsi)
- Sequence for rehabilitation

Rehabilitation Based on EMG

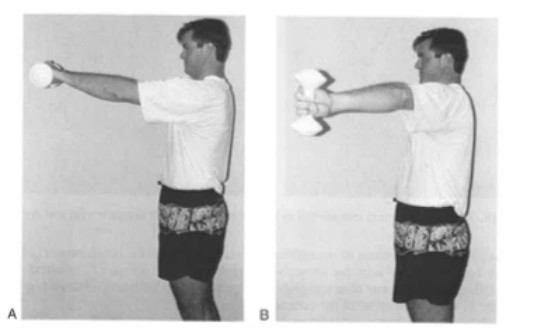
For glenohumeral stabilization:

- scaption
- flexion
- horizontal abduction with external rotation (prone)
- the press-up

Rehabilitation Based on EMG

For scapula stabilizing:

- scaption
- press-up
- bent-over row
- push-up with a plus

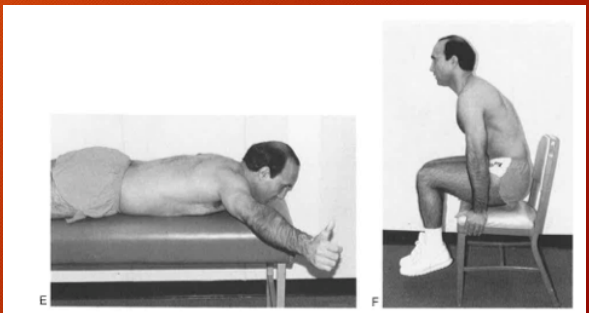


Flexion

Scaption

Horizontal Abduction

FlexionPress-Up



IJSPT

ORIGINAL RESEARCH

ELECTROMYOGRAPHIC ANALYSIS OF SHOULDER GIRDLE MUSCLES DURING COMMON INTERNAL ROTATION EXERCISES

Omid Alizadehkhaiyat, MD, PhD[1]
David H. Hawkes, MD[2]
Graham J. Kemp, DM, FRCPath[3]
Simon P. Frostick, DM, FRCS[2]

ABSTRACT

Background: High level throwing performance requires the development of effective muscle activation within shoulder girdle muscles particularly during forceful internal rotation (IR) motions.

Results: There were significant differences in muscles' activation across IR exercises ($p < 0.05$–$p < 0.001$). Rotator cuff and deltoid muscles were highly activated during IR at 90° of Abduction. Latissimus dorsi exhibited markedly higher activation during IR at Zero-Position. While upper trapezius had the highest activation during IR at Zero-Position, middle and lower trapezius were activated at highest during IR at 90° of Abduction. The highest activation of serratus anterior and rhomboid major occurred in IR at Zero-Position and IR at 90° of Abduction, respectively.

Conclusions: Studied exercises have the potential to effectively activate glenohumeral and scapular muscles involved in throwing motions. Results provide further evidence for developing rehabilitation, injury prevention, and training strategies.

Keywords: Electromyography; Internal Rotation Exercises; Rehabilitation; Shoulder Muscle Activation

Level of Evidence: 4, Controlled laboratory study

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Original Research

Electromyographic Analysis of the Shoulder Girdle Musculature During External Rotation Exercises

Omid Alizadehkhaiyat,*† MD, PhD, David H. Hawkes,‡ MD, Graham J. Kemp,§ DM, FRCPath, and Simon P. Frostick,‡ DM, FRCS
Investigation performed at MARIARC, University of Liverpool, Liverpool, UK

Background: Implementation of overhead activity, a key component of many professional sports, requires an effective and balanced activation of the shoulder girdle muscles, particularly during forceful external rotation (ER) motions.

Purpose: To identify activation strategies of 16 shoulder girdle muscles/muscle segments during common shoulder ER exercises.

Study Design: Descriptive laboratory study.

