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BRACHIAL PLEXUS
Secrets to Treating
Thoracic Outlet Syndrome

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Brachial Plexus: The Secrets of Treating TOS

CEUs:  .4  Interactive; Must Have!
Contact Hours:  4.0

You will understand Brachial Plexus TOS when you complete this course. Must have for everyone! Worksheets, labeling/matching, & identifying coursework of brachial plexus, dermatomes, anatomy and more. EXCELLENT study material for exam for the CHT!

Instructors:

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Description:

Brachial Plexus: Secrets to Treating Thoracic Outlet Syndrome (TOS) is often under-diagnosed, over-diagnosed or misdiagnosed nerve compression that often creates difficulties in management. The purpose of this course is to provide the reader with clarity in understanding the structures involved, the use of provocative testing alone with a systemized plan to treat and improve the identifiable dysfunctions in the upper quadrant.

Objectives:

- Identify 3 main compression sites for TOS
- Distinguish between upper brachial plexus and lower brachial plexus pathologies
- Recognize venous TOS symptoms
- Identify proper tests for lower brachial plexus pathologies
- Identify anatomical structures of the brachial plexus
- Identify symptoms of lower brachial plexus pathologies

Outline & Content:

- Manual complete with brachial plexus worksheets for you to label with answer key in manual
- Worksheets of dermatomes with answer key in manual
- Label worksheet of the structures associated with lower brachial plexus TOS
- Anatomical Introduction
- Therapy Examination and Evaluation
- Neurogenic pain and differential diagnosis of lower brachial plexus: TOS
- Greater Imagery Program detailed look, demonstrations, and implementation
- Extensive Home Treatment Program
- Summary and Tips from the Expert (instructor)
INTRODUCTION

Brachial Plexus: Secrets to Treating Thoracic Outlet Syndrome (TOS) is often under-diagnosed, over-diagnosed or misdiagnosed nerve compression that often creates difficulties in management. The optimal approach for both identification and treatment of the TOS symptoms remains controversial. The purpose of this course is to provide the reader with clarity in understanding the structures involved, the use of provocative testing alone with a systemized plan to treat and improve the identifiable dysfunctions in the upper quadrant.

The initial management of TOS is non-operative with an emphasis on identification of all treatable structures in the upper quadrant causing symptoms. If symptoms cause acute vascular insufficiency, or progressive neurological dysfunction or failed conservative treatment then surgery may be indicated. It is important for a successful outcome to have a well-coordinated team of physicians and therapist whose primary interest is communicating with other health care individuals for this positive functional outcome.

TOS is often a chronic condition in which causes cortical reorganization of the brain and this must be addressed. A brief discussion on Grated Motor Imagery is presented but a full understanding of retraining the brain is beyond discussion.

Your manual will have worksheets, information and test either discussed or for further learning. Please use this manual during your course and enjoy the bonus worksheets that will help solidify your knowledge. There is an online exam in order to receive your Continuing Education Units. Go to handtherapy.com for exam login.
We have interactive Worksheets, to help solidify your knowledge, throughout the manual. All answer keys are in appendix A.

Enjoy this great course
Anatomy of the thoracic outlet area.
Clinical Management of Thoracic Outlet Syndrome

Thoracic Outlet Syndrome
Section 1
Anatomical Introduction
A Riddle Wrapped in a Mystery Inside an Enigma

TOS

[Image of a globe with hands holding it]
Thoracic Outlet Syndrome (TOS)

- Related to compression
- Related to tension of the brachial plexus
- Related to the subclavian artery and vein in an area located above the first rib and behind the clavicle
- Related to nerve root tension

TOS

- Classified into 4 sections
- Vascular
  - Arterial TOS (ATOS): Less than 5%
  - Venous TOS (VTOS)
- Neurogenic TOS (NTOS) – occurs 95%
- Non specific

Vascular is difficult to treat conservatively

Anatomy of the Thoracic Outlet Area
Typical Neurogenic Complaints

- Paresthesia
- Numbness
- Pain

Based on interpretation of the history, symptoms and clinical examination

Variable

Vascular Symptoms

VENOUS
- Swelling
- Cyanosis
- Pain with overhead activity

ARTERIAL
- Pallor
- Cold
- Lower blood pressure by 20mmHg

Emergent care needed
Venous TOS Symptoms (VTOS)

- Comprises about 1-5% of all TOS patients
- Factors that lead to thrombosis is excessive arm activity
  - Throwing a baseball
  - Swimming
  - Weight lifting
  - Working with arms elevated
- Symptoms (aggravated with exercise):
  - Swelling
  - Edema
  - Cyanosis and arm discomfort

