

COMPLEMENT
Osteo & Physio

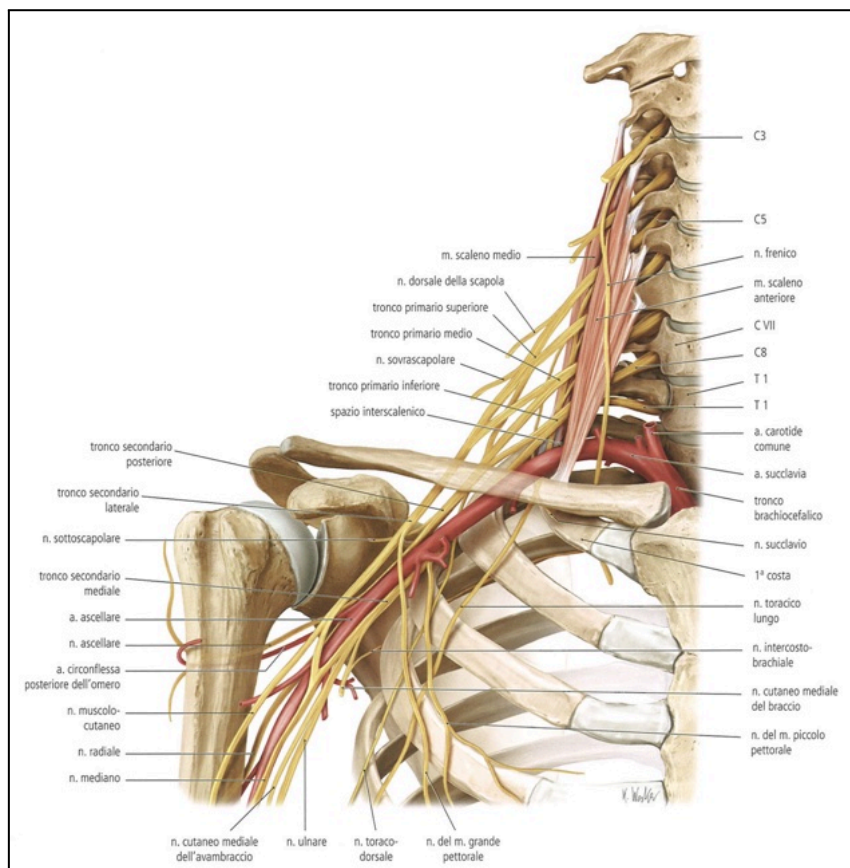
THORACIC OUTLET SYNDROME

Manipulative and Exercise approach

1. Definition & Anatomy

The Thoracic Outlet Syndrome (or TOS) is characterized by intermittent compression of the nervovascular structures of the brachial plexus at their exit in the region of the upper thoracic outlet.

The anatomical region of the thoracic outlet spans from the cervical/costoclavicular space proximally to the axillary canal distally. There are 3 main region who are anatomically relevant: the **scalene triangle**, the **costoclavicular space** and the **subchoracoid space**.



- a) The **interscalenic triangle**: This area is marked by the anterior scalene muscle anteriorly, the middle scalene posteriorly, and the first rib inferiorly. Through this space we have the passage of the brachial plexus and the subclavian artery.
- b) The **costoclavicular space**: The brachial plexus, the subclavian artery and the subclavian vein are passing between the clavicle and the first rib. The subclavian vein is not passing directly into the scalenes triangle, but is passing in front of the anterior scalene muscle. This is relevant for diagnostic reason when differentiating the cause of compression when testing.
- c) The distal portion is the **sub-choracoid space**, between the choracoid process, the minor pectoralis muscle (anteriorly) and the outer portion of the ribcage (2nd/3rd level). In this area we have the passage of the brachial plexus and the subclavian artery and vein.

2. Eziopatology & Epidemiology

Eziology:

a) **Congenital alterations:**

- Transverse megaapofysis process (C7)
- Cervical Rib (C7 or C6)
- Fibrous anomalies (transversocostal, costocostal)
- Abnormalities of the insertion of the scalene muscles
- Fibrous muscular bands
- Exostosis of the first rib
- Cervicodorsal scoliosis

