WHEN IT'S NOT CARPAL TUNNEL: ADDRESSING PROXIMAL ISSUES

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1

OBJECTIVES

- DESCRIBE THE 3 MAIN PASSAGEWAYS THAT CAN BE INVOLVED WITH UPPER QUADRANT COMPRESSION
- DISCUSS CERVICAL AND THORACIC SPINE SEGMENTAL MOBILITY
- DISCUSS COMMON SOFT TISSUE CULPRITS THAT CONTRIBUTE TO UPPER QUADRANT LIMITATIONS
- PERFORM A CLINICAL EXAMINATION: ROOS TEST (ELEVATED ARM STRESS TEST), CYRIAX RELEASE TEST, THORACIC SEGMENTAL MOBILITY
- DEMONSTRATE ABILITY TO TEST AND TREAT 1ST RIB LIMITATIONS ASSOCIATED WITH UPPER QUADRANT LIMITATIONS
- ASSESSMENT OF SCAPULAR ALIGNMENT TO IDENTIFY POSTURAL INFLUENCES IN UPPER QUADRANT COMPRESSION
- PERFORM ASSESSMENT AND TREATMENT OF POSTERIOR GLENOHUMERAL CAPSULE LIMITATIONS
- NEUROMUSCULAR RE-EDUCATION AND HOME PROGRAM STRATEGIES TO MAXIMIZE UPPER QUADRANT AND THORACIC MOBILITY

2

DISCLOSURES

WE HAVE NONE ☺

3

THANK YOU TO THE HAND CENTER

4

HUGE ***SHOUT*** OUT TO OUR MENTOR, ANN PORRETTO-LOEHRKE

5

THORACIC OUTLET SYNDROME

First described by Coot in 1861

In 1956, Peet and colleagues described a spectrum of conditions caused by compression of the brachial plexus (neurogenic), subclavian artery (arterial), or subclavian vein (venous)

*Cadaveric studies have suggested that up to 90% of the population may have what is considered abnormal anatomy of the thoracic outlet, which suggests a multifactorial etiology for the symptomatic disease

Buller LT, Jose J, Baraga M, et al. Thoracic outlet syndrome: current concepts, imaging features, and therapeutic strategies. Am J of Orthop. 2015;Aug:44(8):376-382.
Juvonen T, Satta J, Laitala P, et al. Anomolies at the thoracic outlet are frequent in the general population. Am J of Surg. 1995;170(1):33-37.

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THORACIC OUTLET SYNDROME

Thoracic Outlet Syndrome (TOS) is pain, numbness, tingling, and/or weakness in the arm and hand due to pressure against the nerves of blood vessels that supply the arm. It is due to tight muscles, ligaments, bands, or bony abnormalities in the thoracic outlet area of the body, which lies just behind the collar bone. Pressure on the nerves is the problem more than 90% of the time, but occasionally the artery or vein is involved.

Sanders RJ & Annest SJ. Thoracic outlet and pectoralis minor syndromes. Semin Vasc Surg. 2014;Jun:27(2):86-117.

7

THORACIC OUTLET SYNDROME

The term TOS states where the problem is, but not *what* the problem is.

Not every TOS problem is the *same*.

8

THORACIC OUTLET

ANATOMY

OBJECTIVE: DESCRIBE THE 3 MAIN PASSAGEWAYS THAT CAN BE INVOLVED WITH UPPER QUADRANT COMPRESSION

9

TOS: Anatomy

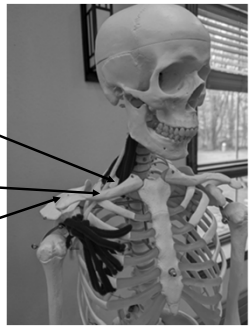
WHERE IS THE THORACIC OUTLET?

Bony Anatomy:

1st Rib

Clavicle

Scapula



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TOS: Anatomy

MECHANICAL DISTURBANCES IN THE THORACIC OUTLET CAN CAUSE COMPRESSION OR TENSION LOADING OF THE BRACHIAL PLEXUS AT 3 PASSAGEWAYS…

•Scalene triangle
•Costoclavicular space
•Subcoracoid space (beneath pect minor)

These are dynamic and change with movement!

Ide J, Kataoka Y, Yamaga M, et al. Compression and stretching of the brachial plexus in thoracic outlet syndrome: correlation between neuroradiographic findings and symptoms and signs produced with provocative manoeuvres. J Hand Surg Br. 2003;28: 218-223.

11

TOS: Anatomy

SCALENE TRIANGLE

1st Passageway

Between the anterior and middle scalene muscles

12

TOS: Anatomy

SCALENES

Origin:
- Anterior – anterior tubercles of transverse processes of 3rd-6th cervical vertebrae
- Middle – posterior tubercles of transverse processes of 2nd-7th cervical vertebrae

Insertion:
- Anterior – scalene tubercle and cranial crest of 1st rib
- Middle – 1st rib, cranial surface between tubercle and subclavian groove

Innervation: Lower cervical nerve

13

TOS: Anatomy

ROLE OF SCALENE MUSCLES

- When the scapular muscles are weak, the scalene muscles can often become "overworked"
- These muscles are responsible for elevating the first rib

14

TOS: Anatomy

CHANGES IN SCALENE MUSCLES

A history of a MVA can also contribute to increased tonicity of the scalenes.

Sanders found atrophy of Type II muscles fibers, predominance of Type I fibers, and a 25% increase in connective tissue in the scalene muscles following a MVA

www.pixabay.com

Sanders RJ. Scalene muscle abnormalities in traumatic thoracic outlet syndrome. Am J of Surg. 1990;159:231-236.

15

TOS: Anatomy

CHANGES IN SCALENE MUSCLES CONTINUED…

The increased recruitment of the scalenes (due to more type I fibers) can lead to:

- Direct nerve compression at the scalene triangle
- Indirect compression of the brachial plexus via 1st rib elevation

Laulan J. Thoracic outlet syndrome. The so-called "neurogenic types". Hand Surg & Rehabilitation. 2016;155-164.

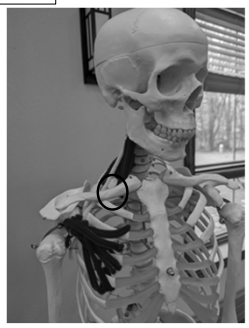
16

TOS: Anatomy

COSTOCLAVICULAR SPACE 2nd Passageway

Between the clavicle and 1st rib
**The lower trunk of brachial plexus (C8-T1) is vulnerable to 1st rib elevation*

Borders:
- Dorsal – scapula & subscapularis
- Ventral – clavicle, subclavius & fascia
- Cadual - clavicle



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Top Anatomy

COSTOCLAVICULAR SPACE

Contents:
- Brachial plexus (lateral, posterior, medial cords)
- Subclavian artery
- Subclavian vein

18

Top Anatomy

SUBCORACOID SPACE

3rd Passageway

Beneath the pectoralis minor muscle

19

Top Anatomy

SUBCORACOID SPACE

Potential areas of involvement:
- Shoulder pathology
- Scapulothoracic instability & postural issues
- Limitations in the upper ribs (1-4)

Sanders RJ & Annest SJ. Pectoralis minor syndrome: subclavius brachial plexus compression. Diagnostics (Basel). 2017; Sept 7 (3): 46.

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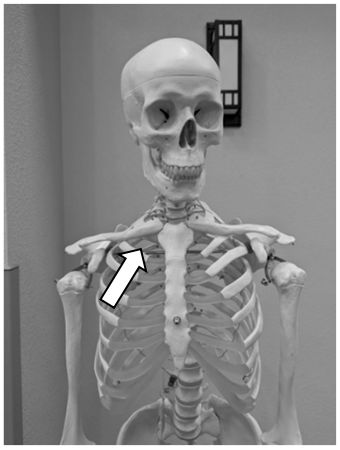
1st Rib

- 45˚ inclination in males
- More transverse orientation in females



Masocatto NO, Da-Matta T, Prozzo TG, et al. Thoracic outlet syndrome: a narrative review. Rev Col Bras Cir. 2019;Dec20;46(5):e20192243.

21

TOS: THE BIG ISSUE

- Patient's present with varying signs and symptoms
- Long duration of symptoms
- Sometimes difficult to find a pattern

What is the key to the puzzle?

22

WHEN IT'S NOT CARPAL TUNNEL: ADDRESSING PROXIMAL ISSUES

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OBJECTIVE

DISCUSS CERVICAL AND THORACIC SPINE SEGMENTAL MOBILITY

2

2

CERVICAL AND THORACIC SEGMENTAL MOBILITY

- CERVICAL SPINE:
  7 VERTEBRAS
- THORACIC SPINE:
  12 VERTEBRAS

(1-6 ARE DYNAMIC)

3

3

CERVICAL SPINE

- Neck region of your spine
- Houses Brachial plexus
- Upper and Lower Cervical Column
- Foundation of Cervical flexors and extensors

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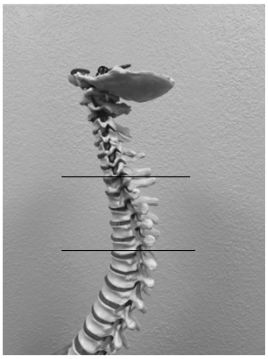


THORACIC SPINE

- 1-5 are dynamic movers for rib cage and reaching with shoulder movement
- Sidebending C6-C7
- Rotation T1-T2
- All has to coincide for scapular, GHJ arthrokinematics
  - If spine locked, ribs are locked, causing kinetic chain issues

5

CERVICAL/THORACIC MOBILITY

	Flexion/Extension	Rotation	Sidebending
C6-C7	**17**	6	**7**
C7-T1	9	2	4
T1-T2	4	**9**	5
T2-T3	4	8	6
T3-T4	4	8	5
T4-T5	4	8	6

6

WHY IS THORACIC SPINE MOVEMENT IMPORTANT?

- SCAPULAR ADHESIONS
- LIMITED RIB TRANSLATION
- RIB ELEVATION = DISTAL COMPRESSION
- GHJ STIFFNESS (POSTERIOR CAPSULE)

7

THORACIC SPINE SCREEN

8

RIB ELEVATION LEADS TO THORACIC STIFFNESS

- 1ST RIB ELEVATES COMPRESSING BRACHIAL PLEXUS INTO THE CLAVICLE
- LOWER TRUNK (C8-T1) OF THE PLEXUS IS VULNERABLE TO 1ST RIB ELEVATION
- SYMPTOMS OF NUMBNESS/TINGLING IN RF/SF, T1 DERMATOME DISTRIBUTION
- SCALENE OVER-STRETCHING (CAR ACCIDENT) OR REPETITIVE ACTIVATION WILL "SHORTEN" PULLING UP 1ST RIB
- ADDITIONALLY: SCAPULAR/GHJ STIFFNESS OR ADHESIONS WILL DRIVE UP 1ST RIB AS A FORM OF STABILITY

9

WHAT CAUSES A STIFF THORACIC SPINE?