Arterial TOS Symptoms (ATOS)

- Develop spontaneously unrelated to trauma or work
- Patient often have true claudication of the arm
- ATOS accounts for less than 5% of TOS
- Screening test to rule out ATOS: cervical x-ray
- Physical findings:
  - Arterial occlusion
  - Loss of pulses at rest
  - Possibly color changes and ischemic finger tips and coldness, paresthesia and fatigue
  - In the supraclavicular area- sometimes a tender lump, bony prominence or even pulsation of the subclavian artery
Patho Anatomical Causes of TOS

- Thoracic outlet region includes 3 common and major areas in which compression can occur
  - Interscalene space or triangle
  - Costoclavicular space
  - Subpectoralis minor space
- From the interscalene triangle to the axilla, there is a fascial sheath
- Fibrous bands, both congenital and acquired

Prevertebral Fascia

This is a firm membrane lying anterior to the three (3) heads of the scalenes, longus capitus and longus colli, as well as the rectus capitis musculature.

Entrapment Sites

From the Christine M. Kleinert Institute for Hand and Microsurgery, Inc; with permission
Patho Anatomical Causes of TOS

Other Causes:

- Congenital bony structures such as large cervical transverse process, or cervical rib and callus formation.
- Fibromuscular anomalies
- Postural deviations
- Muscle imbalances
- Trauma can produce muscle spasm, inflammation and fibrosis
- Myofascial trigger points

Diagnosis and Examination

- Complete history
- Comprehensive physical examination
- Specific provocation test

All of the above can identify the structure causing compromise and help determine muscle weakness and tightness

TOS Etiology

- 3-4 times as frequent in women as in men between the ages of 20-50 yrs of age
- Rationale why females are more prone to develop TOS:
  - Females have less developed muscles
  - Greater tendency for dropping shoulders due to additional breast tissue
  - Narrowed thoracic outlet
  - Anatomical lower sternum
  - Increase in hormones that cause laxity resulting in superior subluxation of the first rib
Clinical Presentation of TOS

- Numbness/tingling in ring and small finger
- Paresthesias occurs at night and/or during daily activities
- Vague pain in uninvolved extremity can occur in
  - Hand
  - Elbow
  - Shoulder
  - Cervical spine
- Subjective complaints of hand/arm weakness
  - Especially with arms raised overhead
- Complaints of swelling in the absence of true swelling

2 Types of Neurogenic TOS

- True
  - Hand weakness
  - Muscle wasting
  - Cervical rib present
  - Axonal loss – shown on EMG or nerve conjunction
- Disputed or Non Specific
  - Vague symptoms
  - Examination test negative but still have symptoms

Neurogenic TOS Symptoms

- Upper plexus includes symptoms involving the C5, C6 and C7
- The lower plexus involves the C8 – T1 levels
- Always perform manual muscle test and 2 point discrimination
ULNAR NERVE WEAKNESS

Neurogenic TOS Symptoms

• If upper plexus is involved
  – Pain is in the side of the neck which may radiate to the ear and face
  – Headaches are not uncommon
  – Some patients feel there is a “stuffy ear” on the affected side
  – Pain
    • May radiate from the ear posteriorly to the rhomboids and anteriorly over the clavicle and pectoralis regions
    • May move laterally to the trapezius, deltoid muscle and down the C5-C6 radial nerve area

UPPER TRUNK
Neurogenic TOS Symptoms

- If lower plexus is involved
  - Patient present with symptoms in the anterior or posterior shoulder region radiating down the ulnar side of the forearm into the hand, the ring and small finger, C7,C8 and T1
  - Patients may present with muscle tenderness with trigger points in the supraclavicular and infraclavicular area
  - Headaches may be disabling and increases with arm activity
  - Pain sometimes mimics the pain associated with cardiac angina

Lower Trunk

Sympathetic Mediated Pain in TOS

- In NTOS, the coldness and color changes may be due to an overactive sympathetic nervous system (SNS)

- Symptoms:
  - Pain out of proportion
  - Allodynia
  - Hyperalgesia
  - Prolonged period of red or blue hand
  - Persistent edema
  - Excessive warmth
  - Sweating changes
  - Movement disorders
Label the sections

Click here for Answer

Question plate 01
**Sympathetic Nervous System**

An anatomic distribution of the sympathetic nervous system is as follows:

- SNS fibers run on the circumference of the nerve root of C8, T1 and lower trunk of the brachial plexus.
- If nerves are compressed, the sympathetic fibers are activated producing Raynaud’s like phenomenon.
  
