

RULE 17, EXHIBIT 3-(Referenced Version)

Thoracic Outlet Syndrome Medical Treatment Guidelines

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**Department of Labor and Employment
DIVISION OF WORKERS' COMPENSATION**



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Department of Labor and Employment

Division of Workers' Compensation

CCR 1101-3

Rule 17, EXHIBIT 3

THORACIC OUTLET SYNDROME MEDICAL TREATMENT GUIDELINES

A. INTRODUCTION

This document has been prepared by the Colorado Department of Labor and Employment, Division of Workers' Compensation (Division) and should be interpreted within the context of guidelines for physicians/providers treating individuals qualifying under Colorado's Workers' Compensation Act as injured workers with upper extremity involvement.

Although the primary purpose of this document is advisory and educational, these guidelines are enforceable under the Workers' Compensation Rules of Procedure, 7 CCR 1101-3. The Division recognizes that acceptable medical practice may include deviations from these guidelines, as individual cases dictate. Therefore, these guidelines are not relevant as evidence of a provider's legal standard of professional care.

To properly utilize this document, the reader should not skip or overlook any sections.

B. GENERAL GUIDELINES PRINCIPLES

The principles summarized in this section are key to the intended implementation of all Division of Workers' Compensation guidelines and critical to the reader's application of the guidelines in this document.

1. **APPLICATION OF GUIDELINES** The Division provides procedures to implement medical treatment guidelines and to foster communication to resolve disputes among the provider, payer, and patient through the Workers' Compensation Rules of Procedure. In lieu of more costly litigation, parties may wish to seek administrative dispute resolution services through the Division or the office of administrative courts.
2. **EDUCATION** of the patient and family, as well as the employer, insurer, policy makers and the community should be the primary emphasis in the treatment of upper extremity pain and disability. Currently, practitioners often think of education last, after medications, manual therapy, and surgery. Practitioners must develop and implement an effective strategy and skills to educate patients, employers, insurance systems, policy makers, and the community as a whole. An education based paradigm should always start with inexpensive communication providing reassuring information to the patient. More in-depth education currently exists within a treatment regime employing functional restorative and innovative programs of prevention and rehabilitation. No treatment plan is complete without addressing issues of individual and/or group patient education as a means of facilitating self-management of symptoms and prevention.
3. **TREATMENT PARAMETER DURATION** Time frames for specific interventions commence once treatments have been initiated, not on the date of injury. Obviously, duration will be impacted by patient compliance, as well as availability of services. Clinical judgment may substantiate the need to accelerate or decelerate the time frames discussed in this document.
4. **ACTIVE INTERVENTIONS** emphasizing patient responsibility, such as therapeutic exercise and/or functional treatment, are generally emphasized over passive modalities, especially as treatment progresses. Generally, passive and palliative interventions are viewed as a means to facilitate progress in an active rehabilitation program with concomitant attainment of objective functional gains.
5. **ACTIVE THERAPEUTIC EXERCISE PROGRAM** goals should incorporate patient strength, endurance, flexibility, coordination, and education. This includes functional application in vocational or community settings.
6. **POSITIVE PATIENT RESPONSE** results are defined primarily as functional gains that can be objectively measured. Objective functional gains include, but are not limited to, positional tolerances, range of motion (ROM), strength, endurance, activities of daily living, cognition, psychological behavior, and efficiency/velocity measures that can be quantified. Subjective reports of pain and function should be considered and given relative weight when the pain has anatomic and physiologic correlation. Anatomic correlation must be based on objective findings.

7. **RE-EVALUATE TREATMENT EVERY 3 TO 4 WEEKS** If a given treatment or modality is not producing positive results within 3 to 4 weeks, the treatment should be either modified or discontinued. Reconsideration of diagnosis should also occur in the event of poor response to a seemingly rational intervention.
8. **SURGICAL INTERVENTIONS** should be contemplated within the context of expected functional outcome and not purely for the purpose of pain relief. The concept of “cure” with respect to surgical treatment by itself is generally a misnomer. All operative interventions must be based upon positive correlation of clinical findings, clinical course, and diagnostic tests. A comprehensive assimilation of these factors must lead to a specific diagnosis with positive identification of pathologic conditions.
9. **SIX-MONTH TIME FRAME** The prognosis drops precipitously for returning an injured worker to work once he/she has been temporarily totally disabled for more than six months. The emphasis within these guidelines is to move patients along a continuum of care and return to work within a six-month time frame, whenever possible. It is important to note that time frames may not be pertinent to injuries that do not involve work time loss or are not occupationally related.
10. **RETURN-TO-WORK** is therapeutic, assuming the work is not likely to aggravate the basic problem or increase long-term pain. The practitioner must provide specific physical limitations and the patient should never be released to “sedentary” or “light duty.” The following physical limitations should be considered and modified as recommended: lifting, pushing, pulling, crouching, walking, using stairs, bending at the waist, awkward and/or sustained postures, tolerance for sitting or standing, hot and cold environments, data entry and other repetitive motion tasks, sustained grip, tool usage and vibration factors. Even if there is residual chronic pain, return-to-work is not necessarily contraindicated.

The practitioner should understand all of the physical demands of the patient’s job position before returning the patient to full duty and should request clarification of the patient’s job duties. Clarification should be obtained from the employer or if necessary, including, but not limited to, an occupational health nurse, occupational therapist, vocational rehabilitation specialist, or an industrial hygienist.

11. **DELAYED RECOVERY** Strongly consider a psychological evaluation, if not previously provided, as well as initiating inter-disciplinary rehabilitation treatment and vocational goal setting, for those patients who are failing to make expected progress 6 to 12 weeks after an injury. The Division recognizes that 3 to 10% of all industrially injured patients will not recover within the timelines outlined in this document despite optimal care. Such individuals may require treatments beyond the limits discussed within this document, but such treatment will require clear documentation by the authorized treating practitioner focusing on objective functional gains afforded by further treatment and impact upon prognosis.
12. **GUIDELINE RECOMMENDATIONS AND INCLUSION OF MEDICAL EVIDENCE** are recommendations based on available evidence and/or consensus recommendations. When possible, guideline recommendations will note the level of evidence supporting the

treatment recommendation. When interpreting medical evidence statements in the guideline, the following apply:

Consensus means the opinion of experienced professionals based on general medical principles. Consensus recommendations are designated in the guideline as “generally well accepted,” “generally accepted,” “acceptable/accepted,” or “well-established.”

“Some” means the recommendation considered at least one adequate scientific study, which reported that a treatment was effective.

“Good” means the recommendation considered the availability of multiple adequate scientific studies or at least one relevant high-quality scientific study, which reported that a treatment was effective.

“Strong” means the recommendation considered the availability of multiple relevant and high quality scientific studies, which arrived at similar conclusions about the effectiveness of a treatment.

All recommendations in the guidelines are considered to represent reasonable care in appropriately selected cases, regardless of the level of evidence or consensus statement attached to it. Those procedures considered inappropriate, unreasonable, or unnecessary are designated in the guideline as being “not recommended.”

13. **CARE BEYOND MAXIMUM MEDICAL IMPROVEMENT (MMI)** should be declared when a patient’s condition has plateaued to the point where the authorized treating physician no longer believes further medical intervention is likely to result in improved function. However, some patients may require treatment after MMI has been declared in order to maintain their functional state. The recommendations in this guideline are for pre-MMI care and are not intended to limit post-MMI treatment.

The remainder of this document should be interpreted within the parameters of these guideline principles that may lead to more optimal medical and functional outcomes for injured workers.

C. DEFINITION OF THORACIC OUTLET SYNDROME

Thoracic Outlet Syndrome (TOS) may be described as a neurovascular disorder affecting the upper extremity which, on rare occasions, is caused by workplace factors, such as jobs that require repetitive activities of the upper extremities with forward head and shoulder postures. It should be emphasized that occupational TOS is a relatively uncommon disorder and other disorders with similar symptomatology need to be ruled out.

There are four types of thoracic outlet syndrome. The two vascular types, comprised of subclavian vein or artery pathology, are diagnosed with imaging. True or classic neurogenic TOS consists of a chronic lower trunk brachial plexopathy diagnosed by positive electrodiagnostic testing. It is usually unilateral, predominantly affects women, and results in classic electrophysiologic and physical exam findings such as hand atrophy. The two vascular types of TOS and true neurogenic are relatively rare and easily diagnosed. The most common type of TOS is non-specific neurogenic (also called disputed) TOS, which is diagnosed based on upper or lower trunk brachial plexus symptoms.

D. INITIAL DIAGNOSTIC PROCEDURES

The Division recommends the following diagnostic procedures be considered, at least initially, the responsibility of the workers' compensation carrier to ensure that an accurate diagnosis and treatment plan can be established. Standard procedures that should be utilized when initially diagnosing a work-related TOS complaint are listed below.

1. **HISTORY TAKING AND PHYSICAL EXAMINATION (Hx & PE)** are generally accepted, well-established and widely used procedures which establish the basis for diagnosis, and dictate all other diagnostic and therapeutic procedures. When findings of clinical evaluations and those of other diagnostic procedures are not complementing each other, the objective clinical findings should have preference. Neurogenic TOS will be described separately from vascular TOS, although some general symptoms may occasionally overlap. Vascular TOS usually requires emergent treatment as described in the surgical section. Treatment for non-specific neurogenic TOS begins with jobsite alteration and therapy as described in Section F. and rarely requires surgical intervention. True neurogenic TOS may require early surgical intervention if there is significant weakness with corresponding EMG/NCV changes. The medical records should reasonably document the following:

- a. **History Taking:**

A careful history documenting exacerbating activities and positions which relieve symptoms is essential. Timing of the onset of symptoms is important. TOS has been associated with trauma and motor vehicle accidents. Avocational pursuits should also be specifically documented.

