Upper Extremity

Montana Utilization and Treatment Guidelines

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Presented by: State of Montana

Department of Labor and Industry EMPLOYMENT RELATIONS DIVISION



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B. General Guidelines 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 Department provides procedures to implement medical treatment guidelines and to foster communication to resolve disputes among the providers, payers, and patients through the Administrative Rules of Montana. In lieu of more costly litigation, parties may wish to request an independent medical review from the Department's Medical Director prior to submitting a Petition for a Workers' Compensation Mediation Conference.

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. An education-based paradigm should start with communication providing reassuring information to the patient. A more in-depth education within a treatment regime employing functional restorative and innovative programs of prevention and rehabilitation is optimal. A treatment plan should address 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 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. FUNCTIONAL IMPROVEMENT GOALS should be consistently addressed. 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 and 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 condition(s).

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 be released to return to work with specific physical activity limitations clearly spelled out per the specific job requirement. Release to "sedentary" or "light duty" is not a specific physical limitation. The following physical limitations should be considered and modified as recommended: lifting, pushing, pulling, crouching, walking, using stairs, overhead work, 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 a health care professional with experience in ergonomics, an occupational health nurse, a physical therapist, an occupational therapist, a vocational rehabilitation specialist, or an industrial hygienist.

11. DELAYED RECOVERY Strongly consider a psychological evaluation, if not previously provided, as well as initiating interdisciplinary rehabilitation treatment and vocational goal setting, for those patients who are failing to make expected progress 6 to 12 weeks after an injury. The Department 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 these 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.

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C. Definitions and Mechanisms of injury

Upper-extremity musculoskeletal disorders (MDSs) continue to account for a significant number of work-related illnesses and disabilities in the United States (U.S.). Upper extremity MSDs now account for at least 4% of all state workers' compensation claims, an increase from 1% seen a decade ago.

Cumulative Trauma Conditions

Cumulative trauma related conditions of the upper extremity comprise a heterogeneous group of diagnoses which include numerous specific clinical entities including disorders of the muscles, tendons and tendon sheaths, nerves, joints and neurovascular structures.

The terms "cumulative trauma disorder", "repetitive motion syndrome", "repetitive strain injury", "myofascial pain" and other similar nomenclatures are umbrella terms that are not acceptable, specific diagnoses. The health care provider must provide specific diagnoses in order to appropriately educate, evaluate, and treat the patient. Examples include: de Quervain's disease, cubital tunnel syndrome, and lateral/medial epicondylitis (epicondylalgia). Many patients present with more than one diagnosis, which requires a thorough upper extremity and cervical evaluation by the health care provider. Furthermore, there must be a causal relationship between work activities and the diagnosis (See Initial Diagnostic Procedures). The mere presence of a diagnosis that may be associated with cumulative trauma does not presume work-relatedness unless the appropriate work exposure is present.

Mechanisms of injury for the development of cumulative trauma related conditions have been controversial. However, repetitive awkward posture, force, vibration, cold exposure, and combinations thereof are generally accepted as occupational risk factors for the development of cumulative trauma related conditions.

Evaluation of cumulative trauma related conditions require an integrated approach that incorporates ergonomics assessment clinical assessment, past medical history and psychosocial evaluation on a case-by-case basis.

The normal working age population may often have non-specific pain complaints that require minimum treatment and may be considered part of the normal aging process. When pain continues or a complete history indicates a potential for other diagnoses, a medical workup is necessary to screen for other diseases. However, in cases where there is no specific diagnosis and corresponding work related etiology, the work-up should generally be performed outside of the workers compensation system.

D. Initial Diagnostic Procedures

The Department 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 upper extremity complaint are listed below.