  This may explain how the coldness and color changes are frequently seen with both NTOS and ATOS.

**Ways to Categorize Symptoms**

**Compressor** - used to evaluate patients who complain of symptoms when performing overhead activities:

- These patients do not have paresthesia at night unless the arm is overhead and have an occupation that requires overhead work.
- This compression occurs when the arms is raised overhead which then causes the brachial plexus to turn over the first rib then under the clavicle at the costoclavicular space.
- When the patient lowers their arm, the compression on the blood supply to the nerve is off and symptoms decrease.
- Roos test is positive when a patient has what is commonly called compressor TOS.
Label the Trunks

Lateral Cord
Posterior cord
Medial Cord

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Question plate 02

Answer on page 97
Releaser

- Term used to identify patients that experience symptoms primarily at the same time each night
- Work in more sedentary jobs – venous pooling
- May have poor posture along with large or heavy upper extremities
- Blood flow is inhibited to the brachial plexus during the day and, when reclining at night, the tension is released

Release Phenomenon

TOS

- Symptoms
  - Think releaser, if patient wakes at night due to nerve pain
  - Think compressor, if patient has more symptoms when reaching overhead
Thoracic Outlet

TOS

End of Anatomical Introduction
THE CERVICOAXILLARY CANAL OR THE THORACIC OUTLET
Section 2
Therapy Examination and Evaluation

Therapy Evaluation

- Subjective history helps to understand patient’s perception, duration of time or chronicity of the symptoms

- The provocation test are used to isolate the pain generators and the joint mobility testing determines areas of segmental dysfunctions

Evaluation
BR Question Plate 03

Label:
1. Lateral Pect Nerve
2. Lower subscapular nerve
3. Draw first rib location
Diagnosing TOS

• Based on history and clinical examination
• Common symptoms:
  – Paresthesia
  – Numbness
  – Pain and burning
• Diagnosis
  – Based on careful methodical history
  – Review of medical records
  – Clinical examination including provocative maneuvers

Examination and Evaluation

Must be a skilled examination to either rule in or rule out a problem. Leads to effective decision making.

Must palpate all areas of tightness and test all muscles that may be weak.

Examination and Evaluation

Observation-posture and gait.
Visual inspection: discoloration, edema, cyanosis, fullness, hand temperature, sweating, allodynia and muscle wasting.

Use Body Diagrams for patient
Examination and Evaluation

Upper Limb Reflexes:  Biceps C6, Triceps C7, and Brachioradialis C6
Tinels Sign

Examination and Evaluation

Manual Muscle Test
Finger Abduction C8
Finger Adduction T1
Sensory testing C5,6,7,C8 and T1

Examination and Evaluation

Sympathetic changes- allodynia, hyperhidrosis, temperature changes, and abnormal movements
Pain out of proportion
Examination and Evaluation

Review what patient has stated; ask is the problem always the same; and have them show you the pain and discomfort with change in positions.

Quality of life Questionnaire

DASH disability of arm, shoulder and hand

EVALUATION

History – acute or chronic, previous injury, aggravating symptoms for leisure and occupation.
Question Plate 04
Label:
1. Median nerve
2. Ulnar nerve
3. Medial antebrachial cutaneous nerve
4. Medial Pectoral Nerve

Answer on Page 99
EVALUATION
Observation of upper limb and posture which helps with determining irritability. Check spine mobility.

EVALUATION
Positions of arm and postures causing symptoms, which helps determine structures involved.
**Neurogenic Test**
Sensory, Motor, or Autonomic

**Clinical Examination**
Deep tendon reflex, manual muscle testing - intrinsic wasting and hypothenar atrophy

**Clinical Examination**
PALPATION OF STRUCTURES
Clinical Examination

• Palpate for tenderness - Scalenes, SCM, pectoralis minor and major

• Trigger points in upper middle, lower trapezius, supraspinatus and infraspinatus

• Tinel's over brachial plexus

Clinical Examination

• Scalenus Anterior and Scalenus Medius Entrapment

• First Rib and Clavicular Entrapment

• Pectoralis Minor Entrapment

• Cervical Rib Entrapment

Scalenus Anterior and Scalenus Medial Entrapment

• Related to fibrous band of tissue

• Shortening of scalenus muscle

• Hypertrophy of the scaleni muscle

• Muscle spasms of the scaleni muscle
Clavicular and 1st Rib Entrapment

• Related to hypomobility of 1st rib
• Restricted clavicular motion
• Result of fractures callus formation