- i. Symptoms common to neurogenic TOS:

Neurological symptoms are usually intermittent in non-specific TOS. If symptoms are constant, consider other diagnoses such as true TOS or other brachial plexus injuries. Neck pain is often the first symptom with complaints within the first few days of injury. Occipital headaches may also occur early. Some patients experience coldness or color changes in the hands. Neurogenic symptoms include the following:

- A) Forearm (frequently medial), or proximal upper extremity pain.
- B) Numbness and paresthesia in arm hand and fingers:
 - 1) 4th and 5th digits: most common pattern (Novak C, 1993; McGillicuddy J, 2004).
 - 2) All 5 fingers: next most common pattern.
 - 3) 1st, 2nd and 3rd digits: symptoms may occur, but one must rule out carpal tunnel syndrome.
- C) Upper extremity weakness: arm and/or hand; "dropping things" may be a common complaint.
- D) Exacerbating factor: arm elevation. Common complaints are trouble combing hair, putting on clothing, driving a car, or

carrying objects with shoulder straps such as back packs;
disturbed sleep, etc.

- ii. Symptoms common to vascular TOS:
 - A) Pain, coldness, pallor, digital ischemia and claudication in the forearm are signs of arterial compromise which is most frequently chronic and due to subclavian aneurysm or stenosis.
 - B) Swollen, cyanotic, and sometimes painful arm is indicative of a venous obstruction requiring immediate attention.

b. Occupational Relationship for Neurogenic and Vascular TOS:

In many cases, trauma is the cause vascular or neurogenic TOS. Clavicular fractures, cervical strain (including whiplash), and other cases of cervical trauma injuries have been associated with TOS. Continual overhead lifting or motion may contribute as can static postures in which the shoulders droop and the head is inclined forward. Activities which cause over developed scalene muscles such as weight-lifting and swimming may contribute (Baltopoulos P, 2008). The Paget-Schroetter syndrome, or effort thrombosis of the subclavian vein, may occur in athletes or workers with repetitive overhead forceful motion and neck extension. Arterial thrombosis or symptoms from subclavian aneurysms or stenosis are usually not work-related (Fiorentini C, 2005; Sanders R, 2007). Both classic neurogenic TOS (usually due to a cervical or anomalous first rib) and vascular TOS due to arterial compromise from stenosis or aneurysm are rarely work-related conditions.

c. Physical Findings:

- i. Physical examination signs used to diagnose classic or non-specific neurogenic TOS. Both extremities should be examined to compare symptomatic and asymptomatic sides.

Provocative maneuvers (listed below in B, C, and D) must reproduce the symptoms of TOS to be considered positive.

- A) Tenderness over scalene muscles in supraclavicular area.
- B) Pressure in supraclavicular area elicits symptoms in arm/hand, or Tinel's sign over brachial plexus is positive. The supraclavicular pressure test is positive for paresthesia in approximately 15% of asymptomatic individuals (Plewa M, 1998).
- C) Elevated arm stress test (EAST) is performed with the arms abducted and shoulders externally rotated to 90 degrees with elbows bent to 90 degrees for 3 minutes (some examiners use 60 seconds) (Sanders R, 2007). The patient may also be asked to repetitively open and close fists. A positive test reproduces upper extremity symptoms. When this test is performed for 3 minutes in an asymptomatic population, approximately 35% experience paresthesia.

Some literature has suggested another provocative elevated arm stress test. The patient holds his arms over head for one minute with elbows extended, wrists in a neutral position, and forearm midway between supination and pronation (Novak C, 2002, 1993). If symptoms are reproduced, the test is positive.

- D) Posture related brachial tests.
 - 1) Head tilting: lateral flexion of the neck (ear to shoulder) causes radiating pain and paresthesia in the contralateral arm consistent with TOS.
 - 2) Military posture or costoclavicular maneuver: Shoulders are depressed and pulled backward in an exaggerated position. Reproduction of symptoms is a positive test. Approximately 15% of asymptomatic individuals will report paresthesia with this test (Plewa M, 1998).
- E) Neurological examination: usually normal in non-specific TOS, but may be abnormal.
 - 1) Sensory exam: may show decreased sensation to light touch, pain, vibration, and/or temperature in lower brachial plexus distribution. The entire ring finger is usually involved. This contrasts with ulnar neuropathy, which usually involves only the ulnar side of the ring finger (Wilbourn AJ, 1999).
 - 2) Motor exam: weakness and/or muscle atrophy in either upper or lower trunk distributions including, but not limited to, valid dynamometer readings indicative of relative weakness in the affected limb. In lower plexus injuries, the abductor pollicis brevis often demonstrates more involvement and atrophy than the intrinsic interosseous muscles.

ii. Physical exam findings for vascular TOS cases–

Suspicion of vascular compromise should lead to confirmation using appropriate imaging procedures.

- A) Arterial cases usually demonstrate an absent radial pulse at rest, pale hand and often ischemic fingers.
- B) Venous obstruction presents with visible or distended superficial veins on the effected signs involving the anterior axillary fold and chest wall. The arm is usually swollen and cyanotic.

iii. Physical Exam - other tests which are recommended and may indicate additional diagnostic considerations.

- A) Neck rotation may be restricted and can indicate the presence of additional pathology.

- B) Upper limb tension test – This provocative test may be positive for cervical radiculopathy, brachial plexus pathology, or other peripheral nerve pathology. It is considered sensitive but non-specific (Wainner RS, 2003; Walsh M, 2005; Sanders R, 2007; Rubenstein SM, 2007). The test has several variations; however, they all consist of a series of systematic maneuvers performed on the upper quadrant to evaluate peripheral nerve function and pathology. Head tilting is one of the maneuvers included. Provocation of abnormal responses indicates neural tissue sensitization/irritation, and can include implication of specific peripheral nerve trunks. Performance and interpretation of this test requires specific training and experience. A negative response to the upper limb tension test makes the diagnosis of neurogenic TOS unlikely. If negative, investigate other diagnoses.
- C) Rotator cuff/acromioclavicular (AC) joint tenderness suggests rotator cuff, or biceps tendonitis or AC joint disease.
- D) Trapezius muscle, shoulder girdle muscles or paraspinal muscle tenderness suggests a myofascial component.
- E) Drooping shoulders secondary to nerve injuries can be present with TOS symptoms. If a spinal accessory, long thoracic or other nerve injury is identified, treatment should focus on therapy for the nerve injury in addition to conservative measures for TOS. Refer to the Shoulder Injury Medical Treatment Guidelines, Section E. Brachial Plexus and Shoulder Nerve Injuries.
- F) The following tests suggest carpal tunnel syndrome: carpal tunnel compression test, flicking the wrist secondary to paresthesia, Tinel's sign and/or Phalen's sign.
- G) Positive Tinel's sign at elbow (over ulnar groove) suggests ulnar nerve entrapment.
- H) Positive Tinel's sign over the pronator teres muscle suggests median nerve involvement. Positive Tinel's sign over the radial tunnel suggests radial nerve compression.

d. **Cervical Spine X-ray:** is a generally accepted, well-established procedure indicated to rule out cervical spine disease, fracture, cervical rib or rudimentary first rib when clinical findings suggest these diagnoses. Cervical spine x-rays should also be considered when there is an asymmetric diminished pulse in an arm that is symptomatic. X-rays are most useful when arterial TOS is suspected (Sanders R, 2007). The presence of a cervical rib does not confirm the diagnosis unless other clinical signs and symptoms are present, as many cervical ribs are asymptomatic. Therefore, routine roentgenographic evaluation of the cervical spine is frequently unnecessary early in the course of treatment for non-specific TOS.

e. **Vascular Studies:** Vascular laboratory studies, including duplex scanning, Doppler studies, standard and MR arteriography and venography are required for patients presenting with arterial or venous occlusion, as these patients may

require immediate thrombolytic intervention. These studies are not indicated for neurogenic TOS.

REFERENCED VERSION

E. FOLLOW-UP DIAGNOSTIC IMAGING AND TESTING PROCEDURES

1. **CERVICAL COMPUTED AXIAL TOMOGRAPHY OR MAGNETIC RESONANCE IMAGING (CT/MRI)** are generally accepted, well-established procedures indicated to rule out cervical disc or other cervical spine disorders when clinical findings suggest these diagnoses. It should not be routinely performed for TOS. MRI is the preferred test over a CT unless a fracture is suspected, and then CT may be superior to MRI. CT/MRI is not indicated early unless there is a neurological deficit and/or the need to rule out a space-occupying lesion, such as a tumor. Repeat cervical MRI is not indicated for TOS. If cervical spine injury is confirmed, refer to Division's Cervical Spine Injury Medical Treatment Guidelines. If a cervical spine disorder is not suspected, conservative therapy as indicated in Section F., Non-operative Procedures should be done for at least 8 to 12 weeks, prior to ordering an MRI for persistent symptoms.
2. **ELECTRODIAGNOSTIC STUDIES**
 - a. **Electromyography/Nerve Conduction Velocities (EMG/NCV)**: is a generally accepted, well-established procedure. EMG/NCV is primarily indicated to rule out other nerve entrapment syndromes such as carpal tunnel or cubital tunnel syndrome when indicated by clinical examination, or to establish true neurogenic TOS. Most cases of non-specific TOS have normal electrodiagnostic studies, but EMG/NCV should be considered when symptoms have been present for approximately 3 months or if the patient has failed 8 weeks of conservative therapy. EMG/NCV may also be performed to rule out other disorders. Somatosensory evoked potentials (SSEPs), F waves and NCV across the thoracic outlet have no diagnostic value and should not be performed (Wilbourn AJ, 1999; Tolson T, 2004). The diagnosis is usually made by comparison to the normal extremity. For bilateral disease, each EMG lab must establish its own absolute limits of latency and amplitude from volunteer controls so that measurements exceeding these limits can be noted.