- Posture
- Sleeping
- Repetition
- Poor body mechanics
- Autoimmune
- Other medical/ortho diagnoses
- Above and below fusions
- Idiopathic

10

SCAPULA

- Optimizes glenoid position for concavity compression
- Adapts to task requirements in elevation (mobility vs stability)
- Clears the acromion over the moving RTC
- Proximal to distal link for all functional tasks within environment

Forthomme B, Crielaard JM, Croisier JL. Scapular Positioning in Athlete's Shoulder: Particularities, Clinical Measurements and Implications. Sports Med. 2008;38(5):369-86

11

SCAPULAR MOVEMENT

- Degrees of upward/downward rotation
- Degrees of IR/ER
- Degrees of Anterior/Posterior Tilting
- Contributes to clavicular protraction/retraction
- Fun fact (SC connection)

12

SHOULDER ELEVATION CHAIN

- 6 IMPORTANT MEMBERS
  - GHJ
  - ACJ
  - SCJ
  - SCAPULOTHORACIC "JOINT"
  - CERVICO-THORACIC "JUNCTION"
  - RIBS (ESPECIALLY 1ST RIB)

13

WHEN THE ELEVATION CHAIN GOES WRONG?

- SHOULDER PAIN
- RIB TIGHTNESS
- NUMBNESS TINGLING IN HANDS (PRESENTS LIKE CTS)
- FOREARM ACHINESS
- INDESCRIBABLE PAIN

14

WHAT DO WE DO?

- Testing/evaluating
  - Spine
  - Ribs
  - Scapular movement
  - GHJ motion
- Movement patterns
- Soft tissue connections and tautness
  - Leads us to the next phase…..

15

COMMON SOFT TISSUE CULPRITS RELATED TO UPPER QUADRANT LIMITATIONS

1

SOFT TISSUE CULPRITS

Structures to Consider & Identify:

- Sternocleidomastoid
- Scalene Anterior
- Brachial Plexus
- Middle Scalene
- Upper Trapezius
- Pectoralis Minor
- Latissimus Dorsi

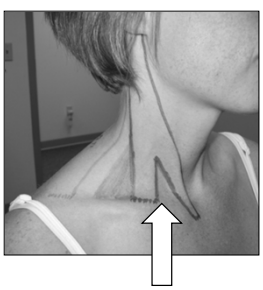
2

SOFT TISSUE

Sternocleidomastoid

Origin:
Sternal Head – Manubrium
Clavicular Head – Clavicle

Insertion:
Mastoid process and superior nuchal line of occipital bone



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SOFT TISSUE

Sternocleidomastoid

To isolate this muscle, the examiner can provide resistance to neck flexion with the patient's head rotated to the contralateral side. The sternal and clavicular heads can be identified.

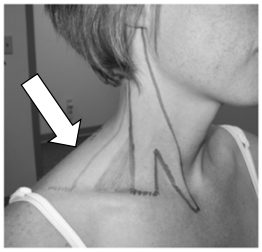
4

SOFT TISSUE

Upper Trapezius

Origin:
Occipital bone, nuchal ligament, spinous process of 7th cervical and all thoracic vertebrae

Insertion:
Clavicle, acromion, spine of scapula



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SOFT TISSUE

Upper Trapezius

To isolate this muscle, the therapist can provide resistance to shoulder elevation and retraction. The most ventral edge can be palpated as it extends to the clavicle.

6

SOFT TISSUE

Scalenus Anterior and Middle

Anterior Scalene
Origin: Transverse processes of 3rd-6th cervical vertebrae
Insertion: Scalene tubercle of 1st rib

Middle Scalene
Origin: Transverse processes of 2nd-6th cervical vertebrae
Insertion: upper surface of 1st rib

7

SOFT TISSUE TREATMENT: SCALENES

- The superior hand performs a myofascial technique along the scalene muscles transversely, along the superior aspect of the clavicle
- The inferior hand prevents anterior scapular tilting

8

SOFT TISSUE

Pectoralis Minor

Origin:
Superior margins; outer surfaces of 3rd-5th ribs near cartilages; fascia over corresponding intercostal muscles

Insertion:
Medial border, superior surface of the coracoid process of the scapula

9

SOFT TISSUE

Pectoralis Minor

Shortness of the pec minor tends to depress the scapula due to its insertion on the coracoid process and origin on the ribs. This may impinge the underlying cords of the brachial plexus and axillary blood vessels.

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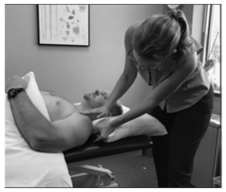
SOFT TISSUE ASSESSMENT: PECTORALIS MINOR



Pec minor length at rest: assessing the distance from the posterior acromion to the table

With posterior tilting, is the posterior acromion able to touch the table?

11

SOFT TISSUE ASSESSMENT: PECTORALIS MINOR

"Stiff": if the patient's posterior acromion comes in contact with the mat table, but passively recoils back to the starting position

"Short": if the patient's posterior acromion is unable to come in contact with the mat table

12

SOFT TISSUE TREATMENT: PECTORALIS MINOR

Step 1:
Place your thumbs behind the pec minor muscle

Step 2:
Slowly provide a stretch by "bending" the muscle and bringing your forearms to a more neutral position

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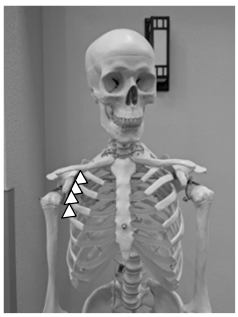
SOFT TISSUE

Serratus Anterior

Origin:
Outer surfaces and superior borders of the upper 8-9 ribs.

Insertion:
Costal surface of the medial border of the scapula.



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SOFT TISSUE TREATMENT:
SERRATUS ANTERIOR

Manual Technique to Improve Scapular Elevation with Upward Rotation

- After stretching out the latissimus dorsi, provide manual assistance to promote AA scapular elevation with combined upward rotation (promoting Serratus Anterior)
- Most TOS patients lack the ability to perform combined elevation with upward rotation

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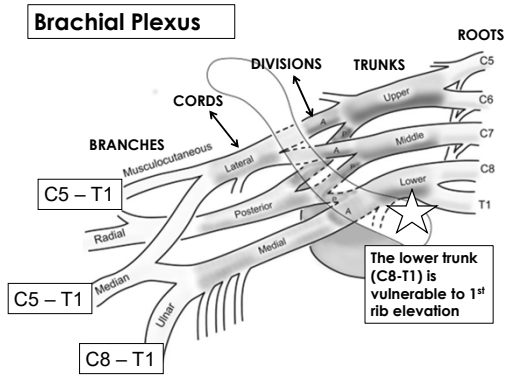
SOFT TISSUE

Brachial Plexus



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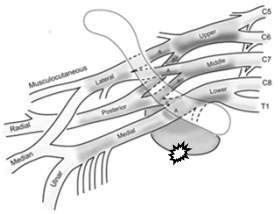
SOFT TISSUE

Brachial Plexus

- The lower brachial plexus is affected in approximately 80% of nTOS cases, corresponding to compression of the C8-T1 nerve roots
- Most patients present with symptoms of the hand and forearm within the C8-T1 distribution



Hooper TL, et al. Thoracic outlet syndrome: a controversial clinical condition. Part 1: anatomy, and clinical examination/diagnosis. J Man Manip Ther. 2010; 18(2):74-83.

17

SOFT TISSUE

Brachial Plexus

Located between the anterior and middle scalenes.

This area can be palpated to detect brachial plexus edema and/or tenderness.

18

OTHER SOFT TISSUE STRUCTURES TO CONSIDER

19

SOFT TISSUE

Quadratus Lumborum

Origin:
Iliac crest and iliolumbar ligament

Insertion:
Transverse process of L1-5 and inferior border of the 12th rib

20

SOFT TISSUE ASSESSMENT:
QUADRATUS LUMBORUM (QL)

Stiffness in the QL muscle can cause an inability to dissociate the scapula and pelvis. Assess the mobility of the QL by placing your hands between the rib cage and pelvis and pulling up

21

SOFT TISSUE ASSESSMENT:
QUADRATUS LUMBORUM (QL)

Watch to see if you can move the QL without the patient's scapula and hips moving together. If there is no dissociation between the scapula and pelvis, there is stiffness present.

22

SOFT TISSUE TREATMENT:
QUADRATUS LUMBORUM (QL)

Step 1:
Start with the patient's arms at the sides. Provide transverse force along the QL by pulling in a ventral direction

23

SOFT TISSUE TREATMENT:
QUADRATUS LUMBORUM (QL)

Step 2:
Progress the stretch with having the patient place his/her arms overhead. This further facilitates elongation of the QL.

24

SOFT TISSUE

Latissimus Dorsi

Origin:
Spinous processes of last 6 thoracic vertebrae, last 3-4 ribs, through the thoracolumbar fascia from the lumbar and sacral vertebrae and posterior 1/3 of external lip of iliac crest, and a slip from the inferior angle of the scapula

Insertion:
Intertubercular groove of humerus

25

SOFT TISSUE ASSESSMENT:
LATISSIMUS DORSI

Latissimus Dorsi Length


Step 1:
Patient performs a posterior pelvic tilt to keep the lumbar spine in contact with the mat table
Step 2:
Passively bring the patient's shoulder into full elevation, insuring there is no compensation with lumbar extension

26

SOFT TISSUE ASSESSMENT:
LATISSIMUS DORSI

Latissimus Dorsi Length

(-) Test: the patient's shoulder achieves full elevation without lumbar extension compensation.

(+) Test: if the patient's shoulder is unable to achieve full extension without lumbar extension.

27

SOFT TISSUE TREATMENT:
LATISSIMUS DORSI

Myofascial Technique

Step 1:
Place the patient in a sidelying position with the shoulder pre-positioned overhead.
Step 2:
Crossing your hands, stabilize the inferior hand along the iliac crest while providing a superior stretch along the lateral aspect of the patient's rib cage.

28

SOFT TISSUE TREATMENT:
LATISSIMUS DORSI

Myofascial Technique

Step 3:
Ask the patient to take a deep breath. With inhalation, attempt to further lengthen the lateral trunk by bringing the inferior portion of the ribcage away from the iliac crest. This will further facilitate scapular elevation

29

DO WE NEED TO ASSESS OUTSIDE OF THE UPPER QUADRANT?