Pectoralis Minor Entrapment

• Shortening of muscle
• Tightness in fascia
• Abnormal insertion sites at the 3rd and 5th rib
• Abnormal anatomical position of coracoid process

Cervical Rib Entrapment

• Decrease space due to extra rib
• Related to fibrous band on the cervical rib

X-ray needed to determine this
Evaluation of Tests and Soft Tissue Restrictions

Prognostic Test

• Adson Test
• Wright's Test
• Roos Test
• Cyriax Release Test
• Elevated arm stress test

• Costoclavicular Test
• Elevated First Rib Test
• Upper Limb Neurodynamics Test

Adson Test

Wright's Test
Elevated First Rib Test

Costoclavicular Test

Lindgren Test

- Cervical rotation lateral flexion (CRLF)

Roos Test
(test is positive if patient shows signs of compression TOS)
Roos Test

- Patient is positioned standing and abducts the arms to 90° with lateral rotation of the shoulder
- The patient then opens and closes the hands slowly for 3 minutes
- Test is positive if the patient is unable to maintain the position or reports heaviness and tingling in the arm

CYRIAX TEST

Neurogenic Pain

- Chapter point
Evaluation (Cervical Radiculopathy)

- History and Exam
  - Gradual or acute onset differs from patient to patient
- Cervical Spine = ROM – AM stiffness
- Cervical Compression -
  - Spurling’s Test
  - Cervical Distraction Test
  - Range of Motion Test

Spurling’s Test

- The patient is seated and the neck is passively side bent toward the symptomatic side.
- The therapist applies approximately 7 kg of force through the patient’s head with a caudally directed force.
- Positive if reproduction of the patient’s upper extremity symptoms
Neck Distraction Test

- The patient is positioned supine and the therapist grasps under the patient's chin and occiput.
- The therapist flexes the neck to patient comfort and then applies a distraction force of approximately 14 kg.
- Positive with reduction or resolution of the patient's upper extremity symptoms.

Cervical Range of Motion Test

- Positive if less than 60° of opposite side

Spine-Things to Rule Out

- Decreased upper thoracic spine kyphosis from T3 through T5
- Decreased cervical extension
- Decreased mobility at the cervical thoracic junction
- Recent literature identified a correlation between mobility at the cervical thoracic junction and thoracic pain with neck/shoulder pain

Cervical Range of Motion Test

- Positive if less than 60° of opposite side
T4 Mobilization

Neurogenic Pain

- Provocative test, such as upper limb nerve tension testing (ULTT), will determine specific areas of entrapment
- ULTT and Tinels can assist in locating the neurogenic irritability proximal and distal
  - Often associated with double-crush syndrome

Injury to Nerve

- Physical force – compression or pressure gradient changes
- Ischemia
  - Tissue injuries, postural sustained demands, lack of movement, tension in muscle, tension forces fluid out of tissue so acidic tissue causes pain
- Anomalies – canal anatomy
- Occupation – sustained postural demands
- Vibration – near site of vibration or in constricted sites
BR Question 05
Name the 6 divisions

Lateral Cord
Posterior cord
Medial Cord
Double Crush

Median Nerve

Palpable areas
A. Upper Arm
B. Medial to the biceps tendon
C. Indirectly at the carpal tunnel – between palmaris longus and flexor carpi radialis
D. Brachial Plexus

Common entrapments/syndromes
A. Carpal Tunnel Syndrome
B. Post Colles’ fracture symptoms
C. C5-6 nerve root
Ulnar Nerve (C7, C8, T1)

**Palpable Areas**
- Pisiform area at the wrist
- At the elbow and in the upper arm – cubital tunnel between olecranon and medial epicondyle

**Common Entrapments**
- Guyon's canal
- Cubital tunnel

Radial Nerve

**Palpable Areas**
- A. Mid humerus
- B. Radial sensory nerve on the lateral aspect of the forearm

**Common entrapments/syndromes**
- A. De Quervain’s tenosynovitis
- B. Supinator muscle
- C. Post humeral fracture pain
DIFFERENTIAL DIAGNOSIS OF TOS

Treatable Functional Causes

• Entrapment sites
• Abnormal breathing pattern
• Common postural deviations
• Muscle imbalance
• Trigger points
**Treatable Functional Causes**

- Scapular resting position
- Shoulder pathology & related joints
- Spine dysfunction
- Brain Change

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**Treatable Functional Causes**

First decrease pressure on the neurovascular bundle and give the patients the tools to manage their symptoms.