Criteria for True Neurogenic TOS:

 - i. Reduction of the ulnar sensory nerve action potential to digits (usually less than 60% of unaffected side); or
 - ii. Medial antebrachial sensory action potential which is low or absent compared to the unaffected side (Wilbourn AJ, 1999; Seror P, 2004); or
 - iii. Reduction of the median M-wave amplitude (usually less than 50% of unaffected side); or
 - iv. Needle EMG examination reveals neurogenic changes in intrinsic hand muscles and the abductor pollicis brevis muscle (Washington Department of Labor and Industries (2002) as cited in National Guidelines Clearinghouse (2004); Huang JH, 2004).
 - b. **Portable Automated Electrodiagnostic Device**: (also known as SurfaceEMG) is not a substitute for conventional EMG/NCS testing in clinical decision making, and therefore, is not recommended.
 - c. **Quantitative Sensory Testing (QST)**: Research is not currently available on the use of QST in the evaluation of TOS. QST tests the entire spectrum of the

neurological system including the brain. It is not able to reliably distinguish between organic and psychogenic pathology and therefore, is not recommended (Chong P, 2004).

3. **VASCULAR STUDIES** Noninvasive vascular testing, such as pulse-volume recording in different positions, is not indicated in cases of neurogenic TOS. Since the presence or absence of a pulse cutoff on physical examination is not helpful in establishing a diagnosis of TOS, the recording of finer degrees of positional pulse alteration will not add to the diagnosis. Vascular laboratory studies, including duplex scanning, Doppler studies, standard and MR arteriography and venography, are not cost-effective in cases of neurogenic TOS. These studies are only indicated in patients who have arterial or venous occlusive signs. Dynamic venography with the arm in 180 degrees of abduction may be used in cases with continued swelling and/or periodic cyanosis who have not improved with conservative therapy. Approximately 20% of asymptomatic individuals will have an abnormal dynamic venogram (Sanders R, 2005). Some individuals may have a pectoralis minor syndrome which occludes the axillary vein rather than the subclavian vein. In these cases, less invasive surgery than the TOS operative procedures may be indicated (Sanders R, 2007).
4. **THERMOGRAPHY** is not generally accepted or widely used for TOS. It may be used if differential diagnosis includes CRPS; in such cases refer to the Division's Complex Regional Pain Syndrome/Reflex Sympathetic Dystrophy Medical Treatment Guidelines.
5. **ANTERIOR SCALENE OR PECTORALIS MUSCLE BLOCKS** may be performed to provide additional information prior to expected surgical intervention. It is recommended that EMG or sonography guidance be used to assure localization (Jordan SE, 1998).
6. **PERSONALITY/PSYCHOLOGICAL/PSYCHOSOCIAL EVALUATIONS** are generally accepted and well-established diagnostic procedures with selective use in the acute TOS population and more widespread use in the sub-acute and chronic TOS population.

Diagnostic testing procedures may be useful for patients with symptoms of depression, delayed recovery, chronic pain, recurrent painful conditions, disability problems, and for pre-operative evaluation as well as a possible predictive value for post-operative response. Psychological testing should provide differentiation between pre-existing depression versus injury caused depression, as well as post-traumatic stress disorder.

Formal psychological or psychosocial evaluation should be performed on patients not making expected progress within 6 to 12 weeks following injury and whose subjective symptoms do not correlate with objective signs and tests. In addition to the customary initial exam, the evaluation of the injured worker should specifically address the following areas:

- a. Employment history;
- b. Interpersonal relationships — both social and work;
- c. Leisure activities;
- d. Current perception of the medical system;
- e. Results of current treatment;
- f. Perceived locus of control; and

- g. Childhood history, including abuse and family history of disability.

This information should provide clinicians with a better understanding of the patient, and enable a more effective rehabilitation.

The evaluation will determine the need for further psychosocial interventions, and in those cases, a Diagnostic Statistical Manual (DSM) of mental disorders diagnosis should be determined and documented. An individual with a PhD, PsyD, or Psychiatric MD/DO credentials should perform initial evaluations, which are generally completed within one to two hours. A professional fluent in the primary language of the patient is strongly preferred. When such a provider is not available, services of a professional language interpreter must be provided. When issues of chronic pain are identified, the evaluation should be more extensive and follow testing procedures as outlined in the Division's Chronic Pain Disorder Medical Treatment Guidelines.

- ❖ Frequency: One time visit for evaluation. If psychometric testing is indicated as a portion of the initial evaluation, time for such testing should not exceed an additional two hours of professional time.

7. **SPECIAL TESTS** are generally well-accepted tests and are performed as part of a skilled assessment of the patients' capacity to return to work, his/her strength capacities, and physical work demand classifications and tolerance. The procedures in this subsection are listed in alphabetical order, not by importance.

- a. **Computer-Enhanced Evaluations:** may include isotonic, isometric, isokinetic and/or isoinertial measurement of movement, range-of-motion, endurance or strength. Values obtained can include degrees of motion, torque forces, pressures or resistance. Indications include determining validity of effort, effectiveness of treatment and demonstrated motivation. These evaluations should not be used alone to determine return to work restrictions. The added value of computer enhanced evaluations is unclear. Targeted work tolerance screening or gradual return to work is preferred.

- ❖ Frequency: One time for evaluation. Can monitor improvements in strength every 3 to 4 weeks up to a total of 6 evaluations.

- b. **Functional Capacity Evaluation (FCE):** is a comprehensive or modified evaluation of the various aspects of function as they relate to the worker's ability to return to work. Areas such as endurance, lifting (dynamic and static), postural tolerance, specific range of motion, coordination and strength, worker habits, employability as well as psychosocial, cognitive, and sensory perceptual aspects of competitive employment may be evaluated. Components of this evaluation may include: (a) musculoskeletal screen; (b) cardiovascular profile/aerobic capacity; (c) coordination; (d) lift/carrying analysis; (e) job-specific activity tolerance; (f) maximum voluntary effort; (g) pain assessment/psychological screening; and (h) non-material and material handling activities.

When an FCE is being used to determine return to a specific jobsite, the provider is responsible for fully understanding the job duties. A jobsite evaluation is frequently necessary. FCEs cannot be used in isolation to determine work restrictions. The authorized treating physician must interpret the FCE in light of the individual patient's presentation and medical and personal perceptions. FCEs should not be used as the sole criteria to diagnose malingering.

Full FCEs are rarely necessary. In many cases, a work tolerance screening will identify the ability to perform the necessary job tasks.

- ❖ Frequency: Can be used 1) initially to determine baseline status and 2) for case closure when patient is unlikely to return to pre-injury position and further information is desired to determine permanent work restrictions. Prior authorization is required for FCEs performed during treatment.

- c. **Jobsite Evaluation:** is a comprehensive analysis of the physical, mental and sensory components of a specific job. These components may include, but are not limited to: (a) postural tolerance (static and dynamic); (b) aerobic requirements; (c) range of motion; (d) torque/force; (e) lifting/carrying; (f) cognitive demands; (g) social interactions; (h) visual perceptual; (i) sensation; (j) coordination; (k) environmental requirements; (l) repetitiveness; and (m) essential job functions. Job descriptions provided by the employer are helpful but should not be used as a substitute for direct observation.

A jobsite evaluation may include observation and instruction of how work is done, what material changes (desk, chair) should be made, and determination of readiness to return to work. Postural risk factors should be identified and awkward postures of overhead reach, hyperextension or rotation of the neck, shoulder drooped or forward-flexed and head-chin forward postures should be eliminated. Unless combined with one of the above postures, repetitiveness is not by itself a risk factor. Refer to Cumulative Trauma Disorder and Shoulder Guidelines for further suggestions.

Requests for a jobsite evaluation should describe the expected goals for the evaluation. Goals may include, but are not limited to the following:

- i. To determine if there are potential contributing factors to the person's condition and/or for the physician to assess causality;
- ii. To make recommendations for, and to assess the potential for ergonomic changes;
- iii. To provide a detailed description of the physical and cognitive job requirements;
- iv. To assist the patient in their return to work by educating them on how they may be able to do their job more safely in a bio-mechanically appropriate manner;
- v. To give detailed work/activity restrictions.

- ❖ Frequency: One time with additional visits as needed for follow-up per jobsite.

- d. **Vocational Assessment:** If the injury is such that the practitioner can easily determine that the worker will be unable to return to his/her previous occupation, then vocational rehabilitation assistance at that time may aid in the overall medical management and rehabilitation of the patient. The physician may decide that the patient is unable to return to the previous occupation prior to declaration of maximum medical improvement (MMI).

The vocational assessment should provide valuable guidance in the determination of future rehabilitation program goals. It should clarify rehabilitation goals, which optimize both patient motivation and utilization of rehabilitation resources. The physician should have identified the expected permanent limitation(s) prior to the assessment. Declaration of MMI should not be delayed solely due to lack of attainment of a vocational assessment.

❖ Frequency: One time with additional visits as needed for follow-up.

e. **Work Tolerance Screening:** is a determination of an individual's tolerance for performing a specific job based on a job activity or task and may be used when a full Functional Capacity Evaluation is not indicated. The screening is monitored by a therapist and may include a test or procedure to specifically identify and quantify work relevant cardiovascular, physical fitness and postural tolerance. It may also address ergonomic issues affecting the patient's return-to-work potential.

❖ Frequency: One time for initial screen. May monitor improvements in strength every 3 to 4 weeks up to a total of 6 visits.

F. THERAPEUTIC PROCEDURES – NON-OPERATIVE

Treating providers, as well as employers and insurers are highly encouraged to reference the General Guideline Principles (Section B) prior to initiation of any therapeutic procedure.