Method: Thirty healthy subjects were included in this study, and 16 shoulder girdle muscles/muscle segments were investigated (surface electrode: anterior, middle, and posterior deltoid; upper, middle, and lower trapezius; serratus anterior; teres major; upper and lower latissimus dorsi; and upper and lower pectoralis major; fine wire electrodes: supraspinatus, infraspinatus, subscapularis, and rhomboid major) using a telemetric electromyography (EMG) system. Five ER exercises (standing ER at 0° and 90° of

Results: Muscular activity differed significantly among the ER exercises ($P < .05$ to $P < .001$). The greatest activation for anterior and middle deltoid, supraspinatus, upper trapezius, and serratus anterior occurred during standing ER at 90° of abduction; for posterior deltoid, middle trapezius, and rhomboid during side-lying ER with underarm towel; for lower trapezius, upper and lower latissimus dorsi, subscapularis, and teres major during prone ER at 90° of abduction; and for the clavicular and sternal part of the pectoralis major during standing ER with underarm towel.

Keywords: overhead sports; electromyography; shoulder exercises; external rotation; rehabilitation

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One or more of the authors has declared the following potential conflict of interest or source of funding: This study was internally funded by the Musculoskeletal Science Research Group, University of Liverpool, Liverpool, UK.

The Orthopaedic Journal of Sports Medicine, 3(11), 2325967115613988
DOI: 10.1177/2325967115613988

Effective overhead activity, a key element of many professional sports such as baseball, cricket, swimming, tennis, and volleyball, requires effective activation of shoulder girdle muscles during forceful rotational movements to produce a healthy balance between mobility and functional stability of the shoulder.[3,5,11,16,45,47] Several shoulder pathologies such as rotator cuff tears, subacromial impingement syndrome, internal impingement, joint laxity, labral lesions, and scapular dyskinesis are common in overhead athletes, arguing the need to develop effective training, injury prevention, and rehabilitation strategies.[4,9,16,18,27,39,59]

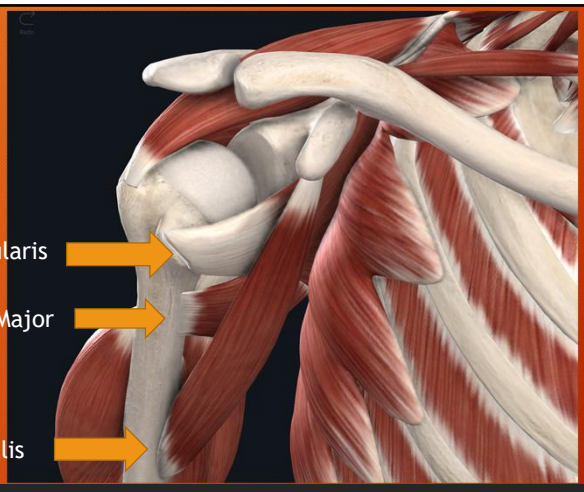
The glenohumeral (GH) joint presents a greater range of motion than any other human body articulation. The osseous structure provides limited intrinsic stability to the shoulder joint[61] so that functional stability is mainly

Electromyographic Analysis of the Rotator Cuff and Deltoid Musculature During Common Shoulder External Rotation Exercises

Michael M. Reinold, DPT, ATC[1]
Kevin E. Wilk, PT[2]
Glenn S. Fleisig, PhD[3]
Nigel Zheng, PhD[4]

Results: EMG activity varied significantly among the 7 exercises. Sidelying ER produced the greatest amount of EMG activity for the infraspinatus (62% MVIC) and teres minor (67% MVIC). The greatest amount of activity of the supraspinatus (82% MVIC), middle deltoid (87% MVIC), and posterior deltoid (88% MVIC) was observed during prone horizontal abduction at 100° with full ER.

