

RULE 17, EXHIBIT 3

Thoracic Outlet Syndrome

Medical Treatment Guidelines

Revised: September 29, 2005

Effective: January 1, 2006

Adopted: January 9, 1995

Effective: March 2, 1995

Revised: January 8, 1998

Effective: March 15, 1998

Presented by:

State of Colorado
Department of Labor and Employment
DIVISION OF WORKERS' COMPENSATION



TABLE OF CONTENTS

SECTION	DESCRIPTION	PAGE
A. INTRODUCTION		1
B. GENERAL GUIDELINE PRINCIPLES		2
1. APPLICATION OF GUIDELINES		2
2. EDUCATION.....		2
3. TREATMENT PARAMETER DURATION.....		2
4. ACTIVE INTERVENTIONS.....		2
5. ACTIVE THERAPEUTIC EXERCISE PROGRAM		2
6. POSITIVE PATIENT RESPONSE		2
7. RE-EVALUATE TREATMENT EVERY 3-4 WEEKS		3
8. SURGICAL INTERVENTION.....		3
9. SIX-MONTH TIME FRAME.....		3
10. RETURN-TO-WORK		3
11. DELAYED RECOVERY		3
C. DEFINITION.....		4
D. INITIAL DIAGNOSTIC PROCEDURES		5
1. HISTORY TAKING AND PHYSICAL EXAMINATION (Hx & PE).....		5
a. History Taking.....		5
b. Physical Findings.....		5
c. Cervical Spine X-ray		7
E. FOLLOW-UP DIAGNOSTIC IMAGING AND TESTING PROCEDURES.....		8
1. CERVICAL CT OR MRI (Computed Axial Tomography/Magnetic Resonance Imaging)		8
2. ELECTRODIAGNOSTIC STUDIES		8
a. Electromyography/Nerve Conduction Velocities (EMG/NCV).....		8
b. Quantitative Sensory Testing (QST).....		8
3. VASCULAR STUDIES		9
4. THERMOGRAPHY		9
5. SCALENE MUSCLE BLOCKS.....		9
6. PERSONALITY/PSYCHOLOGICAL/PSYCHOSOCIAL EVALUATIONS		9
F. THERAPEUTIC PROCEDURES		10
1. NON-OPERATIVE TREATMENT PROCEDURES		10
a. Physical Medicine and Rehabilitation		10
2. OPERATIVE TREATMENT PROCEDURES		13
a. Diagnostic Criteria for Surgical Procedures.....		13
b. Surgical Procedures		14
c. Surgical Indications.....		14
d. Return to Work – Time		15
3. POST-OPERATIVE TREATMENT.....		15
a. Physical Medicine and Rehabilitation		15
b. Biofeedback.....		17
c. Reactivation and Reconditioning		17
d. Work Simulation Modalities		18
e. Psychosocial Intervention		19
f. Vocational Rehabilitation		19
g. Vocational Assessment		19
h. Interdisciplinary Team Approach Interventions		19

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 text is 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. 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 GUIDELINE PRINCIPLES

The principles summarized in this section are key to the intended implementation of these 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 judgement 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** 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** Positive results are defined primarily as functional gains which can be objectively measured. Objective functional gains include, but are not limited to, positional tolerances, range-of-motion, strength, endurance, activities of daily living, cognition, psychological behavior, and efficiency/velocity measures which 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 3-4 WEEKS** If a given treatment or modality is not producing positive results within 3-4 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** Surgery 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 condition(s).
9. **SIX-MONTH TIME FRAME** Since 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 which do not involve work-time loss or are not occupationally related.
10. **RETURN-TO-WORK** Even if there is residual chronic pain, return-to-work is not necessarily contraindicated. Return-to-work may be therapeutic, assuming the work is not likely to aggravate the basic problem or increase long-term pain. The practitioner must write detailed restrictions when returning a patient to limited duty. The following functions 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. The patient should never be released to "sedentary or light duty" without specific physical limitations. The practitioner must 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 6-12 weeks after an injury. The Division recognizes that 3-10% of all industrially injured patients will not recover within the timelines outlined in this document despite optimal care. Such individuals may require treatment 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.