Initial Treatment Recommendations: Vascular cases will require surgical management and thus are not appropriate candidates for initial non-operative therapy. Cases of “non-specific” (also called disputed) TOS are treated conservatively first for a minimum of 3 months. Patients undergoing therapeutic procedures may return to modified or restricted duty during their rehabilitation, at the earliest appropriate time. Cessation and/or review of treatment modalities should be undertaken when no further significant subjective or objective improvement in the patient’s condition is noted. Most literature of conservative therapy for TOS suggests benefit for patients with non-specific TOS. Non-surgical patients may be less likely to lose as much time from work as surgical patients (Franklin G, 2000; Landry GJ, 2001). Initial treatment for TOS patients without indications for early surgery should include, patient education, jobsite alterations (especially if job activities are related to symptoms), neuromuscular education to emphasize proper breathing techniques and posture, nerve gliding and core body therapeutic exercise.

Postural risk factors should be identified. Awkward postures of overhead reach, hyperextension or rotation of the neck, shoulder drooped or forward flexed and head-chin forward postures should be eliminated. Proper breathing techniques are also part of the treatment plan.

Therapy is primarily a daily self-managed home program developed and supervised by an appropriately trained professional. Nerve gliding and upper extremity stretching usually involves the following muscle groups: scalene, pectoralis minor, trapezius and levator scapulae. Endurance or strengthening of the upper extremities early in the course of therapy is not recommended, as this may exacerbate cervical or upper extremity symptoms.

Jobsite evaluation should be done early in all non-traumatic cases and should be performed by a qualified individual in all cases of suspected occupational TOS. Postural risk factors discussed above should be considered when making jobsite changes. Unless combined with one of the above postures, repetition alone is not a risk factor. Work activities need to be modified early in treatment to avoid further exposure to risk factors.

Individual treatment options are listed below in alphabetical order.

1. **ACUPUNCTURE** is an accepted and widely used procedure for the relief of pain and inflammation and there is some scientific evidence to support its use. The exact mode of action is only partially understood. Western medicine literature suggests that acupuncture stimulates the nervous system at the level of the brain, promotes deep relaxation, and affects the release of neurotransmitters. Acupuncture is commonly used as an alternative or in addition to traditional Western pharmaceuticals. While it is commonly used when pain medication is reduced or not tolerated, it may be used as an adjunct to physical rehabilitation and/or surgical intervention to hasten the return of functional activity. Acupuncture should be performed by licensed practitioners.
 - a. **Acupuncture:** is the insertion and removal of filiform needles to stimulate acupoints (acupuncture points). Needles may be inserted, manipulated and retained for a period of time. Acupuncture can be used to reduce pain, reduce inflammation, increase blood flow, increase range of motion, decrease the side effect of medication induced nausea, promote relaxation in an anxious patient, and reduce muscle spasm.

Indications include joint pain, joint stiffness, soft tissue pain and inflammation, paresthesia, post-surgical pain relief, muscle spasm, and scar tissue pain.

- b. **Acupuncture with Electrical Stimulation:** is the use of electrical current (micro-amperage or milli-amperage) on the needles at the acupuncture site. It is used to increase effectiveness of the needles by continuous stimulation of the acupoint. Physiological effects (depending on location and settings) can include endorphin release for pain relief, reduction of inflammation, increased blood circulation, analgesia through interruption of pain stimulus, and muscle relaxation.

It is indicated to treat chronic pain conditions, radiating pain along a nerve pathway, muscle spasm, inflammation, scar tissue pain, and pain located in multiple sites.

- c. **Total Time Frames for Acupuncture and Acupuncture with Electrical Stimulation:** Time frames are not meant to be applied to each of the above sections separately. The time frames are to be applied to all acupuncture treatments regardless of the type or combination of therapies being provided.

- ❖ Time to Produce Effect: 3 to 6 treatments.
- ❖ Frequency: 1 to 3 times per week.
- ❖ Optimum Duration: 1 to 2 months.
- ❖ Maximum Duration: 14 treatments.

Any of the above acupuncture treatments may extend longer if objective functional gains can be documented or when symptomatic benefits facilitate progression in the patient's treatment program. Treatment beyond 14 treatments must be documented with respect to need and ability to facilitate positive symptomatic or functional gains. Such care should be re-evaluated and documented with each series of treatments.

- d. **Other Acupuncture Modalities:** Acupuncture treatment is based on individual patient needs and therefore treatment may include a combination of procedures to enhance treatment effect. Other procedures may include the use of heat, soft tissue manipulation/massage, and exercise. Refer to F.11, Active Therapy (Therapeutic Exercise) and F.12, Passive Therapy sections (Massage and Superficial Heat and Cold Therapy) for a description of these adjunctive acupuncture modalities and time frames.

2. **BIOFEEDBACK:** is a form of behavioral medicine that helps patients learn self-awareness and self-regulation skills for the purpose of gaining greater control of their physiology, such as muscle activity, brain waves, and measures of autonomic nervous system activity. Electronic instrumentation is used to monitor the targeted physiology and then displayed or fed back to the patient visually, auditorily, or tactilely, with coaching by a biofeedback specialist. Biofeedback is provided by clinicians certified in biofeedback and/or who have documented specialized education, advanced training, or direct or supervised experience qualifying them to provide the specialized treatment needed (e.g., surface EMG, EEG, or other.)

Treatment is individualized to the patient's work-related diagnosis and needs. Home practice of skills is required for mastery and may be facilitated by the use of home training tapes. The ultimate goal in biofeedback treatment is normalizing the physiology to the pre-injury status to the extent possible and involves transfer of learned skills to the workplace and daily life. Candidates for biofeedback therapy or training must be motivated to learn and practice biofeedback and self-regulation techniques.

Indications for biofeedback include individuals who are suffering from musculoskeletal injury where muscle dysfunction or other physiological indicators of excessive or prolonged stress response affects and/or delays recovery. Other applications include training to improve self-management of emotional stress/pain responses such as anxiety, depression, anger, sleep disturbance, and other central and autonomic nervous system imbalances. Biofeedback is often utilized along with other treatment modalities.

- ❖ Time to Produce Effect: 3 to 4 sessions.
- ❖ Frequency: 1 to 2 times per week.
- ❖ Optimum Duration: 5 to 6 sessions.
- ❖ Maximum Duration: 10 to 12 sessions. Treatment beyond 12 sessions must be documented with respect to need, expectation, and ability to facilitate positive symptomatic or functional gains.

3. **INJECTIONS - THERAPEUTIC:**

- a. **Scalene Blocks:** have no therapeutic role in the treatment of TOS.
- b. **Trigger Point Injections:** although generally accepted, are not routinely used in cases of TOS. However, it is not unusual to find myofascial trigger points associated with TOS pathology, which may require injections.

Description - Trigger point treatment can consist of dry needling or injection of local anesthetic with or without corticosteroid into highly localized, extremely sensitive bands of skeletal muscle fibers that produce local and referred pain when activated. Medication is injected in a four-quadrant manner in the area of maximum tenderness. Injection efficacy can be enhanced if injections are immediately followed by myofascial therapeutic interventions, such as vapor-coolant spray and stretch, ischemic pressure massage (myotherapy), specific soft tissue mobilization and physical modalities. There is conflicting evidence regarding the benefit of trigger point injections. A truly blinded study comparing dry needle treatment of trigger points is not feasible. There is no evidence that injection of medications improves the results of trigger point injections. Needling alone may account for some of the therapeutic response.

There is no indication for conscious sedation for patients receiving trigger point injections. The patient must be alert to help identify the site of the injection.

Indications -Trigger point injections may be used to relieve myofascial pain and facilitate active therapy and stretching of the affected areas. They are to be used as an adjunctive treatment in combination with other treatment modalities such as functional restoration programs. Trigger point injections should be utilized primarily for the purpose of facilitating functional progress. Patients should continue with a therapeutic exercise program as tolerated throughout the time

period they are undergoing intensive myofascial interventions. Myofascial pain is often associated with other underlying structural problems and any abnormalities need to be ruled out prior to injection.

Trigger point injections are indicated in those patients where well circumscribed trigger points have been consistently observed, demonstrating a local twitch response, characteristic radiation of pain pattern and local autonomic reaction, such as persistent hyperemia following palpation. Generally, these injections are not necessary unless consistently observed trigger points are not responding to specific, noninvasive, myofascial interventions within approximately a 6 week time frame.

Complications - Potential but rare complications of trigger point injections include infection, pneumothorax, anaphylaxis, neurapraxia, and neuropathy. If corticosteroids are injected in addition to local anesthetic, there is a risk of local myopathy developing. Severe pain on injection suggests the possibility of an intraneural injection, and the needle should be immediately repositioned.

- ❖ Time to Produce Effect: Local anesthetic 30 minutes; no anesthesia 24 to 48 hours.
- ❖ Frequency: Weekly, suggest no more than 4 injection sites per session per week to avoid significant post-injection soreness.
- ❖ Optimal Duration: 4 Weeks.
- ❖ Maximum Duration: 8 weeks. Occasional patients may require 2 to 4 repetitions of trigger point injection series over a 1 to 2 year period.

4. **MEDICATIONS:**

Thrombolytic agents will be required for some vascular TOS conditions.

Medication use is appropriate for pain control in TOS. A thorough medication history, including use of alternative and over the counter medications, should be performed at the time of the initial visit and updated periodically.

Acetaminophen is an effective and safe initial analgesic. Nonsteroidal anti-inflammatory drugs (NSAIDs) are useful in the treatment of inflammation, and for pain control. Pain is subjective in nature and should be evaluated using a scale to rate effectiveness of the analgesic in terms of functional gain. Other medications, including antidepressants and anti-convulsants, may be useful in selected patients with neuropathic and/or chronic pain (Refer to the Division's Chronic Pain Guidelines). Narcotics are rarely indicated for treatment of TOS, and they should be primarily reserved for the treatment of acute severe pain for a limited time on a case-by-case basis. Topical agents may be beneficial in the management of localized upper extremity pain.

The use of a patient completed pain drawing, visual analog scale (VAS), is highly recommended to help providers track progress. Functional objective goals should be monitored regularly to determine the effectiveness of treatment. The patient should be advised regarding the interaction with prescription and over-the-counter herbal products.