The glenohumeral joint exhibits the greatest amount of motion of any articulation in the human body, consequently little inherent stability is provided by its osseous configuration.[1] Functional stability of the



Smaller Internal Rotators

Journal of Bodywork & Movement Therapies (2017) 21, 582–588

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ORIGINAL RANDOMISED STUDY

Different weight bearing push-up plus exercises with and without isometric horizontal abduction in subjects with scapular winging: A randomized trial

Woo-Jeong Choi, PT, MS, Tae-Lim Yoon, PT, PhD,

The results suggest that IHA application using a Thera-Band can effectively reduce PM muscle activity during SPP and WPP exercises. Moreover, the SPP exercise can be used to increase UT and SA muscle activity and reduce the UT/SA and PM/SA muscle activity ratios in subjects with scapular winging.

Received 15 October 2014; received in revised form 25 June 2016; accepted 30 August 2016

Elastic Tubing Exercise

A standard progressive approach includes:

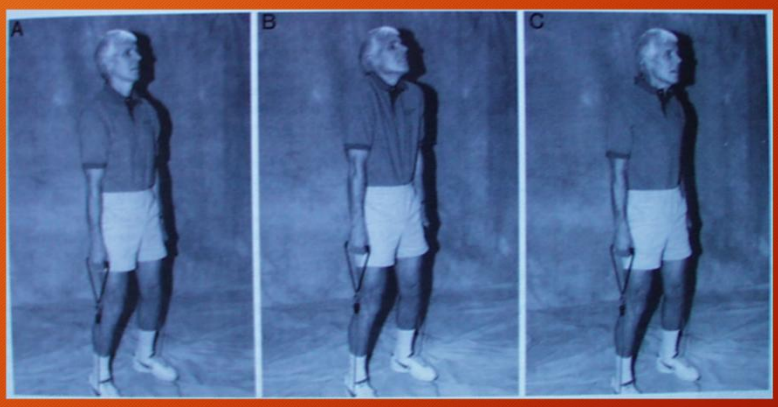
1. facilitation phase using quick mid-range movement
2. strength phase using full ROM held at endrange for an isometric contraction
3. endurance phase use full ROM performed 1 per second

- Emphasis on eccentric training
- Functional movement patterns (diagonals)
- Simulated sports patterns (with or without equipment)

Elastic Tubing Approach Based on EMG Evidence

- **Shoulder shrug** - overall great exercise for most shoulder muscles
- **Forward punch** - another great exercise for primarily supraspinatus, serratus anterior, and anterior deltoid
- **External rotator** - generally good exercise for all rotator cuff
- **Seated rows** - primarily rotator cuff and trapezius

Shoulder Shrug with Retraction – Best Overall Activator of Shoulder Muscles with No Overhead Activity Necessary



Seated Rows

- **Arms at Side** – Subscapularis
- **Arms at 60 Degrees Abduction** – Subscapularis plus Supraspinatus
- **90 Degrees Shoulder Abduction** – overall stimulation of both rotator cuff and scapular retractors

Study by Horrigan et al. Evaluated three exercises:

- scaption with internal rotation
- side-lying abduction (SLA)
- military press

Exercise induced signal intensity increases are seen after exercise

Specific muscles were activated with specific exercises

Side-lying abduction (SLA) - greatest increase in SI for supraspinatus, infraspinatus, and subscapularis as well as deltoid

Scaption with internal rotation - increases were seen but not as high as SLA

Subscapularis Rehab

- Nine men and six women were evaluated with needle EMG while performing a series of exercises
- Upper subscapularis activity was greater than lower subscapularis activity for all exercises except internal rotation at 0 degrees abduction
- The push-up plus and diagonal exercises stressed both portions of the muscle to the greatest extent
- Two section of subscapularis may have different functional responses with exercise

Decker MJ, Tokish JM, Ellis HB, Torry MR, Hawkins RJ. Subscapularis activity during selected rehabilitation exercises. *Am J Sports Med* 2003;31(1):126-134.