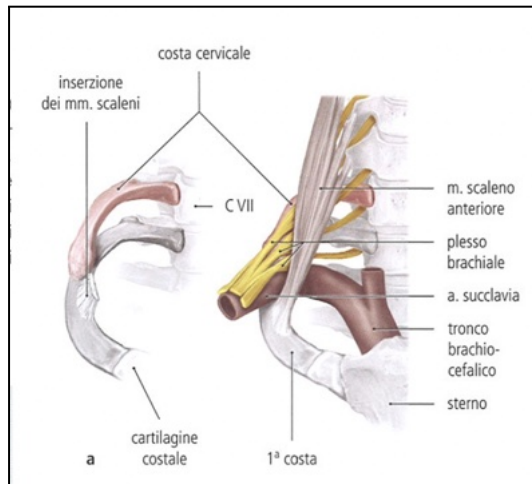
b) **Disfunctions/MSK/Postural factors:**

- Postural adaptations to traumas (clavicle/shoulder/ribcage fractures, whiplash, etc) or surgeries
- Anteriorized / Elevated / Depressed shoulder
- Spine adaptations/dysfunctions
- TMJ Dysfunctions
- Hypertrophy / increased tone of the scalene muscles
- Decrease of the tonus/weakness of the M. trapezius, M. levator scapulae, M. rhomboids
- Shortening of the scalene muscles, M. trapezius, M. levator scapulae, pectoral muscles, subclavius muscle, SCM
- Post pregnancy (holding the baby, breathing dysfunction - accessory pattern)
- Breathing dysfunctions (smokers, asthmatic, other respiratory conditions)

c) **Occupational factors:**

- Desk posture (standing or sitting without support for the mid upper back onto the backrest and without support for the elbow/forearm)
- Repetitive stress injuries
- Pay attention to the side (dominant/work-exercise)

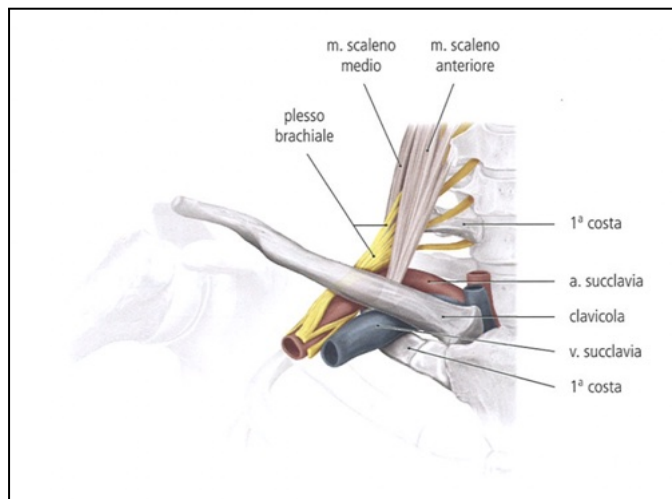
Patophysiology of different presentations:



Scalenes Syndrome

In this case the compression of the neurovascular complex happens between the medial and anterior scalenes, which are increased in tone/trophism/spasm (aquired or congenital conditions).

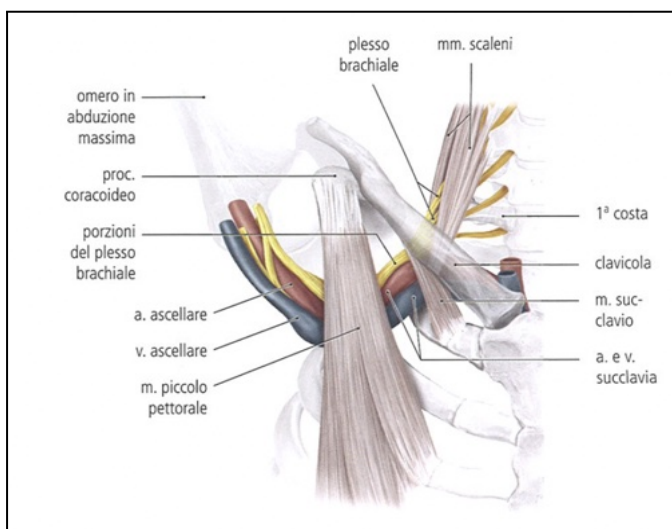
In the image there is also an anatomical variant, with the cervical rib creating potentially more possible compression due to the reduced space for the exit of the plexus from the scalene triangle.



Costoclavicular syndrome

The compression of the brachial plexus and subclavian vein and artery can happen in patients with compressed shoulder posture, lowered and anteriorized.

Together with the shoulder posture, there is usually a dysfunction with breathing patterns, and the first rib tends to be elevated (scalenes, SCM and subclavious).