The following medications are listed in alphabetical order:

a. **Acetaminophen:** is an effective analgesic with antipyretic but not anti-inflammatory activity. Acetaminophen is generally well tolerated, causes little or no gastrointestinal irritation and is not associated with ulcer formation. Acetaminophen has been associated with liver toxicity in overdose situations or in chronic alcohol use. Patients may not realize that many over-the-counter preparations may contain acetaminophen. The total daily dose of acetaminophen is recommended not to exceed 4 grams per 24-hour period, from all sources, including narcotic-acetaminophen combination preparations.

- ❖ Optimal Duration: 7 to 10 days.
- ❖ Maximum Duration: Chronic use as indicated on a case-by-case basis. Use of this substance long-term for 3 days per week or greater may be associated with rebound pain upon cessation.

b. **Anticonvulsants:** Although the mechanism of action of anticonvulsant drugs in neuropathic pain states remains to be fully defined, they appear to act as nonselective sodium channel blocking agents. A large variety of sodium channels are present in nervous tissue, and some of these are important mediators of nociception, as they are found primarily in unmyelinated fibers and their density increases following nerve injury. While the pharmacodynamic effects of the various anticonvulsant drugs are similar, the pharmacokinetic effects differ significantly. Carbamazepine has important effects as an inducer of hepatic enzymes and may influence the metabolism of other drugs enough to present problems in patients taking more than one drug. Gabapentin and oxcarbazepine, by contrast, are relatively non-significant enzyme inducers, creating fewer drug interactions. Because anticonvulsant drugs may have more problematic side-effect profiles, their use should usually be deferred until antidepressant drugs have failed to relieve pain.

i. **Gabapentin (Neurontin)**

- A) Description – Structurally related to gamma aminobutyric acid (GABA) but does not interact with GABA receptors.
- B) Indications – Neuropathic pain.
- C) Relative Contraindications – Renal insufficiency.
- D) Dosing and Time to Therapeutic Effect – Dosage may be increased over several days.
- E) Major Side Effects – Confusion, sedation.
- F) Drug Interactions – Oral contraceptives, cimetidine, antacids.
- G) Recommended Laboratory Monitoring – Renal function.

c. **Antidepressants:** are classified into a number of categories based on their chemical structure and their effects on neurotransmitter systems. Their effects on depression are attributed to their actions on disposition of norepinephrine and serotonin at the level of the synapse; although these synaptic actions are immediate, the symptomatic response in depression is delayed by several weeks. When used for chronic pain, the effects may in part arise from treatment

of underlying depression, but may also involve additional neuromodulatory effects on endogenous opioid systems, raising pain thresholds at the level of the spinal cord.

Pain responses may occur at lower drug doses with shorter times to symptomatic response than are observed when the same compounds are used in the treatment of mood disorders. Neuropathic pain, diabetic neuropathy, post-herpetic neuralgia, and cancer related pain may respond to antidepressant doses low enough to avoid adverse effects that often complicate the treatment of depression.

- i. Tricyclics (e.g., amitriptyline [Elavil], nortriptyline [Pamelor, Aventyl], doxepin [Sinequan, Adapin])
 - A) Description – Serotonergics, typically tricyclic antidepressants (TCAs), are utilized for their serotonergic properties as increasing CNS serotonergic tone can help decrease pain perception in non-antidepressant dosages. Amitriptyline is known for its ability to repair Stage 4 sleep architecture, a frequent problem found in chronic pain patients and to treat depression, frequently associated with chronic pain.
 - B) Indications – Chronic musculoskeletal and/or neuropathic pain, insomnia. Second line drug treatment for depression.
 - C) Major Contraindications – Cardiac disease or dysrhythmia, glaucoma, prostatic hypertrophy, seizures, suicide risk.
 - D) Dosing and Time to Therapeutic Effect – Varies by specific tricyclic. Low dosages are commonly used for chronic pain and/or insomnia.
 - E) Major Side Effects – Anticholinergic side effects including, but not limited to, dry mouth, sedation, orthostatic hypotension, cardiac arrhythmia, weight gain.
 - F) Drug Interactions – Tramadol (may cause seizures), clonidine, cimetidine, sympathomimetics, valproic acid, warfarin, carbamazepine, bupropion, anticholinergics, quinolones.
 - G) Recommended Laboratory Monitoring – Renal and hepatic function. Electrocardiogram (EKG) for those on high dosages or with cardiac risk.

d. **Minor Tranquilizer/Muscle Relaxants:** are appropriate for muscle spasm, mild pain and sleep disorders.

❖ Optimum Duration: Up to 1 week.

❖ Maximum Duration: 4 weeks.

e. **Narcotics:** medications should be prescribed with strict time, quantity and duration guidelines, and with definitive cessation parameters. Adverse effects

include respiratory depression, impaired alertness, and the development of physical and psychological dependence.

- ❖ Optimum Duration: Up to 7 days.
- ❖ Maximum Duration: 2 weeks. Use beyond two weeks is acceptable in appropriate cases, such as patients requiring complex surgical treatment.

f. **Nonsteroidal Anti-Inflammatory Drugs (NSAIDs):** are useful for pain and inflammation. In mild cases, they may be the only drugs required for analgesia. There are several classes of NSAIDs, and the response of the individual injured worker to a specific medication is unpredictable. For this reason, a range of NSAIDs may be tried in each case with the most effective preparation being continued. Patients should be closely monitored for adverse reactions. The US Food and Drug Administration advises that many NSAIDs may cause an increased risk of serious cardiovascular thrombotic events, myocardial infarction, and stroke, which can be fatal. Naproxen sodium does not appear to be associated with increased risk of vascular events (Chou R, 2004). Administration of proton pump inhibitors, Histamine 2 Blockers, or prostaglandin analog misoprostol along with these NSAIDs may reduce the risk of duodenal and gastric ulceration but do not impact possible cardiovascular complications. Due to the cross reactivity between aspirin and NSAIDs, NSAIDs should not be used in aspirin sensitive patients, and should be used with caution in all asthma patients. NSAIDs are associated with abnormal renal function, including renal failure, as well as, abnormal liver function. Certain NSAIDs may have interactions with various other medications. Individuals may have adverse events not listed above. Intervals for metabolic screening are dependent upon the patient's age, general health status and should be within parameters listed for each specific medication. Complete blood count (CBC), and liver and renal function should be monitored at least every six months in patients on chronic NSAIDs and initially when indicated.

i. Non-selective Nonsteroidal Anti-Inflammatory Drugs.

Includes NSAIDs and acetylsalicylic acid (aspirin). Serious GI toxicity, such as bleeding, perforation, and ulceration can occur at any time, with or without warning symptoms in patients treated with traditional NSAIDs. Physicians should inform patients about the signs and/or symptoms of serious gastrointestinal toxicity and what steps to take if they occur. Anaphylactoid reactions may occur in patients taking NSAIDs. NSAIDs may interfere with platelet function. Fluid retention and edema have been observed in some patients taking NSAIDs.

- ❖ Optimal Duration: 1 week.
- ❖ Maximum Duration: 1 year. Use of these substances long-term (3 days per week or greater) is associated with rebound pain upon cessation.

ii. Selective Cyclo-oxygenase-2 (COX-2) Inhibitors.

COX-2 inhibitors are more recent NSAIDs and differ in adverse side effect profiles from the traditional NSAIDs. The major advantages of selective COX-2 inhibitors over traditional NSAIDs are that they have

less gastrointestinal toxicity and no platelet effects. COX-2 inhibitors can worsen renal function in patients with renal insufficiency, thus renal function may need monitoring.

COX-2 inhibitors should not be first line for low risk patients who will be using an NSAID short-term but are indicated in select patients for whom traditional NSAIDs are not tolerated. Serious upper GI adverse events can occur even in asymptomatic patients. Patients at high risk for GI bleed include those who use alcohol, smoke, are older than 65, take corticosteroids or anti-coagulants, or have a longer duration of therapy. Celecoxib is contraindicated in sulfonamide allergic patients.

- ❖ Optimal Duration: 7 to 10 days.
- ❖ Maximum Duration: Chronic use is appropriate in individual cases. Use of these substances long-term (3 days per week or greater) is associated with rebound pain upon cessation.

5. OCCUPATIONAL REHABILITATION PROGRAMS

a. **Non-Interdisciplinary:** These generally accepted programs are work-related, outcome-focused, individualized treatment programs. Objectives of the program include, but are not limited to, improvement of cardiopulmonary and neuromusculoskeletal functions (strength, endurance, movement, flexibility, stability, and motor control functions), patient education, and symptom relief. The goal is for patients to gain full or optimal function and return to work. The service may include the time limited use of passive modalities with progression to achieve treatment and/or simulated/real work. These programs are frequently necessary for patients who must return to physically demanding job duties or whose injury requires prolonged rehabilitation and therapy spanning several months.

i. Work Conditioning:

These programs are usually initiated once reconditioning has been completed but may be offered at any time throughout the recovery phase. It should be initiated when imminent return of a patient to modified or full duty is not an option, but the prognosis for returning the patient to work at completion of the program is at least fair to good.

- ❖ Length of visit: 1 to 2 hours per day.
- ❖ Frequency: 2 to 5 visits per week.
- ❖ Optimum Duration: 2 to 4 weeks.
- ❖ Maximum Duration: 6 weeks. Participation in a program beyond six weeks must be documented with respect to need and the ability to facilitate positive symptomatic or functional gains.

ii. Work Simulation:

Work simulation is a program where an individual completes specific work-related tasks for a particular job and return-to-work. Use of this

program is appropriate when modified duty can only be partially accommodated in the work place, when modified-duty in the work place is unavailable, or when the patient requires more structured supervision. The need for work place simulation should be based upon the results of a functional capacity evaluation and/or jobsite analysis.