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**Treatable Functional Causes**

Release the pressure in the three (3) tunnels. Start with Scalene triangle, progress to costoclavicular and then pectoralis area.
The Role of Scalene Muscles

- Scalenes become overworked when scapula muscles are weak
  – Scalene muscles responsible for elevating the 1st rib
- Whiplash causes increased tone of the scalenes
- Atrophy of type 2 muscle fibers and an increase in connective tissue binding in the scalene muscles

Scalene Entrapment

Soft tissue and trigger point release.

Stretch scalene with first rib depressed.
**Clavicular Entrapment**

Mobilization of the first rib

- Therapist stands at head of patient (supine) and rotates head away from painful side.
- Depresses the first rib with their MCP joint (hand wrapped around the neck and first rib)
- Use MCP to move rib toward opposite hip

**Clavicular Mobilization Inferior**

- The patient is supine and therapist is at the head of the patient.
- Using the thumb of one hand and the ulnar side of other hand over the clavicle. Move it posterior or caudally.

**Clavicular Mobilization Superior**

- The patient is supine and therapist stands to the side where the clavicle is going to be mobilized.
- Put thumb under the clavical and other hand at sternal margin. Move the clavicle cranially.
**Pectoralis Entrapment**

- Patient is supine and therapist stands to the side.
- Therapist identifies trigger points or soft tissue restrictions.
- Therapist mobilizes the joints by moving the hands in opposite direction.

**Tight Pectoralis Minor**
Deltoid Pectoral Tightness

Treatable Functional Causes

Proper breathing must happen to maintain muscle balance and to allow for relief of intrinsic pressure.

Proper Breathing

- Patient is supine with one hand on upper abdominals and the other on lower rib cage.
- Abdomen lifts with inspiration and lowers with expiration.
Abnormal Breathing Pattern
• TOS patients tend to breathe with their upper thorax instead of their abdominal musculature
• This causes accessory muscles, especially the scalene muscles, to elevate the first rib which causes narrowing of the thoracic outlet
• Symptoms of abnormal breathing include (vicious cycle):
  – Pain and tingling, spasm and congestion
  – Decrease in hand temperature
  – Decrease in blood flow
  – Abnormal sympathetic response altering blood flow

Proper Breathing Pattern
• Diaphragmatic breathing should occur and this allows for opening in the thoracic outlet and reduces muscle tension
• The abdomen lifts with inspiration and lowers with expiration
• Place 1 hand on the upper abdomen and 1 hand on the lower rib cage to feel correct breathing and palpate movement

Benefits of Relaxed Breathing Patterns
• Decrease in muscle tension
• Changes pressure gradient in tunnels thus reducing venous stasis and hypoxia
**Muscle Imbalance**

Main three areas to evaluate are neck, anterior chest wall, shoulder, and scapula.

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**1st RIB ELEVATION**

Viscious cycle of dysfunction caused by breathing deficits, tight scalenes, and restricted rib movement.

If 1st rib is elevated check 2nd rib for elevation
   Compare right to left

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**Common Postural Deviations**

- Forward head - muscle imbalance with soft tissue restrictions
- Spinal abnormalities - Increase thoracic kyphosis, protracted scapulae with spinal segment restrictions
- Shortening of anterior neck muscles
BAD POSTURE

Abnormal Posture

Abnormal Posture (Domino Effect)

• Head and shoulders are held in a forward position

• Shortening of various neck musculatures may occur over time

• Posterior shoulder girdle weakness
**Muscle Imbalance**

- Abnormal posture such as forward head, rounded shoulders, protracted shoulders, weaken the scapular muscles and cause tension in the neck muscles.

- Abnormal scapular movement patterns in which there is scapular weakness, reveal middle and lower trapezius and serratus anterior dysfunction.

- Often caused by trigger points in upper quadrant.