D.1 History Taking and Physical Examination (Hx & PE)

History Taking and Physical Examination (Hx & PE) are generally accepted, well-established and widely used procedures that establish the foundation/basis for and dictates subsequent 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. The medical records should reasonably document the following:

D.1.a History of Present Injury

i. Age, hand dominance, gender should be documented.

ii. Onset: date of onset, triggering event (if present) versus gradual onset. Activity at/or before onset of symptoms.

iii. Nature of symptoms: pain, numbness, tingling, weakness, swelling, stiffness, temperature change, moisture change, color change.

iv. Any history of pain, intermittent or constant, and intensity. A pain scale (0 = no pain, and 10 = worst imaginable pain) may be used. The use of a patient completed pain drawing, Visual Analog Scale (VAS) is highly recommended, especially during the first 2 weeks following injury to assure that all work related symptoms are addressed.

Use comprehensive pain diagrams as it is important to solicit the reporting of more proximal symptoms.

Evaluate the patient's overall pain behavior. The behavior should be consistent with the current pain levels reported by the patient.

v. Provocative and alleviating factors (occupational and non-occupational): identify the specific physical factors that are aggravating or alleviating the problem.

vi. Sleep disturbances.

vii. Other associated signs and symptoms noted by the injured worker.

viii. Ability to perform activities of daily living (ADLs). ADLs include: such activities as selfcare and personal hygiene, communication, ambulation, attaining all normal living postures, travel, non-specialized hand activities, sexual function, sleep, and social and recreational activities. Specific movements in this category include: pinching or grasping keys/pens/other small objects (brushing teeth, doing laundry), grasping telephone receivers or cups or other similar-sized objects, and opening jars. The quality of these activities is judged by the independence, appropriateness, and effectiveness, with which they are completed. Assess not simply the number of restricted activities, but the overall degree of restriction or combination of restrictions.

ix. Prior occupational and non-occupational injuries to the same area including specific prior treatment and any prior supportive devices.

x. Discussion of any symptoms present in the uninjured extremity.

D.1.b Relationship to Work and Other Activity

Assess the individual's ability to perform job duties: this may include a jobsite evaluation as well as the patient's description of the job duties.

Job title alone is not sufficient information. The clinician is responsible for documenting specific information regarding repetition, force, other risk factors and duration of employment. Refer to risk factors as listed in the tables entitled 'Primary Risk Factor Definitions and Diagnosis Based Risk Factors.' A formal jobsite evaluation may be required.

Information must be obtained regarding other employment, sports, recreational, and avocational activities that might contribute to, or be impacted by CTC development. Activities such as hand operated video games, crocheting/needlepoint; baseball/softball playing musical instruments, home computer operation, golf, tennis, and gardening are included in this category. Duration of these activities should be documented.

D.1.c Past History

i. Demographics.

ii. Past injury/symptoms involving the upper extremities, trunk and cervical spine.

iii. Past work-related injury or occupational disease.

iv. Past personal injury or disease that resulted in temporary or permanent job limitation.

v. Medical conditions associated with cumulative trauma: The following are examples of medical conditions which have been commonly seen in association with cumulative trauma conditions. These require treatment and may impact the recovery of the work comp injury. A) Amyloidosis;

B) Arthropathies including connective tissue disorders, rheumatoid arthritis, systemic lupus erythematosus, gout, osteoarthritis and spondyloarthropathy;

C) Cancer;

D) Diabetes mellitus, including family history or gestational diabetes;

E) Hypothyroidism, especially in older females;

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F) Obesity;G) Pregnancy.

vi. History of smoking and alcohol use; history of substance abuse;

vii. Medication history including, birth control pills, corticosteroid use, and other prescription and non-prescription medication; and

viii. Psychosocial history.

D.1.d Physical Examination

The evaluation of any upper extremity complaint should begin at the neck and upper back and then proceed down to the fingers and include the contralateral region. It should include evaluation of vascular and neurologic status, and describe any dystrophic changes or variation in skin color or turgor. A description of the patient's general posture (e.g., neck rotation, shoulder depression, spine kyphosis), body type (e.g. mesomorph, ectomorph, etc.), and anthropometric measurements, (e.g. body mass index [BMI]) should be documented. Behavioral adaptations to symptoms should be documented. Additional physical exam components may be necessary based on past medical history.