30

30

THE KINETIC CHAIN

Allows the efficient transfer of energy between the quadrants of the body

Abnormal posture and muscle mechanics of the lower quadrant result in persistent TOS symptoms

Levine NA, Rigby BR. Thoracic outlet syndrome: biomechanical and exercise considerations. Healthcare. 2018;68(6).

31

THE KINETIC CHAIN

Consider the size and power output of all the muscles in the body

- Where are the largest and most powerful muscles located?

Levine NA, Rigby BR. Thoracic outlet syndrome: biomechanical and exercise considerations. Healthcare. 2018;68(6).

32

MYOFASCIAL SLING SYSTEMS

Anterior Oblique Sling

Posterior Oblique Sling

Any impairment within either of the oblique slings may result in changes to GHJ kinematics and/or accessory movement patterns

Joseph LH, Pirunsan U, Sitilertpisan P, Paungmali A. Effect of lumbopelvic myofascial force transmission on glenohumeral kinematics – a myo-fascia-biomechanical hypothesis. Polish Annals of Medicine. 2017;24:276-282

33

THE LOWER QUADRANT

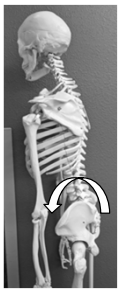
POSTURAL ASSESSMENT:
- SUBTALAR POSITIONING
- PLANTAR ARCH
- POSITION OF THE KNEES
- LEG LENGTH DISCREPANCIES
- PELVIC POSITIONING

ACTIVE ASSESSMENT:
- LOWER QUADRANT STRENGTH
- EMG ACTIVITY
- GAIT ASSESSMENT
- DYNAMIC BALANCE ASSESSMENT
- GLUTEAL BRIDGING
- STEP-UPS/STEP-DOWNS
- SINGLE LEG RAISES (SLR)
- ACTIVITY VS SPORTS-SPECIFIC ASSESSMENTS

34

THE LOWER QUADRANT – PELVIS

Anterior Pelvic Tilt or Rotation
- Tight hip flexors versus weak hip extensors and abdominals



Lumbar Lordosis → Thoracic Kyphosis → Scapular Protraction

Sucher BM, Heath DM. Thoracic outlet syndrome – a myofascial variant: part 3. Structural and postural considerations. JAOA. 1993;93(3)

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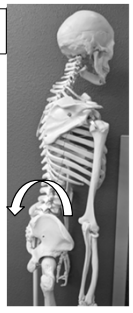
THE LOWER QUADRANT – PELVIS

Posterior Pelvic Tilt or Rotation
- Tight hip extensors and/or abdominals versus weak hip extensors and/or low back musculature



Hypo-lordosis → Scapular Protraction

Sucher BM, Heath DM. Thoracic outlet syndrome – a myofascial variant: part 3. Structural and postural considerations. JAOA. 1993;93(3)

36

THE LOWER QUADRANT - PELVIS

Pelvic stability results from isometric contractions of the tensor fascia latae (TFL), gluteus medius, and gluteus minimus

Hip and core strength are directly related to dynamic balance

Mayes M, Salesky M, Lansdown DA. Throwing injury prevention strategies with a whole kinetic chain-focused approach. Curr Rev Musculoskelet Med. 2022;15: 53-64

37

UNTIL THE ALIGNMENT/MECHANICS OF THE LOWER QUADRANT ARE STABILIZED, THE THORACIC OUTLET AND SHOULDER GIRDLE WILL CONTINUE TO BE AFFECTED

38

WHEN IT'S NOT CARPAL TUNNEL: ADDRESSING PROXIMAL ISSUES

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OBJECTIVES:

PERFORM A CLINICAL EXAMINATION: ROOS TEST (ELEVATED ARM STRESS TEST), CYRIAX RELEASE TEST, 1ST AND 2ND RIB

2

2

CLINICAL EXAMINATION

WHERE DO WE BEGIN?

3

WHAT ARE WE LOOKING FOR?

- DID YOU GET A GOOD HISTORY?
- CAR ACCIDENT, TRAUMA, REPETITIOUS ONSET?
- OBSERVATION AND APPEARANCE?
- WHAT ARE PATIENT'S SYMPTOMS?
- DID YOU WATCH HOW THE PATIENT WALKED IN?

4

WHAT ARE THE MAIN SYMPTOMS OR PRIMARY ISSUES?

- SYMPTOMS BEGIN AFTER OCCUPATIONAL, RECREATIONAL OR ACCIDENTAL INJURY OF THE HEAD, NECK, OR UE
- PREVIOUS CLAVICLE OR 1ST RIB FRACTURE
- IS THERE A CERVICAL RIB?
- PREVIOUS C-SPINE OR PERIPHERAL NERVE SURGERY WITHOUT IMPROVEMENT
- PAIN OR PARESTHESIA RADIATING DOWN THE ARM FROM SUPRACLAVICULAR OR INFRACLAVICULAR SPACE
- SYMPTOMS EXACERBATE WITH ACTIVITY?
- C/O TENDERNESS OVER SCALENES, UPPER QUADRANT, PEC WALL
- WEAKNESS WITH GRIP AND SUSTAINED HOLD ON ITEMS

5

INSPECTION/PALPATION

VISUAL INSPECTION

- POSTURE IN SITTING
- POSTURE IN STANDING
  - ROUNDED SHOULDERS
  - FORWARD HEAD
  - INCREASED THORACIC KYPHOSIS
  - SCAPULAR POSITIONING (DOWNWARD ROTATION, ABDUCTED, DEPRESSED)
- SUPRACLAVICULAR FULLNESS (ELEVATED 1ST RIB)

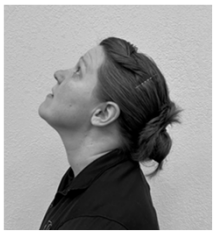
Hooper et al. Thoracic outlet syndrome: a controversial clinical condition: Part 1: anatomy, and clinical examination/diagnosis. J Man Manip Ther. 2010;18:74-83

6

CERVICAL SCREEN

ACTIVE FORWARD FLEXION

ACTIVE EXTENSION
(THEN MOUTH OPEN)



Purpose: to rule out pain coming from a cervical origin: disc or nerve root pathology

7

CERVICAL SCREEN

Active rotation right/left

Active sidebending

8

CERVICAL SCREEN

Spurling's Test

Step #1 Patient performs cervical extension with ipsilateral side bending.

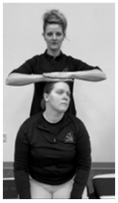
If pain or paresthesia's occur in the arm in a dermatomal pattern, the test is positive and no need to proceed with step 2.

9

CERVICAL SCREEN

Spurling's Test

Step #2 If no symptoms occur, redo the test with extension, ipsilateral sidebending, & rotation, prior to applying gentle downward pressure on patient's head



10

CERVICAL SCREEN

If any of these cervical motions reproduces the patient's symptoms distally……

GAME OVER

11

PROVOCATION TESTS

- THE ROOS TEST (ELEVATED ARM STRESS TEST: EAST), CYRIAX RELEASE TEST, AND SUPRACLAVICULAR PRESSURE TEST: ADDRESS THE REPRODUCTION OF PAIN AND PARESTHESIAS

Hixson, KM, Horris HB, Valvovich McLead TC, et al. The diagnostic, accuracy of clinical diagnostic tests for thoracic outlet syndrome. J Sport Rehabil. 2016; Aug 24 1-14

12

PROVOCATION TESTS

ROOS TEST OR ELEVATED ARM STRESS TEST (EAST)

- TECHNIQUE: THERAPIST STANDS BEHIND PATIENT, PLACES A DOWNWARD PRESSURE ON SCAPULA, WHILE PATIENT OPENS AND CLOSES HANDS INTO FISTS WHILE SUSPENDED IN AIR (SEE PICTURE)
- POSITIVE TEST: REPRODUCES PATIENT'S SYMPTOMS (PAIN AND/OR PARESTHESIA) WITHIN 60 SECOND PARAMETER
- DOCUMENT AMOUNT OF TIME IT TOOK FOR ONSET OF SYMPTOMS

Brantigan C & Roos D. Diagnosing thoracic outlet syndrome. Hand Clinics, 2004; 20: 27-36

13

PROVOCATION TESTS

ROOS TEST OR ELEVATED ARM STRESS TEST (EAST)

- CAUTION: IF PATIENT PRESENTS WITH ULNAR NERVE SYMPTOMS, ROOS MAY PROVOKE BOTH AREAS TO BE POSITIVE DUE TO ELBOW FLEXION
- TWO OPTIONS:
  - PERFORM ELBOW FLEXION TEST
  - PERFORM ROOS TEST WITH ELBOWS SLIGHTLY FLEXED VS A 90 DEGREES

Novak, CB, et al. Provocative testing for cubital tunel syndrome J Hand Surgery. 1994; 19A(5): 73-81

14

PROVOCATION TESTS

ELBOW FLEXION TEST

- TECHNIQUE: THERAPIST PLACES MANUAL PRESSURE AT THE CUBITAL TUNNEL AS THE ELBOW IS PLACED IN TERMINAL EXTENSION
- POSITIVE TEST: INDICATES REPRODUCTION OF ULNAR NERVE SYMPTOMS WITHIN 60 SECONDS
- DOCUMENT: TIME IT TOOK TO REPRODUCE SYMPTOMS

Novak, CB, et al. Provocative testing for cubital tunnel syndrome. J Hand Surgery, 1994; 19A(5): 73-81

15

PROVOCATION TESTS

CYRIAX RELEASE

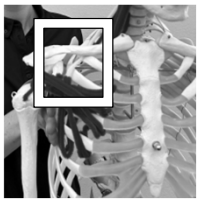
TECHNIQUE: PASSIVELY ELEVATE SHOULDER GIRDLE, UNWEIGHING ARMS, TO PROVOKE INCREASED BLOOD FLOW TO BRACHIAL PLEXUS AND UPPER EXTREMITIES

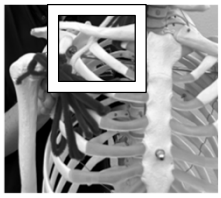
Brismee. J.M., et al. (2004). Rate of false positive using the Cyriax release test for thoracic outlet syndrome in an asympotomatic population. *Journal of Manual & Manipulative Therapy*, 12(2), 73-81

16

PROVOCATION TESTS

CYRIAX RELEASE





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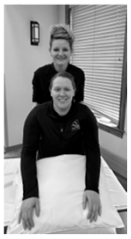
PROVOCATION TESTS

CYRIAX RELEASE-ALTERNATIVE

POSITIVE TEST: REPRODUCES PAIN AND SYMPTOMS WITHIN 60 SECONDS

DOCUMENT: TIME IT TAKES FOR SYMPTOMS TO BEGIN, LOCATION AND DISTRIBUTION OF SYMPTOMS



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PROVOCATION TESTS

DOUBLE CRUSH SYNDROME: IN CYCLISTS

- CLINICALLY + ULNAR NERVE SYMPTOMS,
  32% + ROOS (EAST)
  43% + CYRIAX RELEASE TEST
- CONCLUSION: A SIGNIFICANT GREAT NUMBER OF UPPER LIMBS WITH CLINICAL SIGNS & SYMPTOMS OF ULNAR NEUROPATHY PRESENTED

Smith T, Sawyer S, Sizer P, Brismee, JM. The double crush syndrome: a common occurrence in cyclists with ulnar nerve neuropathy– a case control study. Clinic Sports Medicine. 2008; 18: 55-61.