**Consequence of Tight Musculature**

[Diagram of musculature]
WEAKENED:
Deep Neck Flexors

UNINHIBITED OVERACTIVE:
1. Upper Trapezius
2. Levator Scapula

UNINHIBITED OVERACTIVE:
Pectoral Group

WEAKENED:
Scapular Stabilizers Retractors & Depressors
Assessing Scapular Position
• Scapular rest T2-T7
• Parallel with spine
• Spine of scapular T3/T4
• Assess slope of shoulders
• Assess longer neck appearance

Abnormal Scapular Positioning
• Depression
• Downward rotation
• Winging
• Tilting

Testing for scapular depression
• Raise arms overhead
• Assess symptoms
• Look for decreases in AC joint
• Ask if arms feel heavy
Testing for scapular downward rotation
- Raise arms overhead
- Look for inferior angle position
- Check for tightness in Teres Major & latissimus
d
Testing for Scapular winging and tilting
- Caused by shortened pectoralis muscles
- Weakness lower traps
  - Causes scapular to tilt
- Weakness in serratus anterior
  - Causes to wing

cervical and thoracic spine
- Evaluate curves of the spine
- Any abnormality in spinal curves cause muscle spasms and tightness
Scapula Depression

• With arms overhead, changes occur around the muscle definition in the AC Joint area

• Complaints of paresthesia occur when the arms are raised overhead

• Patients complain of arms feeling heavy when they maintain an overhead position
Muscle Imbalance
(Scapular Depression)

- Scapula is lower than T2-T7
- Slope of the shoulders is increased
- Neck appears longer
- May be associated with headaches and cervical thoracic dysfunction

Scapula Downward Rotation

- Inferior angle of scapula is closer to the spine than the superior angle
- Movement in flexion and abduction causes pulling or pain in the teres major and latissimus dorsi region
- Paresthesia can occur with overhead reaching

Scapular Rotation

**Postural Deviations**

- Compensate for the forward orientation of the glenoid fossa of the humerus
  - The serratus anterior muscle becomes shortened by abduction of the scapula
  - Causes lengthening of the lower and middle trapezius in supporting the scapula
  - Causes mechanical disadvantages and early fatigue

**Postural Weakness**

- Result in the upper trapezius, rhomboids major and minor, along with the levator scapulae having to function as accessory muscles to elevate the shoulder and arm

**Posture Review**

Posture – encourage strengthening of rhomboids and middle and upper trapezius
- Watch for head in forward/protracted position
- Look for rounded, protracted shoulders
- Kyphotic positioning mid-back
- Downward tilt of coracoid process
- Look for winging of scapula or abnormal muscle balance of the scapula and spine
Identify Myofascial Trigger Points and Tissue Restrictions

- Treat MTrPs
  - Trapezius, serratus anterior, rhomboids, levator scapulae and pectoralis
  - These scapular positioning muscles must be recruited in an optimal muscle activation pattern (MAP)
- Soft tissue mobilization before stretching and strengthening
- Dry Needling

Joint Stiffness

- Joint stiffness in the humeral joint, acromioclavicular joint, sternoclavicular joint and/or cervical thoracic joint

- Manual therapy techniques must include
  - Identify and treat all joint tightness
  - T4 syndrome has an effect on the sympathetic nervous system
  - Thoracic mobilization has shown to be effective in improving posture, hand and skin temperature and pain using grade 3 oscillation movements
Joint Stiffness/Capsular Tightness


Joint Stiffness

• Check out
  – Glenohumeral (GH) joint
  – Acromioclavicular (AC) joint
  – Sternoclavicular (SC) joint
  – Thoracic spine
GH girdle tightness

• Posterior/superior
  – Inability to reach behind back
  Test in standing
• Posterior/inferior
  – Limited internal rotation w/abduction
  – Test in standing or sitting

Nervous System Movement

The nervous system (brain, spinal cord and all the peripheral nervous system, both somatic and autonomic) adapt to body movement by:

1. Sliding movement
2. A rise in tension within the system
Plate 06

Label hand and forearm dermatomes

Ans. page 101 & 102

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Clinical Treatment and Management

• Restore normal breathing patterns
• Rewire the brain
• Reduce inflammation
• Decrease muscle tension
• Elongate tight musculature
• Strengthen weak musculature

• Maintain neural excursion
• Maintain mobile joints
• Improve posture and body mechanics
• Restore muscle balance

Greater Motor Imagery
**Graded Motor Imagery for TOS**

Laterality training-imagery-mirror therapy sequential program short sessions often during the day
Laterality Training

Graded Imagery Program

Phase I
- Discuss disorder – establish rapport
- Discuss distortion of limbs representation in the brain
- Understanding what has or has not worked
Graded Imagery Program

Phase II
- Flash Cards
  • 3-4 times daily for 15 minute sessions
  • Identify right or left limb
- Timed identification to monitor improvement
- Decrease time to look at right or left
- Room identification for right or left in human subjects
- Circle pictures in magazine
  Timed and number of correct answers
- Goal achieved 90% as compared to opposite side