A neurological examination typically includes bilateral assessments of pinprick, 2 point sensation as applicable, motor strength and reflexes. Similar assessments of the upper extremities including a vascular assessment may be performed as this will provide information regarding polyneuropathic processes such as diabetic neuropathy. Vibratory sense and Achilles reflexes are frequently lost in diabetic neuropathy. Decreased response to cold temperature or pain response to cold temperature has been related to radicular findings in the spine as discriminated from axial pain.

To confirm a reported hypoalgesic area, some examiners may choose to complete multiple tests that may be done with the patient's eyes closed: 1) having the patient say yes or no whenever they think a stimulus has been applied; 2) repeatedly redefining the affected area.

Fractures are most commonly discovered by deformity in the context of focal pain and an inciting trauma history. Some occur without deformity and are only found on x-rays, although most have focal tenderness on a careful palpatory examination

For cumulative trauma conditions, refer to Table 1: Physical Examination and Findings Reference for details.

	Table 1: Physical Examination Findings Reference
Section F.	Specific Cumulative Trauma Condition Diagnosis

DIAGNOSIS	NOSIS SYMPTOMS SIGNS (Required Findings)		
Aggravated Osteoarthritis	Gradual onset of stiffness and non- radiating pain.	 At least one of the following: Positive grind test resulting in pain; crepitus; Subluxation of the metacarpal may be induced in advanced cases; Swelling, erythema, warmth and other signs of infection or inflammation are not present. Reduced motion; Angular deformities; Tenderness with palpation of thumb phalangeal-metacarpal or carpalmetacarpal joint. 	
de Quervain's Disease	Tenderness over the first dorsal extensor compartment(anatomical snuff box).	 <u>At least one of the following</u>: Pain worsened by resisted thumb abduction and/or extension with or without resistance; Positive Finkelstein's test. 	
Epicondylitis- Lateral (Epicondylalgia)	Elbow pain over the lateral epicondyle increased with gripping.	 Tenderness to palpation at/near lateral epicondyle and pain over the lateral epicondyle and/or extensor mass of the forearm with one of the following maneuvers: Active or resisted wrist extension; Active or resisted middle finger extension; Active or resisted supination. 	
Epicondylitis- Medial (Epicondylalgia)	Elbow pain over the medial epicondyle.	Tenderness to palpation at/near medial epicondyle and pain over the medial epicondyle and/or flexor mass of the	

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		forearm with one of the following maneuvers: • Active or resisted wrist flexion; • Active or resisted pronation.
Extensor Tendon Disorders of the Wrist	Pain localized to the affected tendon(s) worsened by wrist or finger extension.	Pain and/or tenderness with active or resisted wrist/digit extension, specific to the extensor mechanism involved.
Flexor Tendon Disorders of the Wrist	Pain/tenderness localized to affected tendons.	Reproduction of pain with active or resisted wrist/digit flexion or ulnar deviation specific to the flexor mechanism involved.
Hand Arm Vibration Syndrome	Pain in fingers, episodic finger blanching.	Blanching of fingers, worse with cold provocation. Ulceration of finger tips when severe.
Triangular Fibrocartilage Complex Tear (TFCC)	Symptoms mainly on ulnar side of the wrist.	 Tenderness over the TFCC complex and localized pain, clicking, or findings of abnormal motion with one of the following movements: Forced supination and pronation with axial pressure on an ulnar deviated wrist; The patient pushes up from a seating position using the hand, and/or Ballottement of the distal ulna with the wrist supinated causes abnormal motion as compared to the asymptomatic side.
Trigger Finger	Difficulty flexing the finger with a catching or triggering sensation.	 One of the following: Tenderness at the A-1 pulley with finger flexion; Triggering of the digit; Difficulty flexing and extending the finger with a palpable nodule.