19

PROVOCATION TESTS

DOUBLE CRUSH SYNDROME: WITH CTS

- CASE-CONTROL STUDY OF 32 SUBJECT WITH ELECTRODIAGNOSTICALLY-DIAGNOSED CTS AND 32 AGE & GENDER-MATCHED CONTROLS
- EXAMINATION INCLUDED:
  - ELEVATED ARM STRESS/ROOS TEST
  - CYRIAX RELEASE TEST
  - CERVICAL ROTATION LATERAL FLEXION (WE DID NOT DO THIS)
- RESULTS: A SIGNIFICANTLY GREATER NUMBER OF CTS+ SUBJECTS PRESENTED WITH POSITIVE PROVOCATIVE TESTING FOR TOS COMPARED WITH CONTROLS

Vaught MS et al. Associations of disturbances in the thoracic outlet in subjects with carpal tunnel syndrome: A case-control study. J Hand Ther. 2011;24-44-52.

20

PROVOCATION TESTS

DOUBLE CRUSH SYNDROME: WITH CTS

- THE LIKELIHOOD OF NECK PAIN, SHOULDER PAIN, OR AN ELEVATED RIB WAS 16 TIMES GREATER IN THE CTS+ GROUP AS COMPARED WITH THAT IN THE CONTROL
- **CONCLUSION:**
  - **A GREATER NUMBER OF SUBJECTS WITH CTS PRESENTED WITH PROXIMAL DYSFUNCTION AS SUGGESTIVE OF TOS AND HISTORY OF NECK AND SHOULDER PAIN.**
  - **EVALUATION OF PROXIMAL STRUCTURES INVOLVED WITH THORACIC OUTLET DYSFUNCTION IN PERSONS WITH CTS HAS CLINICAL MERIT**

Vaught MS et al. Associations of disturbances in the thoracic outlet in subjects with carpal tunnel syndrome: A case-control study. J Hand Ther. 2011;24-44-52

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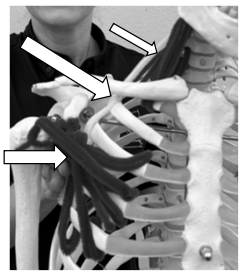


MECHANICAL DISTURBANCES IN THE THORACIC OUTLET CAN CAUSE COMPRESSION OR TENSION LOADING OF THE BRACHIAL PLEXUS AT 3 PASSAGEWAYS…

- SCALENE TRIANGLE
- COSTOCLAVICULAR SPACE
- THORACO-CORACO-PECTORAL SPACE (BENEATH PECT MINOR)
- NOW.. LET'S BREAK THIS DOWN

22

PROVOCATION TEST
SCALENE TRIANGE
1ST PASSAGE WAY

How do you test for this?

What are the culprits?

23

23

PROVOCATION TESTS

SUPRACLAVICULAR PRESSURE TEST

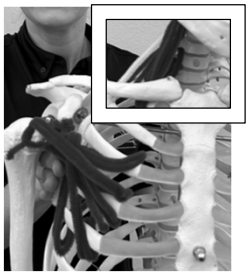
- TECHNIQUE: PATIENT SEATED WITH ARMS AT SIDE. THERAPIST PLACES FINGERS ON THE UPPER TRAPEZIUS AND THE THUMB CONTACTING THE ANTERIOR SCALENE MUSCLE NEAR FIRST RIB AND SQUEEZING THE FINGERS AND THUMB TOGETHER FOR 30 SECONDS

24

PROVOCATION TESTS

SUPRACLAVICULAR PRESSURE TEST

- POSITIVE TEST: REPRODUCES PATIENT'S SYMPTOMS (PAIN AND/OR PARESTHESIA)



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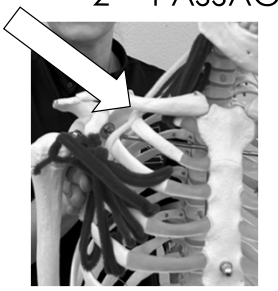
PROVOCATION TESTS

COSTOCLAVICULAR SPACE
2ND PASSAGE WAY



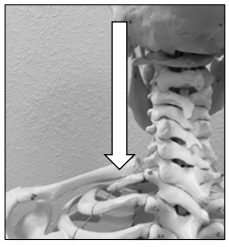
- COMPRESSION BETWEEN CLAVICLE AND 1ST RIB ELEVATING

26

PROVOCATION TESTS

MOBILITY TESTS: RIBS
1ST RIB CVJ SPRING TEST

**LOCATE THE 1ST RIB BY DROPPING DOWN FROM THE MASTOID PROCESS AND PALPATING THROUGH THE UPPER TRAPEZIUS MUSCLE



27

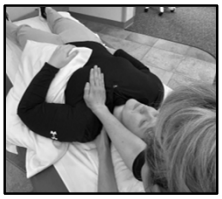
PROVOCATION TESTS

MOBILITY TESTS: RIBS
1ST RIB CVJ SPRING TEST

- FINDING THE 1ST RIB.. TRICKY
- PT IS SEATED, THERAPIST BEHIND
- USING THE LATERAL ASPECT OF THE 2ND MPJ, THE THERAPIST GENTLY PRESSES ON THE 1ST RIB
- DIRECTION OF FORCE: TOWARD PATIENT'S OPPOSITE HIP
- THE THERAPIST ASSESSES THE EXCURSION AND END FEEL (CVJ) COMPARED TO OPPOSITE SIDE

Loyd BJ, Gilber KK, Sizer PS, et al. The relationship between various anatomical landmarks used for localizing the first rib during surface palpation. J Manual Manip Therapy. 2014 Aug;22(3): 129-133

28



PROVOCATION TESTS

MOBILITY TESTS: RIBS
1ST RIB CTJ-***SUPINE***

- USING THE TIPS OF THE IF AND MF, THERAPIST PROVIDES A VENTRAL-LATERAL FORCE ON THE 1ST RIB TO TEST THE COSTOTRANSVERSE JOINT
- THERAPIST ASSESSES THE AMPLITUDE OF MOVEMENT AND END-FEEL OF THE CTJ COMPARED TO OPPOSITE SIDE

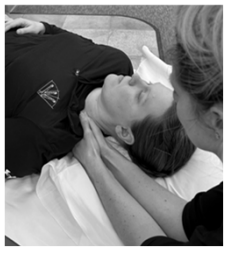
Leonhardt H, Tillmann B, et al, eds. Anatomie des Menschen. Stuttgart: Georg Thieme Verlag; 1987: 177

29

PROVOCATION TESTS

MOBILITY TESTS: RIBS
1ST RIB CTJ-***SUPINE***

WITH TESTING, USE EITHER ONE HAND OR TWO TO TEST THE CTJ IN A VENTRAL-LATERAL DIRECTION



30

PROVOCATION TESTS

MOBILITY TESTS: RIBS
2ND RIB CVJ-***SUPINE COSTOVERTEBRAL JOINT MOBILITY***

SPRING TEST IN SUPINE RIB #2

- PATIENT'S ARM RELAXED ON PILLOW
- A TOWEL IS LONGITUDINALLY FROM T1-T3 TO PREVENT THORACIC EXTENSION
- THERAPIST USES HEEL OF HAND TO PROVIDE GENTLE DOWNWARD PRESSURE ON THE ARCH OF 2ND RIB
- FEELING FOR EXCURSION AND END FEEL COMPARED TO OPPOSITE SIDE

31

PROVOCATION TESTS

THORACO-CORACO-PECTORAL SPACE (BENEATH PECT MINOR)
3RD PASSAGE WAY

WRIGHT'S TEST

PT IS SEATED WITH ARMS AT SIDE. RADIAL PULSE IS PALPATED. THERAPIST PLACES PATIENT'S SHOULDER INTO ABDUCTION ABOVE HEAD. POSITION IS HELD FOR 60-120 SECONDS.

Ozoa G. et al. Thoracic Outlet Syndrome. Phys Med Rehabil Clin N Am 22 (2011) 473-483.

32

PROVOCATION TESTS

THORACO-CORACO-PECTORAL SPACE (BENEATH PECT MINOR)
3RD PASSAGE WAY

WRIGHT'S TEST

POSITIVE TEST: CHANGE IN THE RADIAL PULSE AND/OR PAIN, PARESTHESIA REPRODUCTION

33

WHEN IT'S NOT CARPAL TUNNEL: ADDRESSING PROXIMAL ISSUES

CASSANDRA SCHUH,
OTR, CHT, COMT, CMTPT

ASHLEY PULVERMACHER,
OTR, ATC

1

OBJECTIVE

DEMONSTRATE ABILITY TO TREAT 1ST RIB LIMITATIONS ASSOCIATED WITH UPPER QUADRANT LIMITATIONS

2

ALREADY TESTED…. NOW TREATING THE 1ST RIB

- RELEASING PRESSURE OFF BRACHIAL PLEXUS
- PROVIDING SPACE BETWEEN CLAVICLE AND 1ST RIB FOR GLIDING
- *TEST IS THE TREATMENT, TREATMENT IS THE TEST*

3

RIB TREATMENT

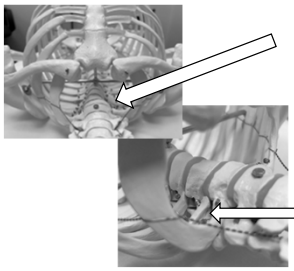
POSITIVE FINDING FROM YOUR EXAMINATION….