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

C. DEFINITION OF THORACIC OUTLET SYNDROME

Thoracic Outlet Syndrome (TOS) is felt to be 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. It should be emphasized that occupational TOS is a relatively uncommon disorder and other disorders with similar symptomatology need to be ruled out.

Because of the frequency of TOS being diagnosed in the workplace in Colorado and the clinical and financial factors that result, these guides are to be used in the evaluation and treatment of occupational TOS. The most commonly associated history before the development of TOS is acute trauma where hyperextension of the neck occurs, usually the result of a motor vehicle accident (MVA) and a resultant "whiplash" injury. Since approximately 19% of occupational spinal cord injuries are from MVAs, this may also be a common cause of TOS from a work-related injury.

The majority of occupations resulting in TOS are probably related to tasks requiring repetitive activities and awkward postures. Although little published literature exists regarding TOS as an occupational disorder, at-risk occupations include workers on assembly lines with repetitive head motions and keyboard work (e.g. typewriter, computer, adding machine). A common factor in the development of TOS in these occupations is that the workers' hands are fixed to a keyboard or machine. When attempting to talk to others in the work area or talk on the telephone, or when looking from copy to monitor to keyboard, in a suboptimal ergonomic worksite. The worker must extend his/her neck in various directions in order to keep the hands in a fixed position. When working on an assembly line, the worker must look up or down for the next item. The result probably is small neck traumata which eventually lead to scalene muscle stretching, fibrosis, and nerve compression, since the nerves of the brachial plexus are normally in contact with these muscle fibers.

D. INITIAL DIAGNOSTIC PROCEDURES

1. **HISTORY TAKING AND PHYSICAL EXAMINATION (Hx & PE)** are generally accepted, well-established and widely used procedures which establish the foundation/basis for and dictate all other following stages of 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.

- a. **History Taking:**

- i. Occupational relationship: activities requiring fixed upper extremity positions and extension of the neck should be documented.
 - ii. History of nonoccupational injury and avocational pursuits needs to be specifically documented.
 - iii. Symptoms Positive to TOS:
 - A) Neck pain: often first symptom within few days of injury.
 - B) Occipital headaches: also an early symptom
 - C) Arm pain.
 - D) Numbness and paresthesia in arm hand and fingers:
 - 1) all 5 fingers: most common pattern
 - 2) 4th and 5th digits: next most common pattern
 - 3) 1st, 2nd and 3rd digits: may occur, but must rule out carpal tunnel syndrome
 - E) Upper extremity weakness: arm and/or hand; "dropping things" is a common complaint
 - F) Exacerbating factor: elevating arms; common complaints are trouble combing hair, driving car, etc.
 - G) Intermittent symptoms: if constant symptoms, consider diagnosis of brachial plexus injury, "true neurogenic" TOS

- b. **Physical Findings:**

- i. Physical Examination Signs Positive in TOS:
 - A) Tenderness over scalene muscles in supraclavicular area

- B) Pressure in supraclavicular area elicits symptoms in arm/hand
 - C) Tinel's sign over brachial plexus is positive
 - D) 90° Abduction External Rotation (AER) test*: While the radial pulse may or may not disappear, this is not important. Duplication of the patient's symptoms of pain and paresthesia in hand and arm are characteristic. (* The 90° AER test is a modified Adson's position test, with the test performed with the arm abducted 90° and in external rotation. There are other test positions which purport to evaluate neurovascular compromise. The best known position is the Adson's, however, many patients with TOS do not have alteration of their radial pulse with any of these maneuvers and many normals will have reduced pulses with positional testing. Neurovascular testing is not felt to be reliable in establishing the diagnosis of TOS.)
 - E) Head Tilting: lateral flexion of the neck (ear to shoulder) causes radiating pain and paresthesia in the contralateral shoulder and sometimes in the arm and hand.
 - F) Neurologic Examination: usually normal, but may be abnormal
 - 1) Sensory exam: may show decreased sensation to light touch, pin and temperature in lower brachial plexus distribution.
 - 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.
- ii. Clinical Prognosis: if the patient has unilateral symptoms, positive physical findings on the ipsilateral side strongly support the diagnosis of TOS. In patients with bilateral symptoms, positive scalene muscle tenderness and a positive response to 90° in abduction and external rotation can still support the diagnosis, but, it is not as strong as in the unilateral situation.
- iii. Physical findings suggest other disorders to consider:
- A) Neck rotation may or may not be restricted; present in many conditions.
 - B) Rotator cuff/acromioclavicular (AC) joint tenderness; suggests rotator cuff or biceps tendinitis or AC joint disease.
 - C) Trapezius muscle, shoulder girdle muscles or paraspinal muscle tenderness suggests myofascial component.