Physical Exam Findings Reference (continued)			
Section G	Specific Peripheral Nerve Diagnosis		
DIAGNOSIS	SYMPTOMS	SIGNS (Required Findings)	
Carpal Tunnel Syndrome	 Specific paresthesias in 2 of the following digits: thumb, index, and middle finger. Shaking of the hand (to relieve symptoms) and nocturnal symptoms are common. 	 At least one of the following: Positive Phalen's sign; Positive Tinel's sign over the carpal tunnel; Positive closed fist test; Positive compression test; Thenar atrophy may be present later in course; Weakness of abductor pollicis brevis; Sensory loss to pinprick, light touch, two-point discrimination or Semmes-Weinstein monofilament tests in a median nerve distribution. 	
Cubital Tunnel Syndrome	Paresthesias or dull, aching sensations in the 4 th and 5 th digits (ring and small fingers) and discomfort near the medial aspect of the elbow.	 Paresthesias or dull, aching in the 4th and 5th digits and at least one of the following exam findings: Diminished sensation of the fifth and ulnar half of the ring fingers, which may sometimes include sensory loss to pinprick, light touch, two-point discrimination or Semmes-Weinstein monofilament tests in an ulnar nerve distribution; Positive elbow flexion/ulnar compression test; Later stages manifested by: intrinsic atrophy and ulnar 	

		innervated intrinsic weakness; Wartenberg's sign; Froment's sign.
Guyon Canal (Tunnel) Syndrome	Paresthesias in the 4 th and 5 th digits (ring and small fingers) without proximal ulnar complaints.	At least one of the following exam findings: • Positive Tinel's at hook of hamate; • Numbness or paresthesias of the palmer surface of the ring and small fingers; • Decreased strength of the adductor pollicis, abductor digiti minimi, and/or lumbricals.
Posterior Interosseous Nerve Entrapment (PIN)	Weakness of finger and thumb extension	Weakness or inability to extend fingers or thumb;
Pronator Syndrome	Pain/paresthesias in the median nerve distribution distal to the elbow.	 Paresthesias in the median nerve distribution and at least one of the following reproduces median nerve symptoms: Resisted pronation with elbow flexed at 90 degrees or elbow extended; Positive Tinel's at the proximal edge of the pronator teres muscle over the median nerve.
Radial Tunnel Syndrome	Pain over the lateral posterior forearm. May occur in conjunction with and must be distinguished from lateral epicondylitis. May include paresthesias over the dorsal radial hand and wrist.	 The following two elements are required: Tenderness over the radial nerve near the proximal edge of the supinator muscle; Resisted supination or resisted middle finger extension with the

D.1.e Assessing Red Flags

Potentially serious conditions for the upper extremity are listed in Table 2. Early consultation by a hand or upper limb specialist, rheumatologist, or other relevant specialist is recommended depending on the providing physician's training and experience in dealing with the particular disorder.

Tab	le 2. Red Flags for Potentially Serious Upper	r Extremity Conditions
Disorder	Medical History	Physical Examination
Fracture	History of significant trauma	Significant swelling
	History of deformities with or without spontaneous reduction or self-reduction	Deformity with displaced fracture
	Focal, severe non-radiating pain combined with history of trauma	Point tenderness Swelling, hematoma
	Inability to use the joint	Ecchymosis
Dislocation	History of significant trauma	Deformity present
	History of deformities with or without spontaneous or self-reduction	Tenderness and instability with history of deformity with reduction
	Inability to use the joint	Hemarthrosis
Infection	History of systemic symptoms: fever, chills/rigor	Tenderness with motion
	History of immunosuppression (e.g., transplant, chemotherapy, HIV)	Systemic signs of sepsis
	Diabetes mellitus	Local heat, swelling, erythema
		Drainage of a sinus tract
	infection)	Painful, red, swollen area(s)
Tumor	History of rapidly growing, painful, firm or hard mass of hand or wrist not consistent with ganglion	Mass of hand, wrist, or forearm, not consistent with ganglion or other benign lesion
	History of immunosuppression (e.g., transplant, chemotherapy, HIV)	
	History of cancer	