Minor pectoralis syndrome (or hyperabduction syndrome)

An increased tone in the minor pectoralis muscle, together with the anteriorized and depressed shoulder complex and other ribcage/spine adaptations can lead to compression at the brachial plexus and subclavious artery and vein.

This can be triggered when the shoulder is maintained in abduction, ER and extension.

Epidemiologically:

- TOS affects approximately 8% of the population
- Higher prevalence in women (due to anatomical and physiological factors).
- It predominantly affects individuals between the ages of 20 and 40, with the brachial plexus being the most commonly affected structure.
- Athletes who frequently engage in overhead activities, such as baseball and football players, swimmers, divers, and weightlifters, frequently expose their subclavian vessels and brachial plexuses to repetitive stress.

3. Clinical Presentation / Symptoms

Signs and symptoms of thoracic outlet syndrome vary from patient to patient due to the location of the nerve and/or vessel involvement. Symptoms range from mild pain and sensory changes to limb-threatening complications in severe cases.

Different symptoms based on the type of TOS:

- a) The **neurogenic** type is the most common (90%) and presents with pain, weakness, paraesthesia, and occasionally loss of muscle at the base of the thumb (thenar) or at the area ipothernar.
- b) The **venous** type results in swelling, pain, and possibly a bluish (cyanotic) coloration of the arm.
- c) The **arterial** type results in pain, coldness, and pallor of the arm.

In general main symptoms:

- Pain and Paresthesia. Pain anywhere between the neck, face, and occipital region or into the chest, shoulder, and upper extremity, and paresthesia in the upper extremity.
- The patient may also complain of altered or absent sensation, weakness, fatigue, or a feeling of heaviness in the arm and hand.
- The skin can also be blotchy or discoloured. A different temperature can also be observed.

When the **upper plexus** (C5,6,7) is involved, there is:

- pain in the side of the neck, and this pain may radiate to the ear and face. Often, the pain radiates from the ear posteriorly to the rhomboids and anteriorly over the clavicle and pectoralis regions. The pain may move laterally down the radial nerve area (lateral forearm, thumb, etc).
- Headaches are not uncommon when the upper plexus is involved.

Patients with **lower plexus** (C8, T1) involvement typically have:

- symptoms that are present in the anterior and posterior shoulder regions and radiate down the ulnar side of the forearm into the hand, the ring, and small fingers.

Typically, **TOS does not follow a dermatomal or myotomal pattern** unless there is nerve root involvement, which will be important in determining your diagnosis and planning your treatment.

Typical Aggravating Factors

- using prolonged postures resulting in increased tension or compression of the thoracic outlet: head forward with the shoulder girdles protracted and depressed, ie sitting all day at the desk, typing/using mouse, driving car, etc
- activities that involve working overhead with the arms elevated, abducted overhead and externally rotated: overhead throwing, serving a tennis ball, painting a ceiling, washing hair, etc

4. Differential diagnosis

Due to its variability, TOS can be difficult to distinguish from other pathologies with similar presentations. A thorough history and evaluation must be done to determine if the patient's symptoms are truly TOS.

The following pathologies are the common differential diagnoses for TOS:

- Carpal tunnel syndrome
- De Quervain's tenosynovitis
- Lateral epicondylitis
- Medial epicondylitis
- Complex regional pain syndrome (CRPS I or II).
- Horner's Syndrome
- Raynaud's disease
- Cervical disease (especially discogenic)
- Brachial plexus trauma
- Systemic disorders: inflammatory disease, oesophageal or cardiac disease
- Upper extremity deep venous thrombosis (UEDVT), Paget-Schroetter syndrome
- Rotator cuff pathology
- Glenohumeral joint instability
- Nerve root involvement
- Shoulder Instability
- Malignancies (local tumors)
- Chest pain, angina
- Pancoast's Syndrome

Important consideration regarding TOS diagnosis:

- The diagnosis of TOS is essentially based on history, physical examination, and provocative tests. If needed, ultrasound, radiological evaluation, and electrodiagnostic evaluation.
- It must always be kept in mind that TOS diagnosis is usually confirmed by the elimination of other causes with similar clinical presentation.
- Especially differential diagnosis of cervical radiculopathies and upper extremity entrapment neuropathies can be hard.