- D) Tinel's sign and/or Phalen's sign at wrist suggests carpal tunnel syndrome.
 - E) Tinel's sign at elbow (over ulnar groove) suggests ulnar nerve entrapment.
 - F) Tinel's sign over pronator or radial tunnel, when positive, suggests nerve compression.
- c. **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 asymmetric diminished pulse in an arm that is symptomatic. Routine roentgenographic evaluation of the cervical spine in the primary care setting provides little significant information.

E. FOLLOW-UP DIAGNOSTIC IMAGING AND TESTING PROCEDURES

1. **CERVICAL COMPUTED AXIAL TOMOGRAPHY OR MAGNETIC RESONANCE IMAGING (CT/MRI)**

IMAGING (CT/MRI) are a generally accepted, well-established procedures indicated to rule out cervical disc or other cervical spine disorders when clinical findings suggest these diagnoses. MRI is the preferred test over a CT unless a fracture is suspected, then CT may be superior to MRI. CT/MRI is not indicated early unless there is a neurological deficit. Either CT or MRI should be done, not both. Repeat cervical CT/MRI is never indicated. 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.1, Non-Operative Procedures should be done for at least 8-12 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. Most cases of TOS have normal electrodiagnostic studies, but EMG/NCV should be considered when symptoms have been present for approximately 3 months or failed 8 weeks of conservative therapy. EMG/NCV may also be performed to rule out other disorders. Criteria for Neurogenic TOS:

- i. Reduction of the ulnar sensory nerve action potential to digits; or
- ii. Reduction of the median M-wave amplitude; or
- iii. Prolongation of ulnar F-wave latencies; or
- iv. Needle EMG examination reveals neurogenic changes in intrinsic hand muscles.

b. **Quantitative Sensory Testing (QST)**: is not generally accepted and has limited use. Research is not currently available on the use of QST in the evaluation of TOS, but the use of QST may be useful in ruling out other nerve entrapments of the upper extremity. Studies in peripheral neuropathy and carpal tunnel syndrome show these studies to be more sensitive than EMG/NCV in detecting subtle nerve injuries; however, these studies are not as localizing as EMG/NCV). QST may be considered when all other studies are negative. Types of QST are

- i. Vibration Perception Thresholds
- ii. Thermal Perception Thresholds
- iii. Current Perception Thresholds

QST is not essential in the evaluation of TOS, but may be a useful, cost-effective method of screening for nerve injuries of the upper extremities or in those cases where conventional EMG/NCV is normal.

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 much to the diagnosis. Procedures that include vascular laboratory studies, duplex scanning, Doppler studies and arteriography are not cost effective in cases of neurogenic TOS. These studies are only indicated in patients who have arterial occlusive symptoms.
4. **THERMOGRAPHY** is not generally accepted or widely used for TOS. In experienced evaluators, "stress" thermography, done while having a patient perform the 90° AER test, may be a useful tool in evaluating some cases of TOS if surgery is being considered. It may be used if differential diagnosis includes RSD; in such cases refer to the Division's Complex Regional Pain Syndrome/Reflex Sympathetic Dystrophy Medical Treatment Guidelines.
5. **SCALENE MUSCLE BLOCKS** are useful only for diagnosis, not for treatment.
 - ❖ Time to produce effect: 2-5 minutes
 - ❖ Duration or effect: 20-30 minutes
 - ❖ Frequency: 1

The interscalene block, sometimes used to treat TOS, is a brachial plexus block and is not indicated to treat or diagnose neurogenic TOS. Repeated blocks are not indicated for therapy.