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Joint Inflammation	History of inflammatory arthropathy or crystal arthritis Clinical history consistent with inflammatory or crystal arthropathies	Swelling and deformity Mostly symmetrical joint involvement for more common inflammatory arthropathies (e.g., rheumatoid arthritis) Erythematous, swollen, warm usually solitary joint for acute crystal arthropathy Painful swollen joints, usually without systemic symptoms
Rapidly Progressive Neurologic Compromise	Rapidly progressive numbness, paresthesias, or weakness in radial, ulnar, or median nerve distribution Inciting traumatic event or history to produce acute neurological compromise Progressive weakness Stroke, cervical spine disorders or other central nervous system compromise	Sensory deficit in ulnar, median, or radial distribution Loss of finger or grip strength when picking up objects Atrophy
Vascular Compromise	History of vascular disease History of diabetes mellitus Compartment syndrome Inflammatory arthropathies with vasculitis	Decreased pulses Decreased capillary filling Cold, cool, or pale hand
Compartment Syndrome	History of trauma, surgery, or extreme unaccustomed forceful activity. Persistent forearm or hand pain and "tightness" Tingling, burning, or numbness	 Palpable tenderness and tension of involved compartment Pain intensified with stretch to involved muscles Paresthesia, paresis, and sensory deficits Diminished pulse and prolonged capillary refill.

D.2 Laboratory Testing

Laboratory tests are generally accepted, well-established and widely used procedures. Patients should be carefully screened at the initial exam for signs or symptoms of diabetes, hypothyroidism, arthritis, and related inflammatory diseases. The presence of concurrent disease

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does not refute work-relatedness of any specific case. This frequently requires laboratory testing. In one study of patients with cumulative trauma conditions other than carpal tunnel syndrome, seen by specialists, 3% of patients were diagnosed with diabetes, 6% with hypothyroidism, and 9% with chronic inflammatory disease including spondyloarthropathy, arthritis, and systemic lupus erythematosus. Up to two thirds of the patients were not aware of their concurrent disease. When a patient's history and physical examination suggest infection, metabolic or endocrinologic disorders, tumorous conditions, systemic musculoskeletal disorders (e.g., rheumatoid arthritis or ankylosing spondylitis), or problems potentially related to medication (e.g., renal disease and non-steroidal anti-inflammatory medications), then laboratory tests, including, but not limited to the following can provide useful diagnostic information:

- 1. Serum rheumatoid factor, antinuclear antigen (ANA), human leukocyte antigen (HLA)-B27 titre for rheumatoid work-up;
- 2. Thyroid stimulating hormone (TSH) for hypothyroidism;
- 3. Diabetic screening recommended for men and women with a BMI over 30, patients with a history of family diabetes, those from high risk ethnic groups, and with a previous history of impaired glucose tolerance. A fasting blood-glucose greater than 125mg/dl is diagnostic for diabetes. Urine dipstick is a specific but not sensitive screening test for testing glucose level. Quantitative urine glucose is sensitive and specific in high-risk populations. There is some evidence that diabetic patients with upper extremity disorders are more likely to be under poor diabetic control. Therefore, it is appropriate to order a hemoglobin A1c for any diabetic patients with a CTC.
- 4. Serum protein electrophoresis;
- 5. Sedimentation rate and C-reactive protein (CRP) are nonspecific, but elevated in infection, neoplastic conditions and rheumatoid arthritis;
- 6. Serum calcium, phosphorus, uric acid, alkaline and acid phosphatase for metabolic, endocrine and neo-plastic conditions;
- 7. Complete blood count (CBC), liver and kidney function profiles for metabolic or endocrine disorders, or for adverse effects of various medications;
- 8. Bacteriological (microorganism) work-up for wound, blood and tissue;
- Serum B6 routine screening is not recommended due to the fact that Vitamin B6 supplementation has not been proven to affect the course of carpal tunnel syndrome. However, it may be appropriate for patients on medications that interfere with the effects of Vitamin B6, or for those with significant nutritional problems.