5. Physical Examination - Postural assessment

Observation of any of these in the area examined: Cyanosis, Oedema, Paleness, Atrophy

Postural evaluation in orthostatic:

- Position/alignment of the cervical/thoracic spine (also thoracolumbar spine, LSSp for broader dysfunctions)/ masses in A/P and L/L schemes (check all planes)
- Position/postural adaptations of the head compared to the other masses/regions
- Position/postural adaptations of the shoulder complex (anteriorized/posteriorized, elevated/depressed, in IR/ER), compare R to L side
- Observation of any spasm, hypertone or other abnormalities

Spine movement analysis in orthostatic: R/L rotation, extension/flexion, R/L side-flexion

GHJ and Scapulothoracic Joint movement analysis: Flex/Abd/ER/IR + Compare to R and L

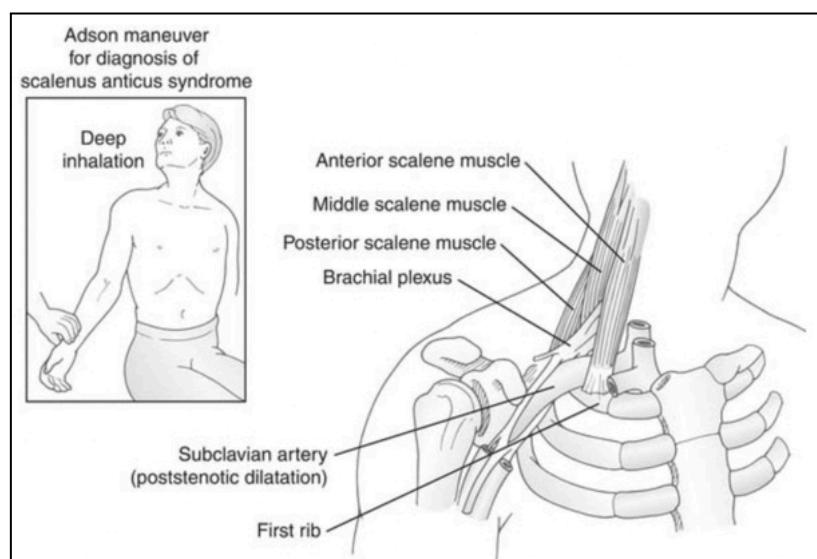
6. Clinical Testing - Assessment

Adson's Test (Scalenes test)

Goal is to create more tension in the scalenes muscles, and reduce the space between the medium and anterior scalenes, so to trigger the compression (on the artery and the brachial plexus). Procedure:

- Seated patient, asked to actively rotate the head omolaterally and side flexing the head contralaterally. Then the patient is required to inhale and hold.
- The arm of the patient is abducted 30 degrees at the shoulder and maximally extended.
- The radial pulse is palpated and the examiner grasps the patient's wrist.
- The quality of the radial pulse is evaluated in comparison to the pulse taken while the arm is resting at the patient's side and the other side

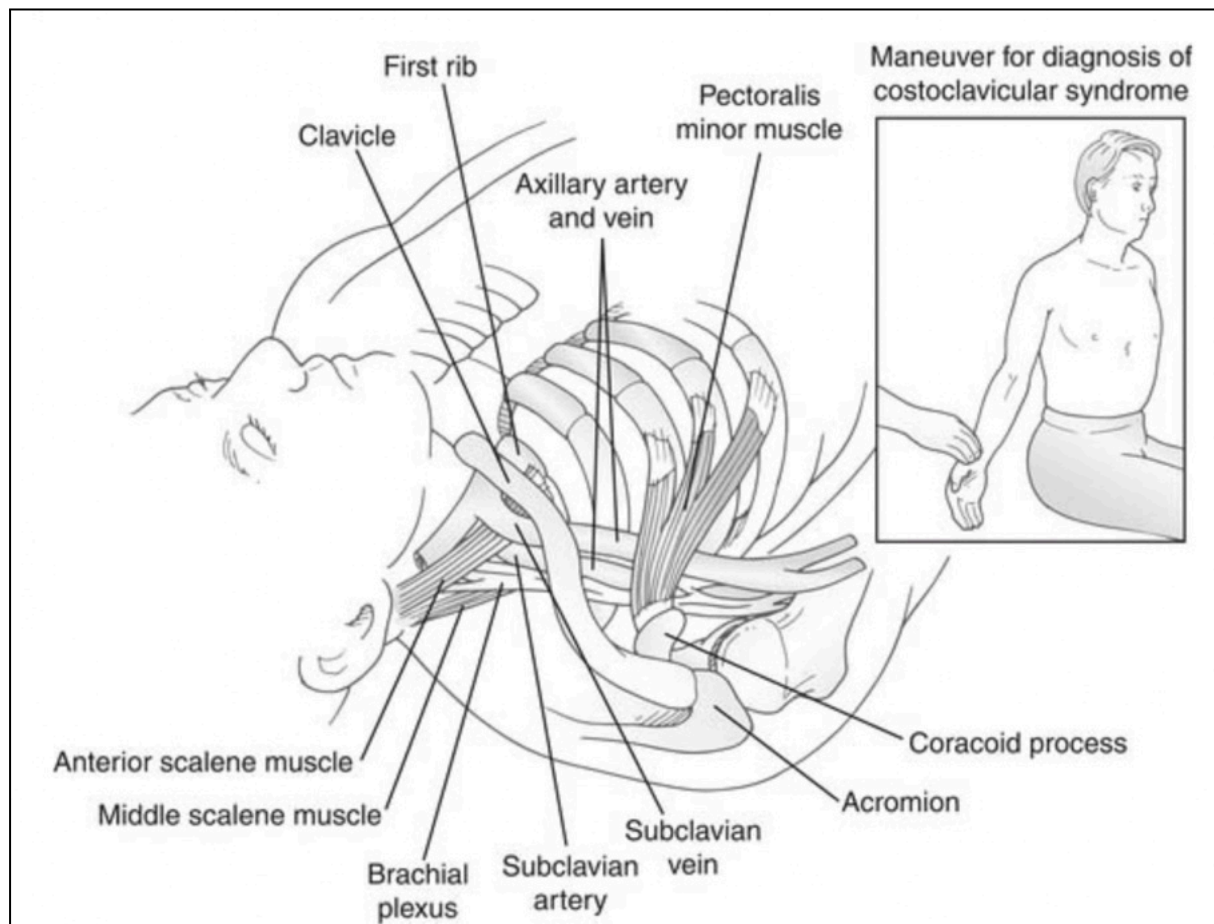
The test is positive if there is a marked decrease, or disappearance, of the radial pulse and also a triggering of the neurological symptoms (pain and parestesias).