6. **PERSONALITY/PSYCHOLOGICAL/PSYCHOSOCIAL EVALUATIONS** are generally accepted and well-established diagnostic procedures with selected use in the acute TOS population, but have more widespread use in the subacute and chronic TOS population. These procedures may be useful for patients with delayed recovery, chronic pain, recurrent painful conditions, suspected concomitant closed head injury, disability problems and pre-operative evaluation, as well as a possible predictive value for post-operative response. Results may provide clinicians with a better understanding of the patient, thus allowing for more effective rehabilitation. Formal psychological or psychosocial screening should be performed on patients not making expected progress within 6-12 weeks following injury and whose subjective symptoms do not correlate with clinical signs and tests as outlined in Section D, Initial Diagnostic Procedures. This testing will determine the need for further psychosocial interventions. Evaluations should be performed by an individual with Ph.D., Psy.D., L.S.W. or Psychiatric M.D./D.O. credentials. Initial psychological screening is generally completed within one hour. If psychometric testing is indicated as a portion of the initial screening process, the time for such testing should not exceed an additional two hours of professional time.

F. THERAPEUTIC PROCEDURES

1. **NON-OPERATIVE TREATMENT PROCEDURES** Work site analysis should be done early in all cases. Most cases are treated conservatively first for a minimum of 3 months.
 - a. **Physical Medicine and Rehabilitation:** It is understood that patients undergoing therapeutic procedures may return to modified or restricted duty during their rehabilitation, at the earliest appropriate time. It is also understood that 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.
 - i. **Work site Analysis:** should be performed by a qualified individual in all cases of suspected occupational TOS unless previously performed. 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. Work activities need to be modified early in treatment to avoid exposing the patient to these ergonomic risk factors while trying to treat symptoms.
 - ii. **Neck and Thoracic Stretching Exercises:** are primarily a daily home program developed and supervised by an appropriately trained professional. Stretching exercises should include the following muscle groups: scalene, pectoralis minor, trapezius and levator scapulae. A patient should attend therapy for up to 4 weeks, then be seen once a week thereafter. Most patients will need to continue to be monitored and progressed in their activities for another 4-8 weeks or until they are able to return to the same level of duties or activities prior to symptom onset.
 - ❖ Time to produce effect: 2-3 weeks
 - ❖ Frequency: 3 times/week for first 2 weeks; 2 times/week for second two weeks; 1 time/week for weeks 4-6
 - ❖ Optimum duration: 6-8 weeks
 - ❖ Maximum duration: 3 months under supervision to assure compliance, then indefinitely on an independent home program as long as symptoms persist.
 - iii. **Exercise:** Unless confined to the lower extremities do not do endurance or strengthening early in the course of therapy and do not exacerbate cervical or upper extremity symptoms. Endurance and strengthening activities may be contraindicated early on. If the patient becomes asymptomatic for 2 weeks, standard endurance and strengthening exercises may begin.

- ❖ Time to produce effect: 2-4 weeks
 - ❖ Frequency: 3-4 times/week
 - ❖ Optimum duration: 4-6 weeks
 - ❖ Maximum duration: 3 months
- iv. Abdominal Breathing, Postural Exercises (Re-education): are part of an overall therapy program and should be primarily a home program supervised by qualified therapist.
- ❖ Time to produce effect: 2-4 weeks
 - ❖ Frequency: 3-4 times/week
 - ❖ Optimum duration: 4-6 weeks
 - ❖ Maximum duration: 3 months under supervision to assure compliance, then indefinitely on an independent home program as long as symptoms persist.
- v. Biofeedback: is the use of physiological monitoring equipment to:
- A) Improve the patient's awareness to, and control of muscle activity (to include a variety of muscle placements that are related to the symptoms and/or areas of entrapment);
 - B) Reinforce the release of muscle tension that is being obtained from stretches, exercises, and abdominal breathing for the purpose of decreasing sympathetic arousal that is associated with stress;
 - C) Improve the patient's ability to feel like they can affect their physical responses and symptoms;
 - D) Assist in avoiding reinjury through the individual returning to repetitive movement and bracing patterns; or
 - E) Prepare for surgery.

Treatment time may or may not overlap return-to-work or maximum medical improvement (MMI).