The Department recommends that lab diagnostic procedures be initially considered the responsibility of the workers' compensation carrier to ensure that an accurate diagnosis and treatment plan can be established. Laboratory testing may be required periodically to monitor patients on chronic medications.

D3. Medical Causation Assessment for Upper Extremity Conditions

General Principles of Causation Assessment

There are numerous occupational and non-occupational risk factors for upper extremity musculoskeletal disorders (MSDs). While some risk factors (e.g., age, diabetes mellitus) generally appear in common with most MSDs, other risk factors do not appear in common across the disorders (e.g., thyroid disorders, pregnancy). The lack of common risk factors across the spectrum of disorders raises questions about the accuracy of generalizing any risk factor, whether occupational or non-occupational across all disorders.

The clinician must determine if it is medically probable (greater than 50% likely or more likely than not) that the need for treatment in a case is due to a work-related exposure or injury. Treatment for a work-related condition is covered when: 1) the work exposure causes a new condition; or 2) the work exposure causes the activation of a previously asymptomatic or latent medical condition; or 3) the work exposure combines with, accelerates, or aggravates a pre-existing symptomatic condition. In some cases, the clinician may need to order diagnostic testing or jobsite evaluations to make a judgment on medical probability. The following steps should be used to evaluate causality:

Step 1: Make a specific and supportable diagnosis. Remember that cumulative trauma, repetitive strain and repetitive motion are not diagnoses. Examples of appropriate diagnoses include: specific tendonopathies, strains, sprains, and mono-neuropathies. Refer to Sections F (Specific Cumulative Trauma Disorders), section G (Specific Peripheral Nerve Disorders) and section H (Specific Musculoskeletal Disorders) for the specific findings..

Step 2: Determine whether the disorder is known to be or is plausibly associated with work. The identification of work-related risk factors is largely based on comparison of risk factors (as described in Section D.3. a. & b. Foundations for Evidence of Occupational Relationships and Using Risk Factors to Determine Causation) with the patient's work tasks.

Step 3: Interview the patient to find out whether risk factors are present in sufficient degree and duration to cause or aggravate the condition. Consider any recent change in the frequency or intensity of occupational or non-occupational tasks. In some cases, a formal jobsite evaluation may be necessary to quantify the actual ergonomic risks. Refer to the Jobsite Evaluation Section E.6.c.

Step 4: Complete the required match between the risk factors identified on the Risk Factor Table and the established diagnosis using the system described in Section D. 3. b.

Step 5: Determine whether a temporal association exists between the workplace risk factors and the onset or aggravation of symptoms.

Step 6: Identify non-occupational diagnoses, such as rheumatoid arthritis, obesity, diabetes, as well as avocational activities, such as golf and tennis. This information infrequently affects the

work-related causation decision. It may be applicable when exposure levels are low and the case does not meet evidence-based criteria.

D.3.a Foundations for Evidence of Occupational Relationships

All results described in this section are a result of a thorough review of the epidemiologic literature available at the time of this guideline. The studies most heavily relied upon healthy worker populations with a variety of exposures, not all of which were well-described quantitatively. No single epidemiologic study fulfills all criteria for causality. The clinician must recognize that currently available epidemiologic data is based on population results. Individual variability lies outside the scope of these studies and must be addressed by the physician on a case-by-case basis. The clinician is responsible for documenting specific information regarding the force, posture, repetition, and other risk factors as listed in the table entitled "Risk Factors Definitions." Job title alone is not sufficient to determine the risk factors. A jobsite evaluation is usually necessary.