- (+) ELEVATED ARM STRESS TEST/ROOS
- (+) CYRIAX RELEASE
- (+) 1ST RIB SPRING TEST
- LIMITED MOBILITY OF JOINT-SPECIFIC TESTING OF THE 1ST RIB IN SUPINE
- MAY HAVE LIMITED MOBILITY OF JOINT-SPECIFIC TESTING OF THE 2ND RIB IN SUPINE

4

RIB TREATMENT

MOBILIZATION



COSTOTRANSVERSE JOINT (CTJ):

CONTROLS THE LATERAL TRANSLATION OF THE RIB CAGE

COSTOVERTEBRAL JOINT (CVJ):

CONTROLS ROTATION (RESEMBLES THE MOTION OF A BUCKET HANDLE)

Neumann D. Kinesiology of the musculoskeletal system: foundations for physical rehabilitation. St. Louis: Mosby 2002.

5

RIB TREATMENT TECHNIQUES

1ST RIB MOBILIZATION

COSTOTRANSVERSE JOINT

- SHOULD ALWAYS BE ADDRESSED 1ST!
- ASSISTS IN MOBILIZING CVJ
- 15-20 SECOND HOLDS X 2 REPS (CAN HOLD UP TO 40 SECONDS)

COSTOVERTEBRAL JOINT

- THE KEY IS TO MAINTAIN PRESSURE ON THE RIB WITH THE PATIENT EXHALING
- MAINTAIN WITH THE 2ND DEEP BREATH
- 15-20 SECOND HOLDS X 2 (CAN HOLD UP TO 40 SECONDS)

Neumann D. Kinesiology of the musculoskeletal system: foundations for physical rehabilitation. St. Louis: Mosby 2022.

6

RIB TREATMENT TECHNIQUES

1ST RIB MOBILIZATION
COSTOTRANSVERSE (CTJ)

MOBILIZE IN A ***VENTRAL-LATERAL*** DIRECTION

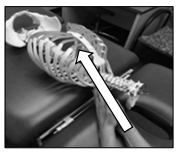
(PATIENT PERFORMS NORMAL BREATHING)

7

RIB TREATMENT TECHNIQUES

1ST RIB MOBILIZATION
COSTOTRANSVERSE (CTJ)

PLACE RADIAL ASPECT OF FINGERTIPS ON THE POSTERIOR ASPECT OF THE 1ST RIB



MOBILIZE IN A VENTRAL-LATERAL DIRECTION

RELAXED BREATHING

8

RIB TREATMENT TECHNIQUES

1ST RIB MOBILIZATION
COSTOVERTEBRAL (CVJ)

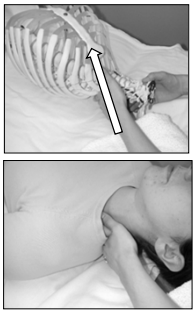
MOBILIZE IN A ***CAUDAL, VENTRAL, MEDIAL*** DIRECTION

(PRESSURE IS APPLIED COINCIDING WITH PATIENT'S BREATHING

9

RIB TREATMENT TECHNIQUES

1ST RIB MOBILIZATION
COSTOVERTEBRAL (CVJ)



- PLACE RADIAL ASPECT OF FINGERTIPS ON THE POSTERIOR ASPECT OF THE 1ST RIB
- MOBILIZE TOWARDS OPPOSITE HIP ***(CAUDAL, VENTRAL, MEDIAL)***
- PATIENT TAKES A DEEP BREATH, PRESSURE IS APPLIED DURING EXHALATION

10

RIB HOME PROGRAM
1ST RIB/SCALENE STRETCH

PURPOSE: IMPROVE SCALENE MUSCLE LENGTH TO MAINTAIN 1ST AND 2ND RIBS IN PROPER POSITION

INDICATION:

ELEVATED 1ST RIB, SCALENE STIFFNESS

SUPPLIES: PILLOW, STABILIZATION BELT, CHAIR

PROMOTES BRACHIAL PLEXUS GLIDE AT SCALENE TRIANGLE AND COSTOCLAVICULAR SPACE

PERFORM 2X/DAY, HOLD 10-15 SECONDS

11

RIB HOME PROGRAM
1ST RIB/SCALENE STRETCH

STEP 1: PATIENT PLACES A LOOPED BELT ACROSS 1ST RIB AND SLIDES THE UNINVOLVED ARM IN THE LOOP

STEP 2: PATIENT TAKES A DEEP BREATH. DURING EXHALATION, THE UNINVOLVED ARM PULLS DOWN ON THE STRAP

IF A STRETCH IS FELT, THEN PATIENT HOLDS THIS POSITION FOR 10-15 SECONDS AND REPS

12

RIB HOME PROGRAM
1ST RIB/SCALENE STRETCH

IF LITTLE TO NO STRETCH IS FELT, PATIENT PERFORMS GENTLE RETRACTION (CHIN TUCK) WITH SIDE-BENDING CONTRALATERAL SIDE

INVOLVED ARM SHOULD STAY COMPLETELY RELAXED THROUGHOUT THE STRETCH

13

RIB HOME PROGRAM
1ST RIB/SCALENE STRETCH

14

RIB HOME PROGRAM
1ST RIB/SCALENE STRETCH

ALTERNATE POSITION: FOR PATIENTS WITH BILATERAL INVOLVEMENT, USING THE STABILIZATION BELT AROUND YOUR ***THIGH,*** FREES UP BOTH ARMS

15

RIB HOME PROGRAM
1ST RIB/RELEASE MANEUVER

INDICATIONS: (+) CYRIAX RELEASE

PURPOSE: TO MAXIMIZE BLOOD FLOW TO THE UPPER EXTREMITIES BY RELEASING THE TENSION ON THE BRACHIAL PLEXUS

WHEN TO COMPLETE: THE VERY LAST TASK YOU DO BEFORE BED

TIME: STAY SUPPORTED WITH INVOLVED ARM UNTIL ALL NUMBNESS/TINGLING DISSIPATES, THEN GO TO BED

SUPPLIES: PILLOWS OR BLANKETS, SOFT CHAIR
HELP PROMOTE SLEEP

16

RIB HOME PROGRAM
1ST RIB/RELEASE MANEUVER

17

1

OBJECTIVE

ASSESSMENT OF SCAPULAR ALIGNMENT TO IDENTIFY POSTURAL INFLUENCES IN UPPER QUADRANT COMPRESSION

&

TREATMENT PROVIDE OPTIONS

2

SCAPULAR ALIGNMENT & STABILITY

WHY IS POSTURE SO IMPORTANT?

The scapula functions as a "bridge" between the shoulder complex and the cervical spine and plays a very important role in providing both mobility and stability to the neck/shoulder region

Poor scapular positioning at rest and/or with activity can contribute to TOS

Cools AMJ, Struyf F, De Mey K, et al. Rehabilitation of scapular dykinesis: from the office worker to the elite overhead athlete. Br J Sports Med. 2014 Apr;48(8):692-697.

3

SCAPULAR ALIGNMENT & STABILITY

Scapular Depression…

Investigated the hypothesis that the lower position of the shoulder girdle relative to the upper thorax may be related to neurogenic TOS (nTOS)

Using plain radiographs, analyzed the number of vertebrae visible above the level of the clavicle on lateral radiograph & above the line connecting the sternal ends of the clavicle on AP radiographs

Cho YJ, Lee HJ, Gong HS, et al. The radiologic relationship of the shoulder girdle to the thorax as an aid in diagnosing neurogenic thoracic outlet syndrome. J Hand Surg. 2012; 37A: 1187-1193.

4

SCAPULAR ALIGNMENT & STABILITY

Results:
Both parameters were greater in the nTOS group, suggesting the level of the shoulder girdle was lower in the nTOS versus controls.

Conclusions:
The lower placement of the shoulder girdle relative to the upper thorax was related to nTOS. Physicians may be able to estimate the portion of the shoulder girdle using plain cervical radiographs when nTOS is suspected.

Cho YJ, Lee HJ, Gong HS, et al. The radiologic relationship of the shoulder girdle to the thorax as an aid in diagnosing neurogenic thoracic outlet syndrome. J Hand Surg. 2012; 37A: 1187-1193.

5

TOS: SCAPULAR ALIGNMENT & STABILITY

Scapulothoracic instability can contribute to brachial plexus irritation at the…

2nd passageway: costoclavicular

3rd passageway: subcoracoid space (beneath pec minor)

6

Scapulothoracic muscles affecting scapular motion

Upper Trapezius

Raise the shoulder girdle

Do NOT like isolated motion

Middle Trapezius

Draw the scapula medially

Like isolated motion

7

Scapulothoracic muscles affecting scapular motion

Lower Trapezius

Depress the shoulder girdle

Helps with upward rotation & posterior tilt lengthens the pec minor)

Do NOT like isolated motion

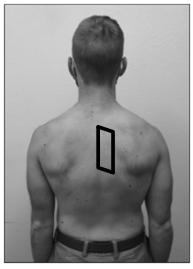
8

Scapulothoracic muscles affecting scapular motion

Rhomboids

Braces back the shoulder

Concerned with downward rotators



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Scapulothoracic muscles affecting scapular motion

Levator Scapulae

Raises the shoulder girdle

Associated with upper trapezius & scalene

10

Scapulothoracic muscles affecting scapular motion

Latissimus Dorsi

Extension, adduction, and medial rotation of the arm

Do NOT want isolated motion

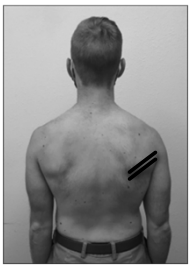
11

Scapulothoracic muscles affecting scapular motion

Teres Major

Extension of the shoulder with medial rotation and adduction of the humerus

"Lats little helper"



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Scapulothoracic muscles affecting scapular motion

Serratus Anterior

Abduction of the scapula with upward rotation during abduction of the arm; stabilization of the scapula by holding it to the chest wall

POWERHOUSE upward rotator

13

SCAPULO-THORACIC ASSESSMENT

GOAL: Identify abnormal scapular motion (dyskinesis), determine any relationship between altered motion and symptoms and identify the underlying causative factors of the movement dysfunction.

Possible contributors to the development of scapular dyskinesis:

- Deficits in strength or motor control of scapular-stabilizing muscles (serratus anterior, middle and lower trapezius)
- Postural abnormalities
- Impaired flexibility

Kibler WB, Ludwig PM, McClure PW, et al. Clinical implications of scapular dykinesis in shoulder injury: the 2013 consensus statement from the "scapular summit". Br J Sports Med. 2013;47:877-885.

14

SCAPULO-THORACIC ASSESSMENT

Resting Position

Scapular positions that can most contribute to TOS:

Depression
Downward Rotation
Anterior Tilting
Winging

Collins E, Orpin M. Physical therapy management of neurogenic thoracic outlet syndrome. Thoracic surg clinic. 2021 Feb; 31(1): 61-69.