Graded Imagery Program

Phase III
Mirror therapy
- Motor imagery tasks in mirror box
- Motor movement – normal to abnormal
Home Exercise Program

Home Treatment Program
For Using ULTT As An Exercise

• The goal determines the number of repetitions
  • Gentle = active 5 reps hold for 3 seconds, progress reps as tolerated
  • Strong = chronic, few reps, move often and hold for 10 seconds
• Identify if it is for an irritable disorder. If so, allow patient to do without any assistance
• When patient causes symptoms to increase and the symptoms stop upon releasing the nerve mobilization. This is ok to continue with repetitions.
  • Remember- when the stretch is released the symptoms should ease

Anterior Scalene Stretch
Pectoralis Minor Stretch

Teres Major Stretch

HEP
  • Posterior/superior GH joint tightness Stretch
Posterior/Inferior Capsular Stretch

Internal Rotator of Shoulder

Teres Major Stretch
Sleeper Stretch

Post/Infer GH Joint Stretch

Muscle Re-education
taping
Sidelying muscle re-education of scapula
Wall slides

Strengthening HEP
• Serratus anterior m.
  – Push against wall
  – Supine with weights
  – Tape scapular in upward rotation for re-education

Middle Trap
• Supine, 90 deg. Shoulder abduction
• Elbow flexed to 90 degrees
• Isometric contraction
Rhomboids
• Supine, 90 deg. Shoulder abduction
• Elbow flexed to 90 degrees
• Isometric contraction push elbow into mat

Tips/Summary
• Hot Pack or heating pad prior to exercise
• Ice after HEP
• When symptoms increase have patient do the Cyriax (pillow) release technique
• Nerve gliding
  – Proximal to distal or distal to proximal

Stretches
Treatment Strategies

• The goal of neurogenic symptom treatment is to teach the patient to open the space between the clavicle and 1st rib by stretching tight muscles, strengthening weak musculature, improved nerve excursion and tension, improve diaphragmatic breathing and spinal mobility

• Treatment often consists of 6 months or longer depending on the chronicity

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treatment

Education

Conservative treatment 4 to 6 months

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Treatment

• Phase 1
  – Entrapment sites
    • Soft Tissue and neurogenic
  – Tight musculature
  – Breathing control
  – Nerve gliding
Treatment

• Phase II
  – Correct postural deviations
  – Treat trigger points
  – Muscle imbalance
  – Scapular re-education at rest and moving

Treatment

• Phase III
  – Proper biomechanics
  – GH joint
  – AC joint
  – SternoClavicular joint
  – C7/T1 Cervical/thoracic junction
  – T4

Educate on Sleeping Positions
Sleep supine with arms flexed

Involved on Pillow
Don’t increase symptoms: Goal

Indications for Surgery

- Confirmed diagnosis based on H & P. Does not require objective findings, such as neuroelectric studies, arterial vascular studies or angiograms
- All associated or differential diagnoses have been evaluated and treated
- Appropriate physical therapy has been tried for at least 3-6 months and has failed
- The patient is experiencing some degree of disability at work, recreation, sleep or ADLs

Surgery

- Vascular involvement often requires reconstruction and decompression.
- Most favored techniques:
  - Transaxillary rib resection
  - Anterior scalenectomy
  - Supraclavicular approach
SURGERY

Post-OP Treatment

Week 1
– ROM nerve gliding
– Diaphragmatic breathing
– Graded Motor Imagery
– Soft tissue massage
– Lymphedema mobilization after drain removed
– Develop home exercise program

Week 2
– Sutures removed
– Gentle proximal and distal gliding
– Continue with week 1 treatment

Week 3
– Scar tissue mobilization
– Graded Motor Imagery (GMI)
– Posture alignment
Post-OP Treatment

Week 4
- Education on good healthy habits
- Strengthening and conditioning

Weeks 5-6
- Remind to lift no greater than 5 pounds
- Continue to check scar
- Continue strengthening

Post-OP Treatment

Weeks 6-8
- Evaluation of work site, simulation, work conditioning

Weeks 8-16
- Reevaluate and continue exercises according to set goals
- Again, review home exercise program

Summary
Treatment Strategies

- Patient empowerment
- Explain dysfunction and treatment
- Set small goals for encouragement
- Turn a firing nerve off by increased movement
- Change sympathetic flow and muscle tension
- Lessen mechanical force
  - Change posture
  - Alter the work place
- Relaxation techniques

Coping Strategies

- Autonomic nervous system education
- Relaxation
- Sleep importance to health
- Psychosocial variables
  - Optimism
  - Motivation
  - Coping skills
PATIENT EDUCATION

REVIEW
Patient education helps to decrease anxiety and improve compliance.