Eden's Test - Military Position (Costoclavicular test)

This maneuver narrows the costoclavicular space by approximating the clavicle to the first rib and thus tends to compress the neurovascular bundle.

Procedure: Patient in sitting. The examiner palpates the radial pulse and then draws the patient's shoulders down and back as the patient lifts their chest in an exaggerated "at attention" posture. A positive test is indicated by an absence or decrease in vigor of the pulse and implies possible costoclavicular syndrome. It is also positive if the client experiences an increase of neurologic symptoms into the upper extremity on that side.



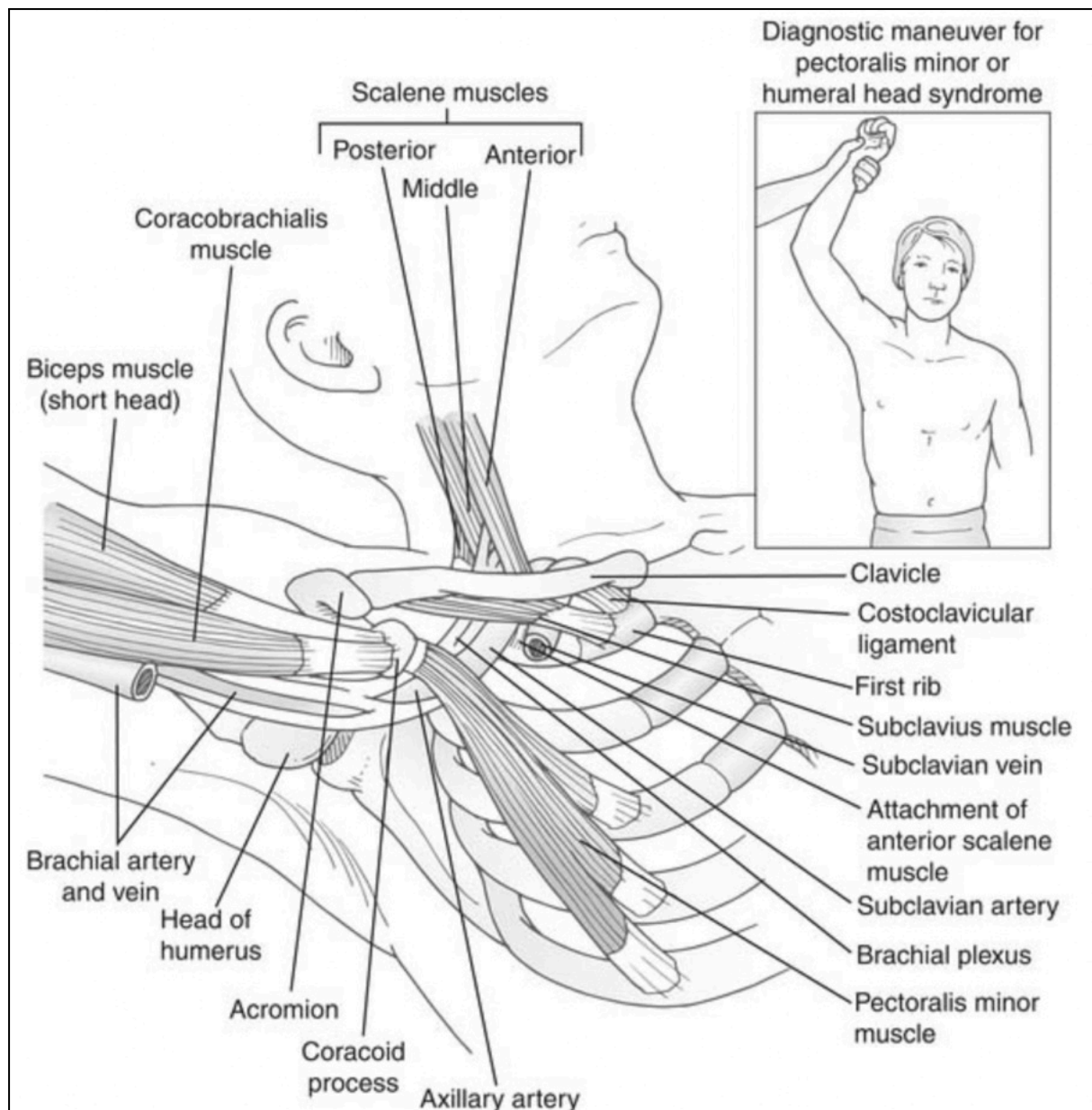
Wright's Test (Minor Pectoralis test)