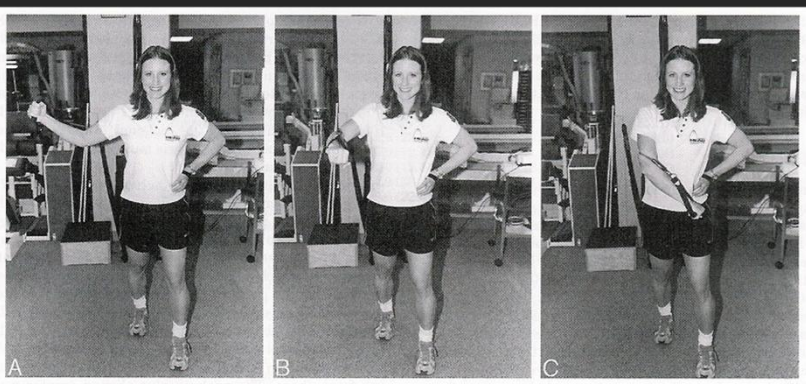
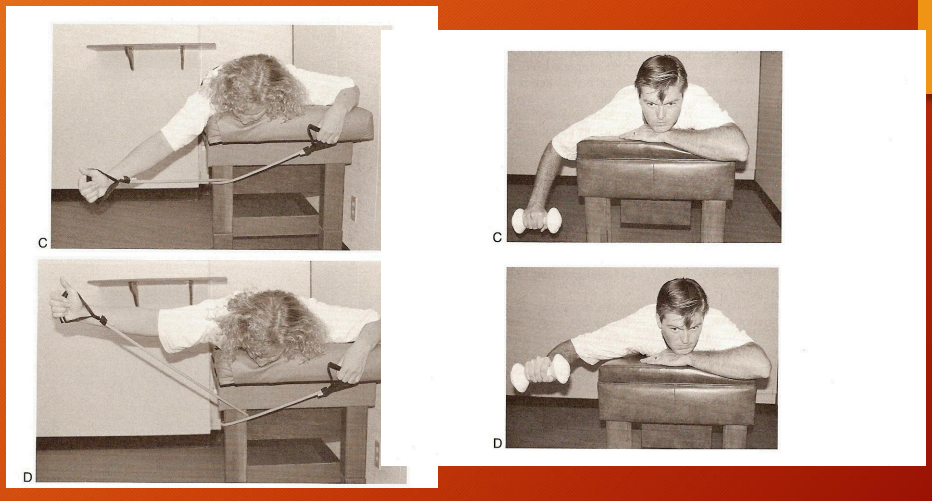


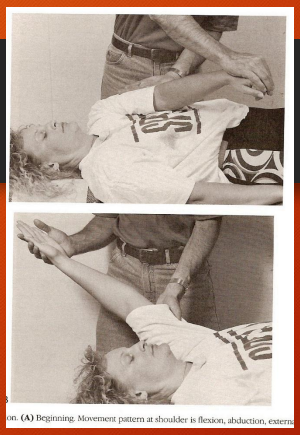
Figure 3. The start (A), the middle (B), and the end (C) of the diagonal exercise.

FIGURE 6. The proper alignment of the upper extremity during the prone horizontal abduction exercise with external rotation. Note how the upper extremity is aligned with the muscle fiber orientation of the lower trapezius.



- The infraspinatus and teres major generated moderate-to-high activity with both the prone horizontal and prone external rotation exercises
- Performing the push-up with a plus with the hands externally rotated and on an unstable surface provided the most stimulation for serratus anterior
- Only the press-up and push-up with a plus activate both the lower trapezius and the serratus anterior
- Side-lying wiper isolated infraspinatus activity without significantly incorporating the upper trapezius or posterior deltoid

ion. **(A)** Beginning. Movement pattern at shoulder is extension, adduction,



on. **(A)** Beginning. Movement pattern at shoulder is flexion, abduction, externa

PNF Diagonal Approaches