- ❖ Time to produce effect: 3-4 sessions
- ❖ Frequency: 1-2 times/week
- ❖ Optimum duration: 5-6 sessions

- ❖ Maximum duration: 10-12 sessions
- vi. Medications: usually include narcotics, minor tranquilizers/muscle relaxants, nonsteroidal anti-inflammatory drugs (NSAIDs), non-narcotic analgesics, and hypnotic/sedatives including antidepressants (refer to the Division's Carpal Tunnel Syndrome Medical Treatment Guidelines, for details on medication recommendations).
- vii. Education in correct body mechanics: sleep postures, activities of daily-living and work-station design is important to prevent re-injury.
- viii. Injections:
 - A) Scalene blocks have no role in the treatment of TOS; use as a diagnostic tool only as indicated in Section E, Follow-up Diagnostic Imaging and Testing Procedures.
 - B) Trigger point injections are generally accepted well-established procedures and of value in treating a coexisting myofascial pain syndrome, which may be contributing to some of the symptoms that the patient is experiencing. 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 a six-week time frame. However, trigger point injections may occasionally be effective when utilized in the patient with immediate, acute onset of upper extremity complaints. Injection efficacy can be enhanced if injections are immediately followed by myofascial therapeutic interventions, such as vapocoolant spray and stretch, ischemic pressure massage (myotherapy), specific soft tissue mobilization and hot packs. Potential, but rare, complications of trigger point injections include infection, anaphylaxis, neuroapraxia and neuropathy. As with the therapeutic blocks discussed above, trigger point injections should be utilized primarily for the purpose of facilitating functional progress. Muscles requiring injection should not be aggressively exercised until post-injection soreness resolves and/or the trial of injections has been completed. However, patients should continue in an aggressive aerobic and stretching therapeutic exercise program as tolerated throughout the time period they are undergoing intensive myofascial interventions.
 - ❖ Frequency: weekly, suggest no more than 4 injection sites per session per week to avoid significant post-injection soreness

- ❖ Optimum duration: 4 weeks
 - ❖ Maximum duration: 8 weeks; occasional patient may require 2-4 repetitions of trigger point injection series over a 1-2 year period
- ix. Manual Therapy Techniques: such as soft tissue and vertebral mobilization/manipulation techniques, may be used as adjunctive therapy to improve thoracic mobility and relieve pain.
 - ❖ Time to produce effect: 2-3 visits
 - ❖ Frequency: 1-3 times/week
 - ❖ Optimum duration: 6-12 weeks
 - ❖ Maximum duration: 12 weeks
- x. Work Restrictions: are prescribed to get the patient back to work with modified activities which will not aggravate the conditions. It is important to note that these work restrictions would also be applicable during the time that the patient is undergoing conservative treatment. Patients with occupational TOS seldom miss any work time, since most patients will respond with the restrictions below, ergonomic adaptation, and ongoing therapy including an independent home program. It is also important to reemphasize that TOS is an uncommon occupational disorder.
Suggested work restrictions include:
 - No repetitive reaching
 - No reaching above shoulder level or into hyperextension
 - No lifting more than 10-15 pounds
 - No repetitive or postural cervical hyperextension
 - No shoulder drooped or head forward postures, e.g., looking into a monitor positioned too low, etc.
 - Frequent changes in activities

2. OPERATIVE TREATMENT PROCEDURES

a. Diagnostic Criteria for Surgical Procedures:

- i. Definite TOS:

- A) Clinical: at least two consistent clinical sign plus symptoms consistent with TOS (see discussion in Section D, Initial Diagnostic Procedures).
 - B) Neurophysiologic meets criteria for neurogenic TOS (refer to Section E, Follow-up Diagnostic Imaging and Testing Procedures).
- ii. Probable TOS:
 - A) Clinical: at least four consistent clinical signs plus symptoms consistent with TOS refer to discussion in Section D, Initial Diagnostic Procedures.
 - B) Neurophysiologic: may have normal EMG/ NCV studies.
 - iii. Possible TOS:
 - A) Clinical: inconsistent clinical signs plus symptoms of TOS for more than 3 months.
 - B) Neurophysiologic: may have normal EMG/ NCV studies.

b. Surgical Procedures Used:

- i. First rib resection
- ii. Anterior and middle scalenectomy
- iii. Anterior scalenectomy
- iv. Combined first rib resection and scalenectomy

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. Complications are felt to be slightly higher for first rib resection than for scalenectomy, RSD is a potential complication of any TOS surgery. No good research is available to establish numbers.

c. Surgical Indications:

- i. Early surgical intervention should only be performed if there is:
 - A) Documented EMG/NCV evidence of nerve compression with sensory loss, weakness (with or without muscle atrophy) **or**
 - B) Acute subclavian vein thrombosis or arterial thrombosis.
- ii. After failed conservative therapy, the following criteria must be fulfilled:

- A) For definite or probable TOS see the preceding subsection, and
 - B) Failed 3 months of conservative therapy, and
 - C) Disabling symptoms interfering with work, recreation, normal daily activities, sleep, and
 - D) Pre-surgical psychiatric or psychological clearance has been obtained, demonstrating motivation and long-term commitment without major issues of secondary gain and with an expectation that surgical relief of pain probably would improve the patient's functioning.
- iii. Even if return to their prior job is unlikely, an individual may need surgical intervention for both increasing activities-of-daily-living and/or return to work in a different job.
 - iv. It is critically important that all other pathology, especially shoulder disorders, be treated prior to surgical intervention for TOS.

d. **Return-to-Work- Time:**

- i. Modified duty in 2 months.
- ii. Full duty with changes outlined previously in 6 months.

3. **POST-OPERATIVE TREATMENT**

a. **Physical Medicine and Rehabilitation:**

- i. Work site Analysis: should be performed by a qualified individual in all cases of suspected occupational TOS unless previously performed. 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. Work activities need to be modified prior to return to work to avoid exposing the patient to these ergonomic risk factors.
- ii. Neck and Thoracic Stretching Exercises: are primarily a daily home program developed and supervised by an appropriately trained professional. Stretching exercises should include the following muscle groups: scalene, pectoralis minor, upper trapezius and levator. A patient should attend therapy for up to four weeks, then be seen once a week thereafter. Most patients will need to continue to be monitored and progressed in their activities for another 4-8 weeks or until they are able to return to the same level of duties or activities prior to symptom onset.

❖ Time to produce effect: 2-3 weeks

- ❖ Frequency: 3 times/week for first 2 weeks; 2 times/week for second 2 weeks; 1 time/week for weeks 4-6
 - ❖ Optimum duration: 6-8 weeks
 - ❖ Maximum duration: 3 months to assure compliance
- iii. Exercise: Unless confined to the lower extremities do not do endurance or strengthening early in the course of therapy and do not exacerbate cervical or upper extremity symptoms. Endurance and strengthening activities may be contraindicated early on. If the patient becomes asymptomatic for 2 weeks, standard endurance and strengthening exercises may begin.
 - ❖ Time to produce effect: 2-4 weeks
 - ❖ Frequency: 3-4 times/week
 - ❖ Optimum duration: 4-6 weeks
 - ❖ Maximum duration: 3 months
- iv. Abdominal Breathing, Postural Exercises (Re-education): are part of an overall therapy program and should be primarily a home program supervised by qualified therapist.
 - ❖ Time to produce effect: 2-4 weeks
 - ❖ Frequency: 3-4 times/week
 - ❖ Optimum duration: 4-6 weeks
 - ❖ Maximum duration: 3 months
- v. Home Program Instruction for Persistent Symptoms: Symptoms which persist without improvement 3 weeks post-operatively may indicate referral to a therapy program which includes home program instruction. The therapy program should include elements of soft tissue healing and return to function as indicated:
 - A) Soft tissue healing/remodeling: Evaluation, electrical stimulation, soft tissue mobilization, scar compression pad, heat/cold application, or edema control may be used as indicated. Ultrasound may be considered after 6 weeks post-operative for soft tissue remodeling. Diathermy is a non-acceptable adjunct.
 - B) Return to function: Range of motion and stretching exercises, strengthening, activities of daily living adaptations, joint protection instruction, posture/body mechanics education, and work site modifications may be as indicated:

- ❖ Time to produce effect: 2-4 weeks
- ❖ Frequency: 2-3 times/week
- ❖ Optimum duration: 4-6 weeks
- ❖ Maximum duration: 8 weeks

b. **Biofeedback:** is the use of physiological monitoring equipment to:

- i. Improve the patient's awareness and control of muscle activity to include a variety of muscle placements that are related to the symptoms and/or areas of entrapment;
- ii. Reinforce the release of muscle tension that is being obtained from stretches, exercises, and abdominal breathing;
- iii. Decrease sympathetic arousal that is associated with stress;
- iv. Improve the patient's ability to feel like they can effect their physical responses and symptoms; and
- v. Assist in avoiding re-injury through the individual returning to repetitive movement and bracing patterns

Treatment time may or may not overlap return-to-work or MMI.