- ❖ Length of visit: 2 to 6 hours per day.
- ❖ Frequency: 2 to 5 visits per week.
- ❖ Optimum Duration: 2 to 4 weeks.
- ❖ Maximum Duration: 6 weeks. Participation in a program beyond six weeks must be documented with respect to need and the ability to facilitate positive symptomatic or functional gains.

b. Interdisciplinary: These generally accepted programs are characterized by a variety of disciplines that participate in the assessment, planning, and/or implementation of an injured workers program with the goal for patients to gain full or optimal function and return-to-work. There should be close interaction and integration among the disciplines to ensure that all members of the team interact to achieve team goals. These programs are for patients with greater levels of perceived disability, dysfunction, de-conditioning and psychological involvement. For patients with chronic pain, refer to the Division's Chronic Pain Disorder Medical Treatment Guidelines.

i Work Hardening:

Work Hardening is an interdisciplinary program addressing a patient's employability and return to work. It includes a progressive increase in the number of hours per day that a patient completes work simulation tasks until the patient can tolerate a full workday. This is accomplished by addressing the medical, psychological, behavioral, physical, functional, and vocational components of employability and return-to-work.

This can include a highly structured program involving a team approach or can involve any of the components thereof. The interdisciplinary team should, at a minimum, be comprised of a qualified medical director who is board certified with documented training in occupational rehabilitation; team physicians having experience in occupational rehabilitation; occupational therapist; physical therapist; case manager; and psychologist. As appropriate, the team may also include: chiropractor, RN, vocational specialist or Certified Biofeedback Therapist.

- ❖ Length of visit: Up to 8 hours/day.
- ❖ Frequency: 2 to 5 visits per week.
- ❖ Optimum Duration: 2 to 4 weeks.
- ❖ Maximum Duration: 6 weeks. Participation in a program beyond six weeks must be documented with respect to need and the ability to facilitate positive symptomatic or functional gains.

6. **PATIENT EDUCATION:** No treatment plan is complete without addressing issues of individual and/or group patient education as a means of prolonging the beneficial effects of treatment, as well as facilitating self-management of symptoms and injury prevention. The patient should be encouraged to take an active role in the establishment of functional outcome goals. They should be educated on their specific injury, assessment findings, and plan of treatment. Instruction on breathing technique, proper body mechanics and posture, positions to avoid, self-care for exacerbation of symptoms, sleep postures, and home exercise should also be addressed. Patients with TOS may find that sleeping on the affected side, with the arms overhead or prone with head to one side can increase symptoms and should be avoided. Cervical roll pillows that do not result in overextension may be useful (Novak C, 2002).

- ❖ Time to Produce Effect: Varies with individual patient.
- ❖ Frequency: Should occur at each visit.

7. **PERSONALITY/PSYCHOSOCIAL/PSYCHOLOGICAL INTERVENTION:** Psychosocial treatment is generally accepted, widely used, and well-established intervention. This group of therapeutic and diagnostic modalities includes, but is not limited to, individual counseling, group therapy, stress management, psychosocial crises intervention, hypnosis and meditation. Any evaluation or diagnostic workup should clarify and distinguish between pre-existing versus aggravated versus purely causative psychological conditions. Psychosocial intervention is recommended as an important component in the total management program that should be implemented as soon as the problem is identified. This can be used alone or in conjunction with other treatment modalities. Providers treating patients with chronic pain should refer to the Division's Chronic Pain Disorder Medical Treatment Guidelines.

- ❖ Time to Produce Effect: 2 to 4 weeks.
- ❖ Frequency: 1 to 3 times weekly for the first 4 weeks (excluding hospitalization, if required), decreasing to 1 to 2 times per week for the second month. Thereafter, 2 to 4 times monthly.
- ❖ Optimum Duration: 6 weeks to 3 months.
- ❖ Maximum Duration: 3 to 12 months. Counseling is not intended to delay but to enhance functional recovery. For select patients, longer supervised treatment may be required and if further counseling beyond 3 months is indicated, extensive documentation addressing which pertinent issues are pre-existing versus aggravated versus causative, as well as projecting a realistic functional prognosis, should be provided by the authorized treating provider every 4 to 6 weeks during treatment.

8. **RETURN-TO-WORK:** Early return-to-work should be a prime goal in treating occupational injuries given the poor return-to-work prognosis for an injured worker who has been out of work for more than six months. It is imperative that the patient be educated regarding the benefits of return-to-work, work restrictions, and follow-up care if problems arise. When attempting to return a patient to work after a specific injury, clear objective restrictions of activity level should be made. An accurate job description with detailed physical duty restrictions may be necessary to assist the physician in making return-to-work recommendations. This may require a jobsite evaluation.

Employers should be prepared to offer transitional work. This may consist of temporary work in a less demanding position, return to the regular job with restrictions, or gradual

return to the regular job. Company policies which encourage return-to-work with positive communication are most likely to have decreased worker disability.

Return-to-work is defined as any work or duty that the patient is able to perform safely. It may not be the patient's regular work. Due to the large spectrum of injuries of varying severity and varying physical demands in the work place, it is not possible to make specific return-to-work guidelines for each injury. Therefore, the Division recommends the following:

- a. **Establishment of a Return-to-Work Status:** Ascertaining a return-to-work status is part of medical care, should be included in the treatment and rehabilitation plan, and addressed at every visit. A description of daily activity limitations is part of any treatment plan and should be the basis for restriction of work activities. In most non-surgical cases, the patient should be able to return-to-work in some capacity or in an alternate position consistent with medical treatment within several days unless there are extenuating circumstances. Injuries requiring more than two weeks off work should be thoroughly documented.
- b. **Establishment of Activity Level Restrictions:** Communication is essential between the patient, employer and provider to determine appropriate restrictions and return-to-work dates. It is the responsibility of the physician to provide clear concise restrictions, and it the employer's responsibility to determine if temporary duties can be provided within the restrictions. For treatment of TOS injuries, the following should be addressed when describing the patient's activity level:
 - Activities such as overhead motion, lifting, abduction;
 - Static neck and shoulder positions with regard to duration and frequency;
 - Restriction of cervical hyperextension;
 - Use of adaptive devices or equipment for proper ergonomics and to enhance capacities;
 - Maximum lifting limits with reference to the frequency of the lifting and/or the object height level;
 - Maximum limits for pushing, pulling, with limits on bending and twisting at the waist as necessary; and
 - Restrictions on 'shoulder drooped' or 'head forward' positions.
- c. **Compliance with Activity Restrictions:** In some cases, compliance with restriction of activity levels may require a complete jobsite evaluation, a functional capacity evaluation (FCE), or other special testing. Refer to the Special Tests section of this guideline.

9. **THERAPY-ACTIVE**

The following active therapies are widely used and accepted methods of care for a variety of work-related injuries. They are based on the philosophy that therapeutic exercise and/or activity are beneficial for restoring flexibility, strength, endurance, function, range of motion, and can alleviate discomfort. Active therapy requires physical

effort by the individual to complete a specific exercise or task. This form of therapy requires supervision from a therapist or medical provider such as verbal, visual, and/or tactile instruction(s). At times, the provider may help stabilize the patient or guide the movement pattern but the energy required to complete the task is predominately executed by the patient.

Patients should be instructed to continue active therapies at home as an extension of the treatment process in order to maintain improvement levels. Follow-up visits to reinforce and monitor progress and proper technique are recommended. Home exercise can include exercise with or without mechanical assistance or resistance and functional activities with assistive devices.

The use of a patient completed pain drawing, visual analog scale (VAS), is highly recommended to help providers track progress. Functional objective goals should be monitored and documented regularly to determine the effectiveness of treatment.

The following active therapies are listed in alphabetical order:

- a. **Activities of Daily Living (ADL)** are well-established interventions which involve instruction, active-assisted training, and/or adaptation of activities or equipment to improve a person's capacity in normal daily activities such as self-care, work re-integration training, homemaking, and driving.

- ❖ Time to Produce Effect: 4 to 5 treatments.
- ❖ Frequency: 3 to 5 times per week.
- ❖ Optimum Duration: 4 to 6 weeks.
- ❖ Maximum Duration: 6 weeks.

- b. **Aquatic Therapy:** is a well-accepted treatment which consists of the therapeutic use of aquatic immersion for therapeutic exercise to promote range-of-motion, core stabilization, endurance, flexibility, strengthening, body mechanics, and pain management. Aquatic therapy includes the implementation of active therapeutic procedures in a swimming or therapeutic pool. The water provides a buoyancy force that lessens the amount of force gravity applies to the body. The decreased gravity effect allows the patient to have a mechanical advantage and more likely have a successful trial of therapeutic exercise. Literature has shown that the muscle recruitment for aquatic therapy versus similar non-aquatic motions is significantly less. Because there is always a risk of recurrent or additional damage to the muscle tendon unit after a surgical repair, aquatic therapy may be preferred by surgeons to gain early return of range of motion. In some cases the patient will be able to do the exercises unsupervised after the initial supervised session. Parks and recreation contacts may be used to develop less expensive facilities for patients. Indications include:

- ❖ Postoperative therapy as ordered by the surgeon; or
- ❖ Intolerance for active land-based or full-weight bearing therapeutic procedures; or
- ❖ Symptoms that are exacerbated in a dry environment; and

- ❖ Willingness to follow through with the therapy on a regular basis.

The pool should be large enough to allow full extremity range of motion and fully erect posture. Aquatic vests, belts, snorkels, and other devices may be used to provide stability, balance, buoyancy, and resistance.

- ❖ Time to Produce Effect: 4 to 5 treatments.
- ❖ Frequency: 3 to 5 times per week.
- ❖ Optimum Duration: 4 to 6 weeks.
- ❖ Maximum Duration: 8 weeks.

A self-directed program is recommended after the supervised aquatics program has been established, or, alternatively a transition to a self-directed dry environment exercise program (Thein JM, 2000; Speer KP, 1993).

- c. **Functional Activities:** are well-established interventions which involve the use of therapeutic activity to enhance mobility, body mechanics, employability, coordination, balance, and sensory motor integration.