15

SCAPULO-THORACIC ASSESSMENT

Scapulohumeral Rhythm

Concentric and Eccentric through full elevation:

With Flexion

With Abduction

16

SCAPULAR ASSESSMENT

Resting Position: Depression

- Scapula sit lower than T2-T7
- Neck appears long
- Slope of the shoulder is increased
- May be associated with neck pain and headaches

17

SCAPULAR ASSESSMENT

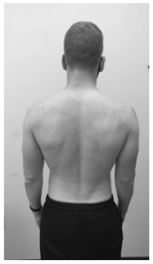
Scapulohumeral Rhythm: Depression

- With overhead reaching, deep creases are observed at the AC joints.
- Associated with large, heavy arms.
- This pattern is commonly seen with *releasors*.

18

SCAPULAR ASSESSMENT

Scapulohumeral Rhythm: Depression



Video: Scapular Depression with overhead motion

Video: Appropriate elevation with overhead motion

19

SCAPULAR ASSESSMENT

Scapulohumeral Rhythm: Depression

- Are there deep creases at the AC joints with end-range motion?
- Are there complaints of paresthesias as the arms are raised overhead?
- Do the arms suddenly "feel heavy" with maintaining the overhead position?

20

SCAPULAR ASSESSMENT

Resting Position: Downward Rotation

- Inferior angle of scapula is closer to the spine than superior angle
- Tend to have large, heavy arms
- Associated with *releasers*

Sharmann S. Diagnosis and Treatment of Movement Impairment Syndromes. Mosby, Inc. 2002

21

SCAPULAR ASSESSMENT

Scapulohumeral Rhythm: Downward Rotation

- Does the inferior angle of the scapula reach the mid-axillary line?
- Are there complaints of paresthesias with overhead reaching?
- Are there complaints of "pulling" or pain in the teres major/latissimus dorsi region?

22

SCAPULAR ASSESSMENT

Resting position: Anterior Tilting or Winging

Muscle Length Impairments:
1. Short pectoralis major and minor muscles
2. Long lower trapezius: scapular anterior tilting
3. Weak or long serratus anterior: scapular winging

23

SCAPULAR ASSESSMENT

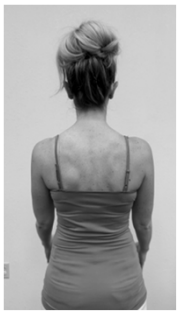
Scapulohumeral Rhythm: Anterior Tilting or Winging

Muscle Length Impairments:
1. Short pectoralis major and minor muscles
2. Long lower trapezius: scapular anterior tilting
3. Weak or long serratus anterior: scapular winging

24

SCAPULAR ASSESSMENT

Scapulohumeral rhythm: Winging



25

TREATMENT STRATEGIES FOR ADDRESSING RESTING SCAPULAR POSITION AND DYNAMIC CONTROL

26

SCAPULAR REHABILITATION

SCAPULAR REHABILITATION ALGORITHM

Lack of Soft-Tissue Flexibility

Scapular Muscles	GH Muscles/Capsule
Pectoralis Minor Levator Scapulae Rhomboids	Posterior Capsule Infraspinatus Latissimus Dorsi

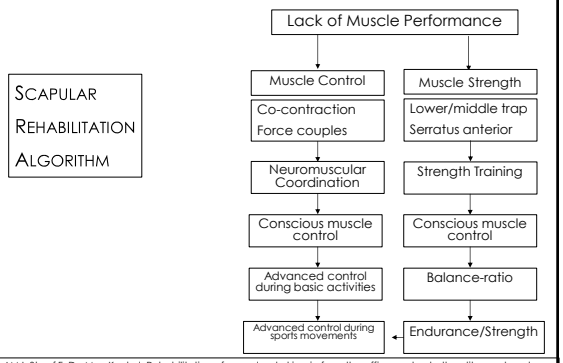
STRETCHING & MOBILIZATION

Manual Stretching
Home Stretching
Soft-Tissue Techniques
Manual Mobilizations (accessory movements)
Mobilization with movement

Cools AMJ, Struyf F, De Mey K, et al. Rehabilitation of scapular dyskinesis: from the office worker to the elite overhead athlete. Br J Sports Med. 2014 Apr;48(8):692-697.

27

SCAPULAR REHABILITATION



Cools AMJ, Struyf F, De Mey K, et al. Rehabilitation of scapular dyskinesis: from the office worker to the elite overhead athlete. Br J Sports Med. 2014 Apr;48(8):692-697.

28

SCAPULAR REHABILITATION

First Stage: Conscious muscle control

- **Improve proprioception – taping can play a role**
- **Normalize scapular resting position**

…HIGHER SURFACE EMG-ACTIVITY IN THE TARGETED MUSCLES (MIDDLE TRAPEZIUS AND LOWER TRAPEZIUS) DURING DYNAMIC SHOULDER EXERCISES WHEN CONSCIOUS CORRECTION OF THE SCAPULA POSITION WAS PERFORMED PRIOR TO THE EXERCISE.

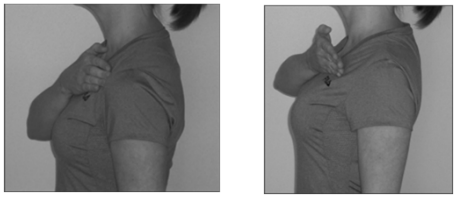
Cools AMJ, Struyf F, De Mey K, et al. Rehabilitation of scapular dyskinesis: from the office worker to the elite overhead athlete. Br J Sports Med. 2014 Apr;48(8):692-697.

29

SCAPULAR REHABILITATION

First Stage: Conscious muscle control

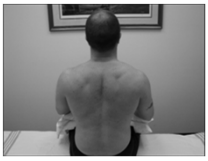
Active posterior tilt of the scapula



Note: It is important to incorporate scapular orientation with spinal posture correction

30

SCAPULAR REHABILITATION



Taping the scapula into extension, posterior tilt and retraction gives proprioceptive feedback to the patient and improves trunk posture and shoulder ROM.

Cools AMJ, Struyf F, De Mey K, et al. Rehabilitation of scapular dyskinesis: from the office worker to the elite overhead athlete. Br J Sports Med. 2014 Apr;48(8):692-697.

31

SCAPULAR REHABILITATION

SECOND STAGE: MUSCLE CONTROL AND STRENGTH FOR DAILY ACTIVITIES

- Improve muscle control and co-contraction
- Muscle strength

The shoulder girdle should be trained in both open-chain and closed-chain activities

Cools AMJ, Struyf F, De Mey K, et al. Rehabilitation of scapular dyskinesis: from the office worker to the elite overhead athlete. Br J Sports Med. 2014 Apr;48(8):692-697.

32

SCAPULAR REHABILITATION

Ineffective treatments for neurogenic TOS

- STRENGTHENING EXERCISES
- RESISTANCE BANDS
- THERABANDS

Sanders RJ & Annest SJ. Thoracic outlet and pectoralis minor syndromes. Semin Vasc Surg. 2014;Jun:27(2):86-117.

33

SCAPULAR REHABILITATION

Open-Chain Exercises: "Lawnmower"

Activated both upper & lower trapezius and serratus anterior equally

Kibler BW et al. Electromyographic analysis of specific exercises for scapular control in early phases of shoulder rehabilitation. Am J Sports Med. 2008:36:1789-98.

34

SCAPULAR REHABILITATION

Open-Chain Exercises: "Robbers"

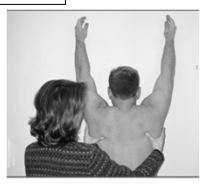
activates both upper & lower trapezius and serratus anterior equally

Kibler BW et al. Electromyographic analysis of specific exercises for scapular control in early phases of shoulder rehabilitation. Am J Sports Med. 2008:36:1789-98.

35

SCAPULAR REHABILITATION

Open-Chain Exercises: wall slides



the patient is instructed to "lead" with the scapula

Hardwick DH, et al. A comparison of serratus anterior muscle activation during a wall slide exercise and other traditional exercises. JOPST. 2006;36(12):903-910.

36

SCAPULAR REHABILITATION

Open-Chain Exercises: wall slides

for patient lacking full scapular upward rotation, bring the arms up in a tear-drop shape

Focus on "bringing your shoulder blades up and around"

37

SCAPULAR REHABILITATION

Open-Chain Exercises: wall slides

to recruit the lower trapezius muscle, the patient can lift the involved hand off the wall

Verbal Cue: "lift your left hand off the wall without bending backwards"

38

SCAPULAR REHABILITATION

Open-chain Exercises: wall slides

adding shoulder external rotation with elevation

performing elevation in the scapular plane with an ER component resulted in higher middle trapezius & lower trapezius activity

verbal cue: "lift your left hand off the wall without bending backwards"

Castelein B, et al. Superficial and deep scapulothoracic muscle electromyographic activity during elevation in the scapular plane. JOPST. 2016;46(3):184-193.

39

SCAPULAR REHABILITATION

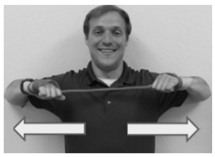
Open-chain Exercises
Pull Aparts to activate middle traps


Start in supine: verbal cue "squeeze your shoulder blade together" (to avoid compensation with shoulder extension)

40

SCAPULAR REHABILITATION

Open-chain Exercises
Pull Aparts to activate middle traps

Progress to standing, provided patient is not compensating with upper trap recruitment

41

SCAPULAR REHABILITATION

Open-chain Exercises: Prone Extension

Highest maximal voluntary isometric contraction of the middle trap with a low upper trap to lower trap ratio

Cools AM, Dewitte V, Lanszweet F, et al. Rehabilitation of scapular muscle balance: which exercises to prescribe? Am J Sports Med. 2007;35:1744-1751.

Moseley JB, Jobe FW, Pink M, et al. EMG analysis of the scapular muscles during a shoulder rehabilitation program. Am J Sports Med. 1992;20:128-134.

42

SCAPULAR REHABILITATION

Open-chain Exercises: Sidelying ER

-Reinold et al: highest maximal isometric voluntary contraction for infraspinatus & teres minor
-Cools et al: minimized upper trap (UT) firing with a low UT to LT ratio

Cools AM, Dewitte V, Lanszweet F, et al. Rehabilitation of scapular muscle balance: which exercises to prescribe? Am J Sports Med. 2007;35:1744-1751.

Reinold MM, Wilk KE, Fleisig GS, et al. Electromyographic analysis of the rotator cuff and deltoid musculature during common shoulder external rotation exercises. J Orthop Sports Phys Ther. 2004;34:385-394.

43

SCAPULAR REHABILITATION

Open-chain Exercises: Sidelying ER

"Therapists shoulder avoid prescribing individuals with UT/LT imbalance exercises that include ER in standing due to excessive postural activation of the upper trapezius."