- ❖ Time to produce effect: 3-4 sessions
- ❖ Frequency: 1-2 times/week
- ❖ Optimum duration: 5-6 sessions
- ❖ Maximum duration: 10-12 sessions

c. **Reactivation and Reconditioning:** are generally accepted, well-established and widely used modalities which should be included in any standard therapeutic exercise program, see Section G. Non-Operative Treatment Procedures of the Division's Shoulder Injury Medical Treatment Guidelines.

- i. Reactivation implies returning the patient to a higher level of activity than was previously utilized during the disabling episode; conducted in the form of encouragement of activities with limited supervised training (walking, stationary bicycle, etc.)
 - ❖ Time to produce effect: 2-4 visits
 - ❖ Frequency: Supervised 2-5 times/week for first 2 weeks, decreasing to 2-3 times/week

- ❖ Optimum duration: 4-6 weeks
 - ❖ Maximum duration: 2 months
- ii. Supervised Reconditioning/Therapeutic Exercise is considered more specific therapeutic exercise involving activation, strength/stabilization training, and endurance/agility training of the injured body parts and used only in the presence of documented physical deficit. In non-surgical cases of upper extremity pain, the Division recommends initiation of a supervised reconditioning program and implementation of a less-active treatment plan if:
 - A) The patient has not demonstrated objective carry over and benefit from an assigned home exercise program; or
 - B) The patient has not objectively progressed within a preceding 3 week period; or
 - C) The patient has not been released to return to full duty or modified work within 3 weeks.

This does not preclude an earlier implementation of an active, supervised reconditioning program:

- ❖ Time to produce effect: 2-6 weeks
- ❖ Frequency: 2-6 times/week supervised for the first 3-4 weeks, decreasing to 2-4 times/week thereafter
- ❖ Optimum duration: 4-6 weeks
- ❖ Maximum duration: 2 months, exclusive of intervening medical complications
- ❖ A self-monitored program with periodic monitoring is recommended thereafter.

- d. **Work Simulation Modalities:** are generally accepted, well-established and widely used. They are simulated activities of daily living including those generally performed by disabled workers in the work place. If placement at modified duty at the work place is unavailable, work simulation should run concurrently or sequentially based upon analysis of physical capacity and job analysis:

- ❖ Time to produce effect: 1-3 weeks
- ❖ Frequency: 2-5 times/week
- ❖ Optimum duration: 2-3 weeks
- ❖ Maximum duration: 3-6 weeks

Work simulation is generally followed either by work hardening, return to work, or a combination thereof, see this Section 1 H,I, Work Hardening, for further discussion.

- e. **Psychosocial Intervention:** is generally accepted, widely used and well-established. This group of therapeutic and diagnostic modalities includes, but is not limited to, individual counseling, group therapy, stress management, psychosocial crisis intervention, biofeedback, hypnosis and meditation. Any screening 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 which should be implemented as soon as the problem is identified. This could be used in conjunction with other treatment modalities:
- ❖ Time to produce effect: 2-4 weeks
 - ❖ Frequency: 1-3 time/week (excluding hospitalization, if required) for the first 4 weeks, decreasing to 1-2 times/week for the second month
 - ❖ Optimum duration: 6-10 weeks
 - ❖ Maximum duration: 6-12 months
- Occasionally, longer supervised treatment may be required, but if further counseling beyond 6 months seems 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 practitioner every 4-6 weeks.
- f. **Vocational Rehabilitation:** is a generally accepted intervention, but Colorado limits its use by statute. Initiation of vocational rehabilitation requires adequate evaluation of patients for quantification of highest functional level, motivation and achievement of MMI. Vocational rehabilitation may be as simple as returning to the original job or as complicated as being retrained for a new occupation.
- g. **Vocational Assessment:** once an authorized practitioner has reasonably determined and objectively documented that a patient will not be able to return to his/her former employment, can reasonably prognosticate final restrictions and date of MMI, implementation of a timely vocational assessment can provide valuable guidance in the determination of future rehabilitation program design. Clarification of rehabilitation goals optimize both patient motivation and utilization of rehabilitation resources. Except in the most extenuating circumstances, this process should be implemented within 3-12 months post-injury at the latest, if prognosis for return to former occupation is determined to be guarded to poor. Declaration of Maximum Medical Improvement should not be delayed solely due to lack of attainment of a vocational assessment.
- h. **Interdisciplinary Team Approach Interventions:** are generally accepted, well-established and widely used. This approach includes work hardening programs,