- ❖ Time to Produce Effect: 4 to 5 treatments.
- ❖ Frequency: 3 to 5 times per week.
- ❖ Optimum Duration: 4 to 6 weeks.
- ❖ Maximum Duration: 6 weeks.

- d. **Nerve Gliding:** is an accepted therapy for TOS. Nerve Gliding exercises consist of a series of gentle movements of the neck, shoulder and arm that produce longitudinal movement along the length of the nerves of the upper extremity. These exercises are based on the principle that the tissues of the peripheral nervous system are designed for movement, and glide (excursion) of nerves may have an effect on neurophysiology through alterations in vascular and axoplasmic flow. Biomechanical principles have been more thoroughly studied than clinical outcomes. The exercises should be done by the patient after proper instruction and monitoring by the therapist.

- ❖ Time to Produce Effect: 2 to 4 weeks.
- ❖ Frequency: Up to 5 times per day by patient (patient-initiated).
- ❖ Optimum Duration: 4 to 6 sessions.
- ❖ Maximum Duration: 6 to 8 sessions.

- e. **Neuromuscular Re-education:** is a generally accepted treatment. Neuromuscular re-education is the skilled application of exercise with manual, mechanical, or electrical facilitation to enhance strength; movement patterns; neuromuscular response; proprioception, kinesthetic sense, coordination; education of movement, balance and posture. Indications include the need to promote neuromuscular responses through carefully timed proprioceptive stimuli

to elicit and improve motor activity in patterns similar to normal neurologically developed sequences, and improve neuromotor response with independent control.

- ❖ Time to Produce Effect: 2 to 6 treatments.
- ❖ Frequency: 3 times per week.
- ❖ Optimum Duration: 4 to 8 weeks.
- ❖ Maximum Duration: 8 weeks.

f. **Therapeutic Exercise:** is a generally well-accepted treatment. Therapeutic exercise with or without mechanical assistance or resistance, may include isoinertial, isotonic, isometric and isokinetic types of exercises. The exact type of program and length of therapy should be determined by the treating physician with the physical or occupational therapist. In most cases the therapist instructs the patient in a supervised clinic and home program to increase motion and subsequently increase strength. Usually, isometrics are performed initially, progressing to isotonic exercises as tolerated.

- ❖ Time to Produce Effect: 2 to 6 treatments.
- ❖ Frequency: 2 to 3 times per week.
- ❖ Optimum Duration: 16 to 24 sessions.
- ❖ Maximum Duration: 36 sessions. Additional visits may be necessary in cases of re-injury, interrupted continuity of care, exacerbation of symptoms, and in those patients with comorbidities. Functional gains including increased range of motion must be demonstrated to justify continuing treatment.

10. **THERAPY – PASSIVE**

The following passive therapies and modalities are generally accepted methods of care for a variety of work-related injuries. Passive therapy includes those treatment modalities that do not require energy expenditure on the part of the patient. They are principally effective during the early phases of treatment and are directed at controlling symptoms such as pain, inflammation and swelling and to improve the rate of healing soft tissue injuries. They should be used adjunctively with active therapies such as postural stabilization and exercise programs to help control swelling, pain and inflammation during the rehabilitation process. Please refer to Section B. 4, General Guidelines Principles, Active Interventions. Passive therapies may be used intermittently as a therapist deems appropriate or regularly if there are specific goals with objectively measured functional improvements during treatment.

On occasion, specific diagnoses and post-surgical conditions may warrant durations of treatment beyond those listed as "maximum." Factors such as exacerbation of symptoms, re-injury, interrupted continuity of care and comorbidities may also extend durations of care. Specific goals with objectively measured functional improvement during treatment must be cited to justify extended durations of care. It is recommended that, if no functional gain is observed after the number of treatments under "time to produce effect" has been completed; alternative treatment interventions, further diagnostic studies, or further consultations should be pursued.

The following passive therapies and modalities are listed in alphabetical order.

a. **Electrical Stimulation (Unattended):** is an accepted treatment. Once applied, electrical stimulation (unattended) requires minimal on-site supervision by the physical therapists, occupational therapist or other provider. Indications include pain, inflammation, muscle spasm, atrophy, decreased circulation, and the need for osteogenic stimulation. A home unit should be purchased if treatment is effective and frequent use is recommended.

- ❖ Time to Produce Effect: 2 to 4 treatments.
- ❖ Frequency: Varies, depending upon indication, between 2 to 3 times/day to 1 time/week.
- ❖ Optimum Duration: 1 to 3 months.
- ❖ Maximum Duration: 3 months.

b. **Iontophoresis:** is an accepted treatment which consists of the transfer of medication, including, but not limited to, steroidal anti-inflammatories and anesthetics, through the use of electrical stimulation. Indications include pain (Lidocaine), inflammation (hydrocortisone, salicylate), edema (mecholy, hyaluronidase, and salicylate), ischemia (magnesium, mecholy, and iodine), muscle spasm (magnesium, calcium), calcifying deposits (acetate), scars, and keloids (sodium chloride, iodine, acetate).

- ❖ Time to Produce Effect: 1 to 4 treatments.
- ❖ Frequency: 3 times per week with at least 48 hours between treatments.
- ❖ Optimum Duration: 8 to 10 treatments.
- ❖ Maximum Duration: 10 treatments.

c. **Manipulation:** is a generally accepted treatment. Manipulative treatment (not therapy) is defined as the therapeutic application of manually guided forces by an operator to improve physiologic function and/or support homeostasis that has been altered by the injury or occupational disease, and has associated clinical significance.

High velocity, low amplitude (HVLA) technique, chiropractic manipulation, osteopathic manipulation, muscle energy techniques, counter strain, and non-force techniques are all types of manipulative treatment. This may be applied by osteopathic physicians (D.O.), chiropractors (D.C.), properly trained physical therapists (P.T.), properly trained occupational therapists (O.T.), or properly trained medical physicians. Under these different types of manipulation exist many subsets of different techniques that can be described as a) direct- a forceful engagement of a restrictive/pathologic barrier, b) indirect- a gentle/non-forceful disengagement of a restrictive/pathologic barrier, c) the patient actively assisting in the treatment and d) the patient relaxing, allowing the practitioner to move the body tissues. When the proper diagnosis is made and coupled with the appropriate technique, manipulation has no contraindications and can be applied

to all tissues of the body. Pre-treatment assessment should be performed as part of each manipulative treatment visit to ensure that the correct diagnosis and correct treatment is employed.

- ❖ Time to produce effect for all types of manipulative treatment: 1 to 6 treatments.
- ❖ Frequency: Up to 3 times per week for the first 3 weeks as indicated by the severity of involvement and the desired effect.
- ❖ Optimum Duration: 10 treatments.
- ❖ Maximum Duration: 12 treatments. Additional visits may be necessary in cases of re-injury, interrupted continuity of care, exacerbation of symptoms, and in those patients with comorbidities. Functional gains including increased range of motion must be demonstrated to justify continuing treatment.

d. **Massage-Manual or Mechanical:** is a generally well-accepted treatment. Massage is manipulation of soft tissue with broad ranging relaxation and circulatory benefits. This may include stimulation of acupuncture points and acupuncture channels (acupressure), application of suction cups and techniques that include pressing, lifting, rubbing, pinching of soft tissues by, or with the practitioner's hands. Indications include edema (peripheral or hard and non-pliable edema), muscle spasm, adhesions, the need to improve peripheral circulation and range of motion, or to increase muscle relaxation and flexibility prior to exercise. In cases with edema, deep vein thrombosis should be ruled out prior to treatment.

- ❖ Time to Produce Effect: Immediate.
- ❖ Frequency: 1 to 2 times per week.
- ❖ Optimum Duration: 6 weeks.
- ❖ Maximum Duration: 2 months.

e. **Mobilization (Joint):** is a generally well-accepted treatment. Mobilization is passive movement, which may include passive range of motion performed in such a manner (particularly in relation to the speed of the movement) that it is, at all times, within the ability of the patient to prevent the movement if they so choose. It may include skilled manual joint tissue stretching. Indications include the need to improve joint play, improve intracapsular arthrokinematics, or reduce pain associated with tissue impingement.

- ❖ Time to Produce Effect: 6 to 9 treatments.
- ❖ Frequency: 3 times per week.
- ❖ Optimum Duration: 6 weeks.
- ❖ Maximum Duration: 2 months.

f. **Mobilization (Soft Tissue):** is a generally well-accepted treatment. Mobilization of soft tissue is the skilled application of muscle energy, strain/counter strain, myofascial release, manual trigger point release and manual therapy techniques designed to improve or normalize movement patterns through the reduction of soft tissue pain and restrictions. These can be interactive with the patient participating or can be with the patient relaxing and letting the practitioner move the body tissues. Indications include muscle spasm around a joint, trigger points, adhesions, and neural compression. Mobilization should be accompanied by active therapy.

- ❖ Time to Produce Effect: 2 to 3 weeks.
- ❖ Frequency: 2 to 3 times per week.
- ❖ Optimum Duration: 4 to 6 weeks.
- ❖ Maximum Duration: 6 weeks.

g. **Superficial Heat and Cold Therapy:** is a generally accepted treatment. Superficial heat and cold therapies are thermal agents applied in various manners that lower or raise the body tissue temperature for the reduction of pain, inflammation, and/or effusion resulting from injury or induced by exercise. It may be used acutely with compression and elevation. Indications include acute pain, edema and hemorrhage, need to increase pain threshold, reduce muscle spasm and promote stretching/flexibility. Includes portable cryotherapy units and application of heat just above the surface of the skin at acupuncture points.