Many studies have been completed in industrial settings focusing on cumulative trauma conditions or upper extremity complaints in relationship to work exposures. The studies vary in several ways that directly affect the interpretation of their results. Studies with 1) an accepted clinical exam confirming the diagnosis and 2) work exposures validated by direct observation, or questionnaires that were correlated with direct observation, provide the strongest evidence. Well-done, prospective, longitudinal studies (cohort studies) are preferred; however for uncommon disorders, these studies may not be able to identify the causal factors. We considered other large prevalence and incidence studies when minimum quality criteria had been met and the self-reported exposure uses reliable questionnaires.

Many studies report symptoms rather than disease conditions. These studies are useful for ergonomic research or as pilot studies but do not directly affect the evidence level for causation. They are mentioned, when useful, as indirect evidence. If multiple well-done symptom studies show no increase in symptomatology with specific activities, it follows that there is very little chance that the studied exposure causes disease.

In addition, there are a few studies which address less common musculoskeletal diagnoses or peripheral nerve conditions other than carpal tunnel syndrome, such as posterior interosseus nerve entrapment and pronator syndrome. In these cases, we rely upon studies which report the risks for related conditions.

Many of the original studies identifying diagnosable cumulative trauma conditions were performed in manufacturing industries and meat, fish and poultry processing companies. In these industries most workers are exposed to highly repetitive mono-task jobs which frequently involve a forceful grip, awkward postures, vibration, and cold environments. The evidence for increased disorders when these multiple risk factors are present is compelling. Research attempting to define clear, threshold exposure limits for increased risk from isolated tasks and/or intermittent exposures has less consistent results.

The quality of keyboarding studies is highly variable. Most of the studies rely on self report. Self report appears to approximately double the actual time spent using the keyboard. Some studies show distortion highest in the medium range of use. There appears to be less inflation for self

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reported mouse use. Fortunately a few studies have provided more objective keyboard use data.

The group of studies now available provides good evidence that keyboarding in a reasonable ergonomic posture (wrist with 30 degrees or less of extension and 15 degrees or less of radial deviation) up to 7 hours per day under usual conditions is very unlikely to cause carpal tunnel syndrome or other upper extremity disorders. This is based on studies of carpal tunnel pressure under a variety of typing and wrist positions as well as a number of studies of workers who keyboard on a regular basis. Clinicians may determine in a particular case that there is a relationship based on the ergonomic conditions or on excessive typing, such as more than 7 hours per day of essentially uninterrupted keyboard use per day or full-day court reporting.

There is some evidence that mouse use appears to be associated with carpal tunnel syndrome and related symptoms with 4 hours or greater per day of continuous use. Studies of pressure within the carpal tunnel indicated that pressures may rise to levels which could affect the median nerve when the mouse is being dragged or clicked. Again the actual ergonomics of the work place should be considered for each individual patient before making a final causation decision.

There was a large variety in assessment strategies for lower quality studies. Examples included: symptom only reports; dichotomous choices for exposures, e.g. 1 hour or less per week repetitive activities versus more than 1 hour per week; self report data that does not follow basic pathophysiology, e.g. mouse use between 2.5 & 5 hours per week causing wrist pain; and bias introduced due to prior knowledge of the participants regarding expected work & symptom correlations. In order to reasonably integrate the volume of disparate data, interpretation of lower quality studies took into account reasonable pathophysiology and exposure limits. Dose response relationships were also examined to look for trends in exposure which resulted in increased disease or symptoms.

Most studies were unable to truly assess repetition alone, unassociated with other risk factors. Indirect evidence from a number of studies supports the conclusion that task repetition up to 6 hours per day unaccompanied by other risk factors is not causally associated with cumulative trauma conditions. Risk factors that are likely to be associated with specific CTC diagnostic categories include: extreme wrist or elbow postures; force including regular work with hand tools greater than 1 kg or tasks requiring greater than 50% of an individual's voluntary maximal strength; work with vibratory tools at least 2 hours per day; or cold environments.