functional restoration programs and pain clinics. In general, these programs are more comprehensive, time consuming and costly and are, therefore, appropriate for patients with greater levels of (perceived) disability, dysfunction, de-conditioning and psychological involvement. For upper extremity involvement, interdisciplinary teams should include a physical therapist or an occupational therapist.

- i. Work Hardening Programs: are generally more comprehensive than the work simulation and include education, reconditioning and specific work simulation with respect to task quality, quantity and intensity (for further discussion, reference this Section 3.D, Work Simulation). Work Hardening involving repetitive use of the upper extremity should be pursued cautiously for most TOS patients, as it may bring back symptoms (even post-surgically). The Division recommends the Commission for the Accreditation of Rehabilitation Facilities (CARF) eligibility and/or accreditation of work hardening programs for all facilities treating injured workers to assure that such programs meet certain standards involving program design and efficacy. Work hardening is generally initiated after reconditioning or functional restoration has been completed if 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. As discussed in this Section 3F& G, Vocational Rehabilitation and Vocational Assessment, identification of realistic vocational goals is essential for the successful completion of a work hardening program. Generally, work hardening programs entail a progressive increase in the number of hours per day that a patient completes work simulation tasks until the patient can tolerate a full work day:
 - ❖ Time to produce effect: 2-4 weeks
 - ❖ Frequency: 2-5 times/week
 - ❖ Optimum duration: 4-6 weeks
 - ❖ Maximum duration: 2-3 months
- ii. Functional Restoration Programs: are intended for patients with both physical de-conditioning and/or significant psychological and socioeconomic involvement. It encompasses work hardening, quantification of function, disability management, adjustment counseling and outcome review. The interdisciplinary team must consist of physicians and therapists working in a structured environment. The Division recommends an interdisciplinary team include physical therapy, occupational therapy and psychology or at least related supervised personnel addressing the physiologic, psychologic and ergonomic factors impacting a patient's upper extremity pain presentation. Regular, documented interdisciplinary team meetings to discuss patient progress and upgrade rehabilitation goals must be a part of any credible interdisciplinary approach. The Division recommends programs which

meet criteria consistent with those for work hardening established by CARF. In non-surgical upper extremity pain patients with evidence of delayed recovery, the Division strongly recommends referral to an interdisciplinary/functional restoration program within three months post-injury.

- ❖ Time to produce effect: 4-6 weeks
- ❖ Frequency: 2-6 times/week
- ❖ Optimum duration: 6-12 weeks
- ❖ Maximum duration: 4 months

iii Pain Clinics: have been the traditional rehabilitation program for chronically disabled upper extremity patients who have not responded to functional restoration interventions. In general, pain clinics deal with irreversible, painful neurological disorders and psychological issues, including drug dependence, high levels of stress and anxiety, failed surgery and pre-existing or latent psychopathology. The Division recommends CARF eligibility and/or accreditation of pain clinics treating injured workers to assure that such programs meet certain standards involving program design and efficacy. The Division also recommends consideration of referral to a pain clinic within 6 months post-injury in those patients with delayed recovery unless surgical interventions or other medical complications intervene. It may be useful in determining the appropriateness of referral to a pain clinic to consider the Colorado Foundation for Medical Care's "Criteria for Outpatient (or Inpatient) Management of Chronic Pain."

- ❖ Time to produce effect: 3-8 weeks
- ❖ Frequency: 2-7 times/week for the first month, decreasing to 2-3 times/week thereafter
- ❖ Optimum duration: 6-12 weeks, including follow-up for outpatient pain clinics; 3-4 weeks for inpatient pain clinics
- ❖ Maximum duration: 4 months, including follow-up

Periodic review and monitoring on an as-needed basis is thereafter founded upon the documented maintenance of functional gains.