- ❖ Time to Produce Effect: Immediate.
- ❖ Frequency: 2 to 5 times per week.
- ❖ Optimum Duration: 3 weeks as primary, or up to 2 months if used intermittently as an adjunct to other therapeutic procedures.
- ❖ Maximum Duration: 2 months.

h. **Transcutaneous Electrical Nerve Stimulation (TENS):** is a generally accepted treatment and should include at least one instructional session for proper application and use. Indications include muscle spasm, atrophy, and decreased circulation and pain control. Minimal TENS unit parameters should include pulse rate, pulse width and amplitude modulation. Consistent, measurable functional improvement must be documented prior to the purchase of a home unit.

- ❖ Time to Produce Effect: Immediate.
- ❖ Frequency: Variable.
- ❖ Optimum Duration: 3 sessions.
- ❖ Maximum Duration: 3 sessions. If beneficial, provide with home unit or purchase if effective.

i. **Ultrasound (including Phonophoresis):** is an accepted treatment and includes ultrasound with electrical stimulation and phonophoresis. Ultrasound uses sonic

generators to deliver acoustic energy for therapeutic thermal and/or non-thermal soft tissue effects. Indications include scar tissue, adhesions, collagen fiber and muscle spasm, and the need to extend muscle tissue or accelerate the soft tissue healing.

Ultrasound with electrical stimulation is concurrent delivery of electrical energy that involves a dispersive electrode placement. Indications include muscle spasm, scar tissue, pain modulation, and muscle facilitation.

Phonophoresis is the transfer of medication to the target tissue to control inflammation and pain through the use of sonic generators. These topical medications include, but are not limited to, steroidal anti-inflammatory and anesthetics.

- ❖ Time to Produce Effect: 6 to 15 treatments.
- ❖ Frequency: 3 times per week.
- ❖ Optimum Duration: 4 to 8 weeks.
- ❖ Maximum Duration: 2 months.

11. **VOCATIONAL REHABILITATION:** is a generally accepted intervention, but Colorado limits its use as a result of Senate Bill 87-79. Initiation of vocational rehabilitation requires adequate evaluation of patients for quantification highest functional level, motivation and achievement of maximum medical improvement. Vocational rehabilitation may be as simple as returning to the original job or as complicated as being retrained for a new occupation.

It may also be beneficial for full vocational rehabilitation to be started before MMI if it is evident that the injured worker will be unable to return to his/her previous occupation. A positive goal and direction may aid the patient in decreasing stress and depression, and promote optimum rehabilitation.

G. THERAPEUTIC PROCEDURES - OPERATIVE

Operative treatment is indicated when the natural history of surgically treated lesions is better than the natural history for non-operatively treated lesions. All patients being considered for surgical intervention should first undergo a comprehensive neuro-musculoskeletal examination to identify mechanical pain generators that may respond to non-surgical techniques or may be refractory to surgical intervention.

1. NON-VASCULAR (DIAGNOSTIC CRITERIA FOR SURGICAL PROCEDURES):

a. True or Classic Neurogenic TOS:

- i. Clinical: at least two consistent clinical sign plus symptoms consistent with TOS (Refer to Section D. 1. c. i, Initial Diagnostic Procedures).
- ii. Neurophysiologic: meets criteria for neurogenic TOS (Refer to Section E, Follow-up Diagnostic Imaging and Testing Procedures).

b. Non-specific Neurogenic TOS (also called disputed):

- i. Clinical: at least three consistent clinical signs plus symptoms consistent with TOS (Plewa M, 1998) refer to discussion in Section D. 1., c, i, Initial Diagnostic Procedures and alternative diagnoses have been explored and tests are negative.
- ii. Neurophysiologic: may have normal EMG/NCV or a pattern not meeting criteria in EMG section.

c. Pectoralis Minor Syndrome without TOS:

Compression of the neurovascular bundle by the pectoralis muscle. This syndrome, described by a few authors, is usually caused by neck or shoulder trauma and generally resolves with physical therapy.

- i. Clinical: Patients do not meet criteria for non-specific or true TOS. They generally have pain over the anterior chest wall near the pectoralis minor and into the axilla, arm, and forearm. They may complain of paresthesia or weakness, and have fewer complaints of headache, neck or shoulder pain. On physical exam there is tenderness with palpation over the pectoralis minor and in the axilla which reproduces the patient's symptoms in the arm. Disabling symptoms have been present for more than 3 months despite active participation in an appropriate therapy program and alternative diagnoses have been explored and tests are negative.
- ii. Neurophysiologic and other diagnostic tests: EMG/NCV studies may show medial antebrachial cutaneous nerve changes compared to the normal side. The axillary vein may show some occlusion. Pectoralis minor block should be positive.

d. Non-surgical Diagnosis for Possible TOS:

- i. Clinical: inconsistent clinical signs plus symptoms of TOS for more than 3 months and alternative diagnoses have been explored and tests are negative.
- ii. Neurophysiologic: may have normal EMG/NCV studies.

2. SURGICAL INDICATIONS:

- a. Early surgical intervention should be performed if there is:
 - i. Documented EMG/NCV evidence of nerve compression with sensory loss, and weakness (with or without muscle atrophy) **or**
 - ii. Acute subclavian vein thrombosis or arterial thrombosis; or
 - iii. Subclavian artery aneurysm or stenosis secondary to a cervical or anomalous rib (Note: this condition is almost never work related.)
- b. After failed conservative therapy, the following criteria must be fulfilled:
 - i. True neurogenic or non-specific TOS: see criteria in the preceding subsection; and
 - ii. A positive upper limb tension test; and
 - iii. Failed 3 months of active participation in non-operative therapy including worksite changes; and
 - iv. Disabling symptoms interfering with work, recreation, normal daily activities, sleep; and
 - v. Pre-surgical psychiatric or psychological clearance has been obtained, demonstrating motivation and long-term commitment without major issues of secondary gain or other psychological contraindications for surgery, and with an expectation that surgical relief of pain probably would improve the patient's functioning.
- c. Even if return to their prior job is unlikely, an individual may need surgical intervention to both increase activities-of-daily living and/or return-to-work in a different job.
- d. It is critically important that all other pathology, especially shoulder disorders, be treated prior to surgical intervention for TOS.
- e. Smoking may affect soft tissue healing through tissue hypoxia. Patients should be strongly encouraged to stop smoking and provided with appropriate counseling.
- f. Prior to surgical intervention, the patient and treating physician should identify functional operative goals and the likelihood of achieving improved ability to perform activities of daily living or work activities. The patient should agree to comply with the pre- and post-operative treatment plan including home exercise

requirements. The patient should understand the amount of post operative therapy required and the length of partial and full disability expected post operatively.

3. SURGICAL PROCEDURES:

Since the success rates for the various surgical procedures are similar, the Division suggests that the surgeon performing the procedure use the technique with which the surgeon has the most experience and is most appropriate for the patient.

No controlled quality literature on surgical outcome for non-specific neurogenic TOS has been published. Uncontrolled case series suggest some improvement in symptoms in the majority of patients (Ellison D, 1994; Balci A, 2003; Lindgren K, 1995; Bhattacharya B, 2003; Landry G, 2001; Green R, 1991; Jamieson WG, 1996.). In one study of workers' compensation patients operated on for TOS, work disability was reported to be 60% at one year. Other pathologies were commonly diagnosed in this population. Comorbid conditions of the shoulder, cervical spine, and carpal tunnel should be treated or ruled out before surgery is considered (Franklin G, 2000). Reported repeat surgery rates vary between approximately 10% and 30% (Atasoy E, 2004; Novak C, 2002; Altobelli GG, Green R, 1991). Some literature contends that patients with non-specific TOS treated conservatively have similar long-term outcomes as those treated with surgery (Landry G, 2001). Complications and/or unsatisfactory outcomes are reportedly in the range of 15 to 20% (Atasoy E, 2004; Franklin G, 2000; Degeorges R, 2004; Balci A, 2003).

Acknowledged complications depend on the procedure and include complex regional pain syndrome; Horner's syndrome; permanent brachial plexus damage; phrenic, intercostal brachial cutaneous or long thoracic nerve damage; and pneumothorax (Degeorges R, 2004).

Vascular TOS procedures include resection of the abnormal rib and repair of the involved vessel. Anticoagulation is required for thrombotic cases.

- a. First rib resection.
- b. Anterior and middle scalenectomy.
- c. Anterior scalenectomy.
- d. Combined first rib resection and scalenectomy.
- e. Pectoralis minor tenotomy. This procedure is done under local anesthesia, normally in an out-patient setting for patients meeting the criteria for pectoralis minor syndrome.

4. POST-OPERATIVE TREATMENT

Individualized rehabilitation programs based upon communication between the surgeon and the therapist.

- a. Generally, progressive resistive exercises no earlier than 2 months post-operatively with gradual return to full activity at 4 to 6 months.
- b. Return-to-work and restrictions after surgery may be made by an experienced primary occupational medicine physician in consultation with the surgeon or by the surgeon. Depending upon the patient's functional response and their job

requirements, return-to-work with job modifications may be considered as early as one week post operatively. The employer must be able to fully accommodate restrictions of overhead activities or heavy lifting. Work restrictions should be evaluated every 4 to 6 weeks during post-operative recovery and rehabilitation, with appropriate written communications to both the patient and the employer.

- c. Should progress plateau, the provider should re-evaluate the patient's condition and make appropriate adjustments to the treatment plan.
- d. Post-operative therapy will frequently require a repeat of the therapy provided pre-operatively. Refer to Section F. Therapeutic Procedures, Non-operative, and consider the first post-operative visit as visit number one for the time frame parameters provided.
- e. Refer to the following areas in the non-operative therapeutic section for post-operative time parameters.
 - ❖ Activities of daily living.
 - ❖ Functional activities.
 - ❖ Nerve gliding.
 - ❖ Neuromuscular re-education.
 - ❖ Therapeutic exercise.
 - ❖ Proper work techniques: Refer to section E. Jobsite Evaluation, and Section F. Return-to-Work of these guidelines.
 - ❖ Limited passive therapies may be appropriate in some cases.