Patient must understand the length of time it will take to improve.

Patient must understand chronic symptoms lead to brain changes.

REVIEW
Tips to remember:
Support arms when sitting and sleeping.
Widen bra straps.
Don’t carry purse or briefcase on involved side
Make sure work conditions are appropriate.
ACTIVITIES OF DAILY LIVING

Educate on good postures of the spine and upper quadrant.

Educate on limiting overhead activities by taking short breaks.

Don’t sleep on the abdomen/ prone or the affected side.
Don’t sleep with arms overhead.

Thank you from Memphis, Tennessee

Upper Limb Neurodynamics Test

Determine entrapment sites and impingement by soft tissue, boney compression or tunnel fibrosis on nerves
Upper Limb Tension Testing

- Depress shoulder girdle
- Shoulder abduction
- Elbow flexion
- Wrist & finger extension w/ pronation
The patient is positioned supine and the therapist places the patient’s upper extremity into:

- Scapular depression
- Shoulder abduction
- Forearm supination and wrist and finger extension
- Shoulder external rotation
- Elbow extension
- Contralateral then ipsilateral cervical lateral flexion
Upper Limb Neurodynamic Test

Test is positive if:

– Symptoms can be reproduced
– Greater than 10° difference in elbow extension from side to side
– An increase in symptoms with contralateral cervical side bending or decrease in symptoms with ipsilateral side bending
Upper Limb Tension Testing
Upper Limb Tension Testing

- Depress shoulder girdle
- Shoulder abduction
- Elbow flexion
- Wrist & finger extension w/ pronation
INSTRUCTIONS

This questionnaire asks about your symptoms as well as your ability to perform certain activities.

Please answer *every question*, based on your condition in the last week, by circling the appropriate number.

If you did not have the opportunity to perform an activity in the past week, please make your *best estimate* on which response would be the most accurate.

It doesn’t matter which hand or arm you use to perform the activity; please answer based on your ability regardless of how you perform the task.
### SPORTS/PERFORMING ARTS MODULE (OPTIONAL)

The following questions relate to the impact of your arm, shoulder or hand problem on playing your musical instrument or sport or both.

If you play more than one sport or instrument (or play both), please answer with respect to that activity which is most important to you.

Please indicate the sport or instrument which is most important to you: ____________

- [ ] I do not play a sport or an instrument. (You may skip this section.)

Please circle the number that best describes your physical ability in the past week. Did you have any difficulty:

<table>
<thead>
<tr>
<th>NO DIFFICULTY</th>
<th>MILD DIFFICULTY</th>
<th>MODERATE DIFFICULTY</th>
<th>SEVERE DIFFICULTY</th>
<th>UNABLE</th>
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### WORK MODULE (OPTIONAL)

The following questions ask about the impact of your arm, shoulder or hand problem on your ability to work (including homemaking if that is your main work role).

Please indicate what your job/work is: ____________

- [ ] I do not work. (You may skip this section.)

Please circle the number that best describes your physical ability in the past week. Did you have any difficulty:

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### SCORING THE OPTIONAL MODULES:

Add up assigned values for each response; divide by 4 (number of items); subtract 1; multiply by 25.

An optional module score may not be calculated if there are any missing items.
APPENDIX A

ANSWERS TO WORKSHEETS
Divisions
- 3 anterior divisions
- 3 posterior divisions

Trunks
- Superior
- Middle
- Inferior

Terminal Branches
- Lateral Cord
- Posterior Cord
- Medial Cord

Long Thoracic nerve (C5-8)

Nerves
- Median nerve
- Ulnar
- Medial antebibrachial cutaneous nerve (C8, T1)
- Medial Pectoral Nerve

Answer plate 05
Back to pg 41
Plate 06

Label hand and forearm dermatomes

Answer plate 06
Plate 06
variation with dermatomes

Note there are variations in dermatomes depending on the researcher. Also note there is overlapping with dermatomes & the borders will vary.
This figure shows dynamic compression of the brachial plexus in the thoracic outlet.

1. Pectoralis minor muscle
2. Coracoid process
3. Median nerve
4. Subclavian artery
5. Brachial plexus
6. Medial scalene muscle
7. Anterior scalene muscle
8. Internal jugular vein
9. Common carotid artery
10. Costoclavicular ligament
11. Subclavious muscle
12. Subclavian vein
13. Clavicle
14. First Ribs