Cricchio M & Frazer C. Scapulothoracic and scapulohumeral exercises: a narrative review of electromyographic studies. J Hand Ther. 2011;24:322-334.

44

SCAPULAR REHABILITATION

Closed-chain Exercises: push-up plus

Serratus anterior strengthening with emphasis on eccentric control

Produces minimal upper trap activation & maximum activation of serratus anterior

Bertilli JA & Ghizoni MF. Long thoracic nerve: anatomy and functional assessment. J Bone Joint Surg. 2005;87:993-998.

Decker MF, et al. Serratus anterior muscle activity during selected rehabilitation exercises. Am J Sports Med. 2002;30:374-381.

45

SCAPULAR REHABILITATION

Third Stage: Advanced control during sports movements/higher demands

Most TOS patients will only be able to participate in a limited amount of these exercises (if any)

- Plyometrics
- Eccentric exercises
- "W" and "V" exercises
- Core exercises

(selection of exercises based on demands)

Cools AMJ, Sturyf F, De Mey K, et al. Rehabilitation of scapular dyskinesis: from the office worker to the elite overhead athlete. Br J Sports Med. 2014 Apr;48(8):692-697.

46

SCAPULAR REHABILITATION

Plyometrics

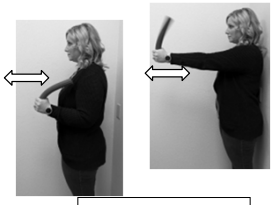
Drop and catch

Side to side pass with a weighted ball

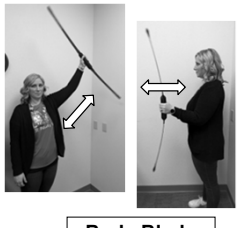
47

SCAPULAR REHABILITATION

Plyometrics



Flex Bar



Body Blade

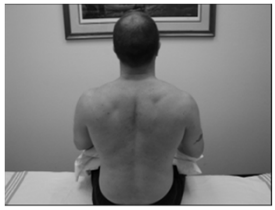
48

SCAPULAR ALIGNMENT TREATMENT

Taping to Improve Scapular Retraction/Elevation

Instruct patient to:

- Sit upright with arms supported on pillows
- Perform active scapular retraction



49

SCAPULAR ALIGNMENT TREATMENT

Taping to Improve Scapular Retraction/Elevation

Place base tape from medial aspect of acromion diagonally across the inferior angle of the contralateral scapula

50

SCAPULAR ALIGNMENT TREATMENT

Taping to Improve Scapular Retraction/Elevation

The stabilization tape is then applied over the base tape (without excessive tension)

51

SCAPULAR ALIGNMENT TREATMENT

Taping to Improve Scapular Retraction/Elevation

Sometimes a small piece of base tape may be needed to anchor the stabilization tape at the superior aspect of the shoulder

52

SCAPULAR ALIGNMENT TREATMENT

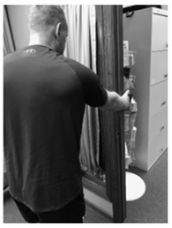
Figure-8 Straps can also be helpful to promote scapular retraction

Recommending bras that have a racer back, t-strap, or crisscross design can help unload the shoulders to avoid scapular depression or downward rotation

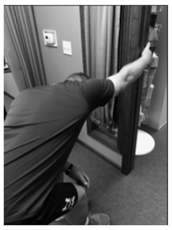
53

SCAPULAR REHABILITATION

Latissimus Dorsi stretches
Treatment for scapular depression



Step 1



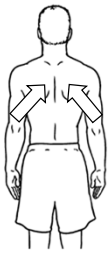
Step 2

Alternate Positioning

54

SCAPULAR REHABILITATION

Scapular Retraction
Treatment for scapular depression



Postural re-education "bring your shoulder blades up and back" (keeping arms relaxed)

3-5 reps, 4-5 times/day

55

SCAPULAR REHABILITATION

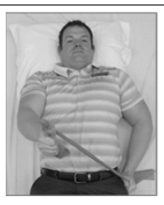
Pec Minor Stretch
Treatment for Anterior Scapular Tilting

Performing a pec minor stretch with the elbows in an extended position can prevent excessive stress on the anterior shoulder capsule

56

SCAPULAR REHABILITATION

PNF D2 Pattern
Treatment for Anterior Scapular Tilting

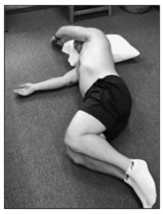


Low repetitions
3-5 reps, 3-4 times/day

57

SCAPULAR REHABILITATION

Shoulder Clocks to improve pec minor and lat length

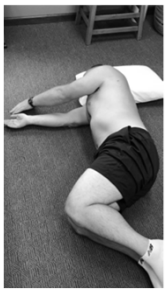


In a sidelying position, perform a large circle (your arm is on the face of a clock) to promote stretching of the pec minor, lat, as well as inducing thoracic extension and rotation

58

SCAPULAR REHABILITATION

Shoulder Clocks to improve pec minor and lat length



Video: "Shoulder Clocks" to improve pec minor and latissimus Dorsi length

59

SCAPULAR REHABILITATION

- With exercises, ensure the patient's scalenes are not compensating during scapular muscle recruitment, as this is the most challenging for TOS patients
- Start with low repetitions (3-5) with no weight/resistance
- Most TOS patients can perform open-chain exercise, but may have limited tolerance for closed-chain or plyometric activities

60

WHEN IT'S NOT CARPAL TUNNEL: ADDRESSING PROXIMAL ISSUES

CASSANDRA SCHUH, OTR, CHT, COMT, CMTPT
ASHLEY PULVERMACHER, OTR, ATC

1

OBJECTIVES

PERFORM ASSESSMENT AND TREATMENT OF POSTERIOR GLENOHUMERAL CAPSULE LIMITATIONS

2

SHOULDER ASSESSMENT

- SHOULDER IMPINGEMENT IS THE MOST COMMON CAUSE OF SHOULDER PAIN
- SHOULDER IMPINGEMENT SYNDROME AKA SIS
- MULTIFACTORAL ISSUES
- SHOULDER SHOULD BE ADDRESSED AFTER RIBS, SOFT TISSUE, SCAPULAR ALIGNMENT
- POSTURE, CERVICAL AND THORACIC ALL ADDRESSED

3

SHOULDER ASSESSMENT

ETIOLOGY AND ANALYSIS OF IMPINGEMENT:

INTRINSIC: PARTIAL OR FULL THICKNESS TENDON TEARS OCCUR AS A RESULT OF DEGENERATIVE PROCESS THAT OCCURS OVER TIME, OVERUSE, OVERLOADED, TRAUMA TO TENDONS.

EXTRINSIC: INFLAMMATION AND DEGENERATION OF THE TENDON AS A RESULT OF MECHANICAL COMPRESSION BY STRUCTURES EXTERNAL TO THE TENDON…..BINGO

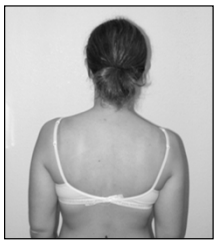
NOW LET'S BEGIN ASSESSING….

Ulmer M. Qadir I, Azam M. Subacromial impingement syndrome. Orthopedic Reviews 2012; 4:e18.

4

SHOULDER ASSESSMENT

SHOULDER IMPINGEMENT PATIENTS ARE PARTICULARLY AFFECTED BY SCAPULAR DYSKINESIS



Kibler WB, Ludewig PM, McClure PW, et al. Clinical implications of scapular dyskinesis in shoulder injury: the 2013 consensus statement from the "scapular summit". Br J Sports Med 2013;47:877-885

5

SHOULDER ASSESSMENT

SCAPULAR-THORACIC MOTION:

NORMAL MOVEMENT PATTERNS INCLUDE

- UPWARD ROTATION
- POSTERIOR TILT
- EITHER INTERNAL OR EXTERNAL ROTATION

Ludwig PM, Phadke V, Braman JP, et al. Motion of the shoulder during multiplanar humeral elevation. J Bone Joint Surg Am. 2009;91:378-389.

6

SHOULDER ASSESSMENT
POSTERIOR INFERIOR VS SUPERIOR

POSTERIOR-SUPERIOR

- CAN LIMIT ABILITY TO REACH BEHIND BACK
- TESTED IN A STANDING POSITION

POSTERIOR-INFERIOR

- CAN LIMIT ABILITY TO IR SHOULDER IN ABDUCTED POSITION
- TESTED IN A STANDING OR SUPINE

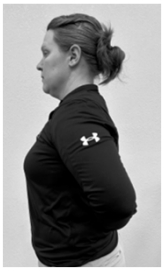
7

SHOULDER ASSESSMENT

POSTERIOR CAPSULE

TIGHTNESS AT THE SHOULDER CONTRIBUTES TO LIMITED INTERNAL ROTATION WITH INTERNAL ROTATION ROM

- WITH SHOULDER IN ADDUCTION (REACHING BEHIND BACK)

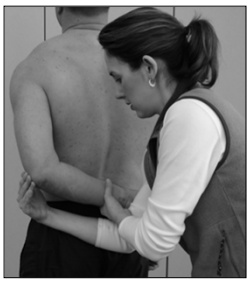


Tyler TF, Nicholas SJ, Roy T, Gleam GW. Quantification of posterior capsule tightness and motion loss in patients with shoulder impingement. Am J Sports Med 2000. 28: 668-73

8

SHOULDER ASSESSMENT
POSTERIOR-SUPERIOR CAPSULE

- IF PATIENT'S ARM CANNOT BE BROUGHT BACK BEHIND BACK, NO NEED TO CONTINUE THE TEST
- MONITOR SCAPULAR POSITION WITH TESTING; IF SCAPULA MOVES SIGNIFICANTLY, ALSO AN INDICATION OF CAPSULAR TIGHTNESS



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SHOULDER ASSESSMENT
POSTERIOR-INFERIOR CAPSULE

- PATIENT IS IN SIDELYING (SCAPTION PLANE) WITH THE SHOULDER IN ABDUCTION
- WHILE MAINTAINING SCAPULAR STABILIZATION, PASSIVE INTERNAL ROTATION IS ASSESSED

Lunden JB, Muffenbier M, Giveans MR, et al. Reliability of shoulder internal rotation passive range of motion measurements in the supine versus sidelying position. JOSPT. 2010; 40(9): 589-594.

