

### III. THORACIC OUTLET SYNDROME

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### III. THORACIC OUTLET SYNDROME

#### A. DEFINITION:

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.

#### B. 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:
- 1) Occupational relationship: activities requiring fixed upper extremity positions and extension of the neck should be documented.
  - 2) History of nonoccupational injury and avocational pursuits needs to be specifically documented.
  - 3) 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:
- 1) 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) 90E 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 90E AER test is a modified Adson's position test, with the test performed with the arm abducted 90E 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 paraesthesia 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.
- 2) 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 90E in abduction and external rotation can still support the diagnosis, but, it is not as strong as in the unilateral situation.
- 3) 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.

### C. FOLLOW-UP DIAGNOSTIC IMAGING AND TESTING PROCEDURES:

1. Cervical CT or 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 Rule XVII, Exhibit E., Cervical Spine Injury Medical Treatment Guidelines. If a cervical spine disorder is not suspected, conservative therapy as indicated in this Section III., Therapeutic 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 Studies (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:

- 1) Reduction of the ulnar sensory nerve action potential to digits; or
- 2) Reduction of the median M-wave amplitude; or
- 3) Prolongation of ulnar F-wave latencies; or
- 4) 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

- 1) Vibration Perception Thresholds
- 2) Thermal Perception Thresholds
- 3) 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 90E 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 Division Rule XVII, Exhibit D., Reflex Sympathetic Dystrophy/Complex Regional Pain Syndrome Medical Treatment Guidelines.
  
5. **Scalene Muscle Blocks** are useful only for diagnosis, not for treatment.
  - a. Time to produce effect: 2-5 minutes
  - b. Duration or effect: 20-30 minutes
  - c. Frequency: 1The 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 this Section III., 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.

**D. THERAPEUTIC PROCEDURES:**

1. **Nonoperative Treatment Procedures:** Worksite 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.
    - 1) **Worksite 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.
    - 2) **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.
      - a) Time to produce effect: 2-3 weeks
      - b) Frequency: 3 times/week for first 2 weeks; 2 times/week for second two weeks; 1 time/week for weeks 4-6
      - c) Optimum duration: 6-8 weeks
      - d) Maximum duration: 3 months under supervision to assure compliance, then indefinitely on an independent home program as long as symptoms persist.
    - 3) **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.
      - a) Time to produce effect: 2-4 weeks
      - b) Frequency: 3-4 times/week

- c) Optimum duration: 4-6 weeks
- d) Maximum duration: 3 months
- 4) Abdominal Breathing, Postural Exercises (Reeducation) are part of an overall therapy program and should be primarily a home program supervised by qualified therapist.
  - a) Time to produce effect: 2-4 weeks
  - b) Frequency: 3-4 times/week
  - c) Optimum duration: 4-6 weeks
  - d) Maximum duration: 3 months under supervision to assure compliance, then indefinitely on an independent home program as long as symptoms persist.
- 5) 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 effect 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).

  - a) Time to produce effect: 3-4 sessions
  - b) Frequency: 1-2 times/week
  - c) Optimum duration: 5-6 sessions
  - d) Maximum duration: 10-12 sessions
- 6) Medications usually include narcotics, minor tranquilizers/muscle relaxants, nonsteroidal anti-inflammatory drugs (NSAIDs), non-narcotic analgesics, and hypnotic/sedatives, including antidepressants (refer to Section II., Occupational Carpal Tunnel Syndrome, for details on medication recommendations).
- 7) Education in correct body mechanics, sleep postures, activities-of-daily-living and work-station design is important to prevent re-injury.
- 8) Injections:
  - a) Scalene blocks have no role in the treatment of TOS; use as a diagnostic tool only as indicated in Section III., 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.

- 1) Frequency: weekly, suggest no more than 4 injection sites per session per week to avoid significant post-injection soreness
- 2) Optimum duration: 4 weeks
- 3) Maximum duration: 8 weeks; occasional patient may require 2-4 repetitions of trigger point injection series over a 1-2 year period

9) 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.

- a) Time to produce effect: 2-3 visits

- b) Frequency: 1-3 times/week
  - c) Optimum duration: 6-12 weeks
  - d) Maximum duration: 12 weeks
- 10) 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:
- a) No repetitive reaching
  - b) No reaching above shoulder level or into hyperextension
  - c) No lifting more than 10-15 pounds
  - d) No repetitive or postural cervical hyperextension
  - e) No shoulder drooped or head forward postures, e.g., looking into a monitor positioned too low, etc.
  - f) Frequent changes in activities

**2. Operative Treatment Procedures:**

- a. Diagnostic Criteria for Surgical Procedures:
  - 1) Definite TOS:
    - a) Clinical: at least two consistent clinical sign plus symptoms consistent with TOS (see discussion in Section III., Initial Diagnostic Procedures).
    - b) Neurophysiologic meets criteria for neurogenic TOS (refer to Section III., Follow-up Diagnostic Imaging and Testing Procedures).
  - 2) Probable TOS:
    - a) Clinical: at least four consistent clinical signs plus symptoms consistent with TOS, refer to discussion in Section III., Initial Diagnostic Procedures.
    - b) Neurophysiologic: may have normal EMG/ NCV studies.
  - 3) 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:
  - 1) First rib resection

- 2) Anterior and middle scalenectomy
- 3) Anterior scalenectomy
- 4) 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:

- 1) 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.
- 2) 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.
- 3) 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.
- 4) It is critically important that all other pathology, especially shoulder disorders, be treated prior to surgical intervention for TOS.

d. Return-to-Work Time:

- 1) Modified duty in 2 months.
- 2) Full duty with changes outlined previously in 6 months.