When the arm is hyperabducted to 180 degrees, the components of the neurovascular bundle are pulled around the pectoralis minor tendon, the coracoid process, and the head of the humerus. If the radial pulse is decreased and neurological symptoms are triggered, compression should be suspected.

First step: head forward, while the arm is passively brought into abduction and external rotation to 90 without tilting the head. The elbow is flexed no more than 45. The arm is then held for 1 min. The tester measure radial pulse and monitor patient symptoms onset

Second step: The tester monitors the patient's symptom onset and the quality of the radial pulse. The test is repeated with extremity in hyperabduction (end range of abduction, 180').

Positive Test: A decrease in the radial pulse and/or reproduction of the patient's symptoms



7. Palpatory Assessment

Static and Dynamic palpation of the interested structures

- Temperature changes
- Supraclavicular fossa
- Scalene muscles (tenderness)
- Trapezius muscle (tenderness)
- Levator Scapulae Muscle
- Subclavious muscle
- SCM
- Minor pectoralis
- 1st Rib
- Ribcage
- Spine (spinous/lat processes in Cx and Tx spine)

8. Manipulative and Exercise Treatment

Conservative management should be the first strategy to treat TOS since this seems to be effective at decreasing symptoms, facilitating return to work, and improving function.

Conservative management includes physiotherapy and osteopathy, which focus mainly on patient education, pain control, range of motion, nerve gliding techniques, manipulative treatment at soft tissues and joints, strengthening and stretching.

Manual Treatment:

- Cervical spine mob (supine) general mob
- Thoracic spine mob (prone, sitting)
- Scapulo thoracic mob in prone
- Cervical spine soft tissues release in supine (scalenes, SCM lev scap UT)
- Min Pectoralis, Lat dorsi in supine release, subclavius release
- Nuchal ligament fascial release
- Diaphragmatic release in supine and/or sitting
- Upper thoracic fascial release in supine
- K1 Mob
- HVT Upper thoracic spine in extension (prone/supine), Cervical spine (lower segments), CT spine in supine side flexion, thoracolumbar passage spine

Exercise therapy:

- Thoracic mobility extension/rotation/side bending
- Cervical mobility / stability
- Scapulothoracic release with release ball
- Pectoralis min stretching/release
- Scalenes stretching/release

- Lats stretching/release
- UT and Lev scap release
- Neural glides for whole plexus (radial, median, ulnar nerves)
- Strengthening scapular girdle ER
- Ant serratus strengthening protocol
- Deep flexors (Cx Spine) protocol
- Diaphragmatic breathing training

Kinesiology Tape

Acupuncture

Education/Self-management/DSE