10

SHOULDER ASSESSMENT
POSTERIOR CAPSULE AND ANTERIOR SCAPULAR TILT

- THE IR DEFICIT GROUP HAD A SIGNIFICANTLY GREATER SCAPULAR ANTERIOR TILT (9.2°)
- CONCLUSION: THESE FINDINGS DEMONSTRATE A SIGNIFICANT RELATIONSHIP BETWEEN GHJ IR DEFICIT & ABNORMAL SCAPULAR POSITIONING, PARTICULARLY INCREASED ANTERIOR TILT

Borich, et al. Scapular angular positioning at end range internal rotation in cases of glenohumeral internal rotation deficit. J Orthop Sports Phys Ther. 2006; 36(12) 926-934.

11

SHOULDER ASSESSMENT
POSTERIOR-SUPERIOR CAPSULE

MOBILIZING THE POSTERIOR-SUPERIOR CAPSULE

- PATIENT LIES IN SUPINE
- THERAPIST'S MOBILIZING HAND PERFORMS A POSTERIOR GLIDE DIRECTED IN A POSTERIOR-SUPERIOR-LATERAL DIRECTION
- THERAPIST'S OTHER HAND PROVIDES AN IR OSCILLATION AT THE DISTAL HUMERUS

12

SHOULDER ASSESSMENT
POSTERIOR-SUPERIOR CAPSULE

MOBILIZING THE POSTERIOR-SUPERIOR CAPSULE

- BEGIN WITH PATIENT'S HAND RESTING ON ABDOMEN, OR IF MILDLY STIFF, PLACE UNDERNEATH BODY, JUST ABOVE HIP
- PLACING INCREASED TENSION ON THE POSTERIOR-SUPERIOR PORTION OF THE GHJ CAPSULE
- PATIENT SHOULD FEEL A MILD STRETCH IN THE TOP-BACK PORTION OF THE SHOULDER

13

SHOULDER ASSESSMENT
POSTERIOR-SUPERIOR CAPSULE

NEURO-MUSCULAR RE-EDUCATION

- AFTER THE MOBILIZATION IS COMPLETE, FOLLOW-UP WITH GENTLE RESISTANCE (EITHER WITH MANUAL RESISTANCE OR BANDS): IR AT 20-30° OF ABDUCTION
- MONITOR FOR SCAPULAR SUBSTITUTION

14

SHOULDER ASSESSMENT
POSTERIOR-SUPERIOR CAPSULE

NEURO-MUSCULAR RE-EDUCATION

DOORFRAME STRETCH

- ***PATIENT MAINTAINS SCAPULAR RETRACTION TO KEEP SCAPULA STABILIZED***
- ***PATIENT IS ADVISED TO KEEP HAND ON ABDOMEN IF MOD/SEVERE CAP TIGHTNESS***
- ***IF ONLY MILD, PLACE HAND BEHIND BACK***
- ***EMPHASIZE THE NEED TO MAINTAIN SCAPULA IN RETRACTED POSITION TO AVOID COMPENSATION***

15

SHOULDER ASSESSMENT
POSTERIOR-SUPERIOR CAPSULE

PASSING A WEIGHT BEHIND YOUR BACK

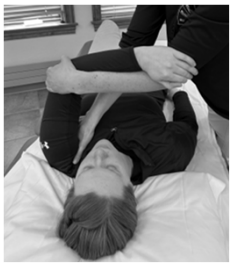
BE SURE PATIENT IS MAINTAINING SCAPULAR STABILIZATION (AVOID ANTERIOR TILT)

16

SHOULDER ASSESSMENT
POSTERIOR-INFERIOR CAPSULE

MOBILIZING THE POSTERIOR-INFERIOR CAPSULE

- **PATIENT LAYS IN SUPINE**
- **THERAPIST PLACES THE PROXIMAL HAND (EITHER IN A PRONATED OR SUPINATED POSITION) IN THE AXILLA TO PERFORM POSTERIOR GLIDE OF THE HUMERAL HEAD**
- **THE OTHER HAND SUPPORTS THE PATIENT'S SHOULDER IN FLEXION AND HORIZONTAL ADDUCTION**



17

SHOULDER ASSESSMENT
POSTERIOR-INFERIOR CAPSULE

MOBILIZING THE POSTERIOR-INFERIOR CAPSULE

- PROXIMAL HAND PROVIDES GLIDE IN A POSTERIOR-SUPERIOR-LATERAL DIRECTION, WHILE THE DISTAL HAND GENTLY PULLS THE PATIENT'S ARM INTO HORIZONTAL ADDUCTION
- RHYTHMIC OSCILLATIONS
- PREPOSITION INTO MORE FLEXION FOR FARTHER STRETCH

18

SHOULDER ASSESSMENT POSTERIOR-INFERIOR CAPSULE

NEURO-MUSCULAR RE-EDUCATION

- AFTER THE MOBILIZATION IS COMPLETE, FOLLOW-UP WITH GENTLE RESISTANCE (EITHER WITH MANUAL RESISTANCE OR BANDS): IR AT 60-90° OF ABDUCTION
- MONITOR FOR SCAPULAR SUBSTITUTION

19

SHOULDER ASSESSMENT POSTERIOR-INFERIOR CAPSULE

POSTERIOR-INFERIOR CAPSULE STRETCH

SLEEPER STRETCH

EVERYONE'S FAVORITE ☺

- PATIENT LIES IN A SEMI SIDELYING POSITION TO STABILIZE THE SCAPULA
- SHOULDER IS ABDUCTED, THEN INTERNALLY ROTATED
- THE FOREARM IS MAINTAINED IN THIS POSITION, WHILE THE PATIENT SLIGHTLY ROLLS ONTO INVOLVED SIDE

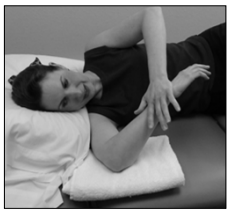
20

SHOULDER ASSESSMENT POSTERIOR-INFERIOR CAPSULE

POSTERIOR-INFERIOR CAPSULE STRETCH

SLEEPER STRETCH

- PATIENT SHOULD FEEL A STRETCH IN THE POSTERIOR-INFERIOR PORTION OF THE SHOULDER CAPSULE
- PAIN FREE, COMFORTABLE STRETCH



21

SHOULDER ASSESSMENT POSTERIOR-INFERIOR CAPSULE

Posterior-Inferior Capsule Stretch

- *Across body stretch in standing*

22

ADDITIONAL STRATEGIES TO MAXIMIZE UPPER QUADRANT AND THORACIC MOBILITY

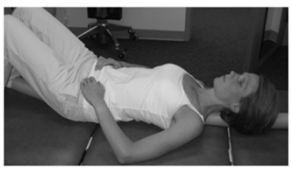
1

NOW WHAT???

2

ADDITIONAL OPTIONS

Pec Minor Foam Roller Stretch



With scapular retraction

- Patient lies on a rolled towel, pool noodle, or foam roller while gravity assists with pectoralis minor stretch.
- Stretch can be intensified with the addition of active scapular retraction.

3

ADDITIONAL OPTIONS

Seated Thoracic Mobility Sequence

Step 1:
Seated with arms comfortably relaxed at chest

A foam roller is placed between the knees to provide stabilization to promote pelvis dissociation

4

ADDITIONAL OPTIONS

Seated Thoracic Mobility Sequence

Step 2:
Perform isolated thoracic rotation

Verbal cue provided to NOT lead with the shoulder

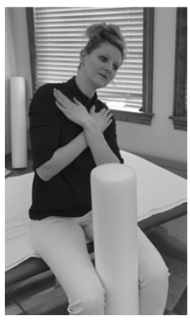
Hold for 10-15 seconds

Performed bilaterally

5

ADDITIONAL OPTIONS

Seated Thoracic Mobility Sequence



Step 3:
Perform isolated thoracic side flexion

Hold for 10-15 seconds

Performed bilaterally

6

ADDITIONAL OPTIONS

Seated Thoracic Mobility Sequence

Step 4:
Perform thoracic rotation followed by thoracic side flexion

Hold for 10-15 seconds

Performed bilaterally

7

ADDITIONAL OPTIONS

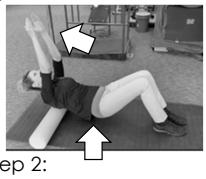
Seated Thoracic Mobility Sequence: Video of Combined Thoracic Rotation with Side Flexion

8

ADDITIONAL OPTIONS

Supine Foam Roller Exercises

Step 1:
Position the foam roller horizontally along the upper thoracic spine with arms pre-positioned in approximately 90 degrees of elevation



Step 2:
Perform a gluteal bridge and initiated shoulder flexion

9

ADDITIONAL OPTIONS

Supine Foam Roller Exercises

Step 3:
As the UE goes into further shoulder flexion, begin the descent from the gluteal bridge

End position

10

ADDITIONAL OPTIONS

Supine Foam Roller Exercises - Video

11

ADDITIONAL OPTIONS

Half-Kneel Sequential Stretches

Step 1:
From a half-knee position, initiate a hip flexor stretch by pushing your hips forward

Step 2:
Maintain the hip flexor stretch while initiating thoracic rotation towards the "up" knee

12

ADDITIONAL OPTIONS

Half-Kneel Sequential Stretches

Step 3:
Progress the stretch with thoracic side bending

13

ADDITIONAL OPTIONS

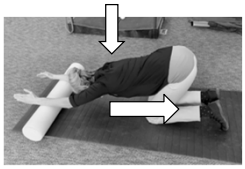
Half-Kneel Sequential Stretches - Video

*For a higher-level progression, you can utilize a golf club to include a focused stretch to the lateral soft tissue of the trunk. This progression will challenge dynamic stability, as well

14

ADDITIONAL OPTIONS

Child's Pose Sequential Stretches



Begin in a quadruped position with hands placed on the foam roller. As the hips move towards the heels, the foam roller is rolled out in front of the body.

**Can be performed with or without a foam roller. The foam roller allows a little more leverage with the progressions

15

ADDITIONAL OPTIONS

Child's Pose Sequential Stretches - Video

16

ADDITIONAL OPTIONS

Child's Pose Sequential Stretches

The foam roller is now positioned vertically next to the stabilizing arm.

As with the previous stretch, the hips will move towards the heels. The foam roller is rolled away from the body as the spine goes into thoracic rotation.

17

ADDITIONAL OPTIONS

Child's Pose with Thoracic Rotation - Video

18

ADDITIONAL OPTIONS

Latissimus Mobility

The horizontally placed foam roller is positioned at the lateral border of the scapula. The hips will remain relaxed on the mat throughout the exercise. The top arm will actively move through abduction to provide a stretch to the lateral soft tissue of the trunk.

19

ADDITIONAL OPTIONS

Latissimus Mobility - Video

20

ADDITIONAL OPTIONS

True Stretch Cage

21

ADDITIONAL OPTIONS

True Stretch Cage

22

ADDITIONAL OPTIONS

True Stretch Cage

23

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