3. Post-Operative Treatment:

a. Physical Medicine and Rehabilitation:

- 1) Worksite 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.

- 2) 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.
  - a) Time to produce effect: 2-3 weeks
  - b) Frequency: 3 times/week for first 2 weeks; 2 times/week for second 2 weeks; 1 time/week for weeks 4-6
  - c) Optimum duration: 6-8 weeks
  - d) Maximum duration: 3 months to assure compliance
- 3) 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.
  - a) Time to produce effect: 2-4 weeks
  - b) Frequency: 3-4 times/week
  - c) Optimum duration: 4-6 weeks
  - d) Maximum duration: 3 months
- 4) Abdominal Breathing, Postural Exercises (Reeducation) are part of an overall therapy program and should be primarily a home program supervised by qualified therapist.
  - a) Time to produce effect: 2-4 weeks
  - b) Frequency: 3-4 times/week
  - c) Optimum duration: 4-6 weeks
  - d) Maximum duration: 3 months
- 5) 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 nonacceptable adjunct.
- b) Return to function: Range-of-motion and stretching exercises, strengthening, activity of daily living adaptations, joint protection instruction, posture/body mechanics education, and worksite modifications may be as indicated:
  - (1) Time to produce effect: 2-4 weeks
  - (2) Frequency: 2-3 times/week
  - (3) Optimum duration: 4-6 weeks
  - (4) Maximum duration: 8 weeks
- b. Biofeedback is the use of physiological monitoring equipment to:
  - 1) 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;
  - 2) Reinforce the release of muscle tension that is being obtained from stretches, exercises, and abdominal breathing;
  - 3) Decrease sympathetic arousal that is associated with stress;
  - 4) Improve the patient's ability to feel like they can effect their physical responses and symptoms; and
  - 5) Assist in avoiding reinjury through the individual returning to repetitive movement and bracing patterns
 Treatment time may or may not overlap return-to-work or MMI.
  - 1) Time to produce effect: 3-4 sessions
  - 2) Frequency: 1-2 time/week
  - 3) Optimum duration: 5-6 sessions
  - 4) 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 this guideline, Section IV.D., Shoulder Injury, Physical Medicine and Rehabilitation:
  - 1) 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.)
    - a) Time to produce effect: 2-4 visits
    - b) Frequency: Supervised 2-5 times/week for first 2 weeks, decreasing to 2-3 times/ week

c) Optimum duration: 4-6 weeks

d) Maximum duration: 2 months

2) 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 nonsurgical 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:

a) Time to produce effect: 2-6 weeks

b) Frequency: 2-6 times/week supervised for the first 3-4 weeks, decreasing to 2-4 times/week thereafter

c) Optimum duration: 4-6 weeks

d) 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:

1) Time to produce effect: 1-3 weeks

2) Frequency: 2-5 times/week

3) Optimum duration: 2-3 weeks

4) Maximum duration: 3-6 weeks

Work simulation is generally followed either by work hardening, return to work, or a combination thereof, see this Section III., 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:

- 1) Time to produce effect: 2-4 weeks
- 2) Frequency: 1-3 time/week (excluding hospitalization, if required) for the first 4 weeks, decreasing to 1-2 times/week for the second month
- 3) Optimum duration: 6-10 weeks
- 4) 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 MMI 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, deconditioning and psychological involvement. For

upper extremity involvement, interdisciplinary teams should include a physical therapist or an occupational therapist.

- 1) 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 III., 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 III., 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:
  - a) Time to produce effect: 2-4 weeks
  - b) Frequency: 2-5 times/week
  - c) Optimum duration: 4-6 weeks
  - d) Maximum duration: 2-3 months
- 2) Functional Restoration Programs are intended for patients with both physical deconditioning 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 nonsurgical 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.

- a) Time to produce effect: 4-6 weeks
- b) Frequency: 2-6 times/week
- c) Optimum duration: 6-12 weeks
- d) Maximum duration: 4 months

3) 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."

- a) Time to produce effect: 3-8 weeks
- b) Frequency: 2-7 times/week for the first month, decreasing to 2-3 times/week thereafter
- c) Optimum duration: 6-12 weeks, including follow-up for outpatient pain clinics; 3-4 weeks for inpatient pain clinics
- d) 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.