The variability in study design presented a challenge for creating physiologically reasonable hour limits for the specific primary and secondary risk factors. We chose the strongest studies for the specific risks involved and extrapolated the measures utilizing the number of quartiles in the working day the person was exposed, or the exposure groups themselves. For example, ³/₄ of a day exposure was translated to a 6 hour exposure and exposure groups working on assembly lines or in similar employment were also assumed to be performing the same tasks for at least 6 hours per day. This cut-off corresponds the best to studies which found positive diagnoses in workers performing repetitive jobs with at least one other risk factor. These constitute our primary risk factor definitions. For the secondary risk factor definitions one study provided direct evidence of 4 hours for the most common risks. We also found indirect evidence from other studies, such as one assessing upper extremity functional impairment and another determining

the presence of upper extremity symptoms that 4 hours was a reasonable cut off point for determining physiologically acceptable secondary risks.

No studies examined the relationship between the development of ganglion cysts and work activities; however, work activities, such as bending or twisting of the wrist repetitively, may cause an aggravation of existing ganglion cysts that interferes with function.

Aggravation of a pre-existing medically established diagnosis must be determined on an individual case basis. A comparison of the worker's specific job duties with usual activities of daily living and the occupational risk factors should contribute to the discussion.

Non-occupational exposures

Most studies demonstrate an association of cumulative trauma conditions with older age; high BMI; the presence of other upper extremity musculoskeletal diagnoses; related diseases such as auto-immune conditions, diabetes, hypothyroidism and rheumatologic diseases; and psychosocial issues including relationships with supervisors. The influence of these non-occupational risk factors varies according to the specific diagnoses involved. While the presence of any of these additional factors may be viewed as contributing to the disorder in question, that does not refute the actual evidence from the defined risk factors supporting a specific work related condition.

Use the Risk Factor Definition and Diagnosis Based Risk Factors tables with the following direction to formulate the causation of diagnoses established as cumulative trauma conditions.

D.3.b Using Risk Factors to Determine Causation (Directions)

The physician should perform the following:

Step 1. Determine the diagnosis.

Using the history, physical examination and supporting studies, a medical diagnosis must be established. Refer to Section F (Specific Cumulative Trauma Disorders), section G (Specific Peripheral Nerve Disorders) and section H (Specific Musculoskeletal Disorders)

Step 2. Clearly define the job duties of the worker.

Do not rely solely on the employer's description of job duties. The worker's description of how they actually perform the duties is extremely important. Jobsite evaluations are always appropriate, but are sometimes unnecessary when the physician can identify the job duty which appears to be causing the symptoms and provide a method for ergonomically correcting the activity.

Step 3. Compare the worker's duties with the Primary Risk Factor Definition Table.

Hours are calculated by adding the total number of hours per day during which the worker is exposed to the defined risk. Breaks, time performing other activities and inactive time are not included in the total time. When the employee meets the definition for a sole Primary Risk Factor and the risk factor is physiologically related to the diagnosis, it is likely that the worker will meet causation for the cumulative trauma condition. When the Primary Risk Factor identified is not physiologically related to the diagnosis, causation will not be established at this point and Step 4 needs to be considered.

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Step 4. Compare the worker's risk factors identified in Step 2 with the Secondary Risk Factor definitions on the Risk Factor Definition Table. If secondary risk factors are identified proceed to the Diagnosis Based Risk Factor Table.

When no Primary Risk Factors are present but one or more Secondary Risk Factors are found on the Risk Factor Definitions Table proceed to the Diagnosis Based Risk Factor Table. Elements in this table are listed under the strength of evidence headings. This includes a category for strength of evidence for risks that have been demonstrated not to be related to the diagnosis. Consult the diagnostic category pertaining to the worker. For a number of less common diagnoses, little direct research has been done that meets our quality standards. Therefore, the risk factors for these diagnoses use the risk factors from physiologically related, better researched diagnostic titles. Initially, check the evidence statements for or against causation based on the secondary risks identified previously. If the Diagnosis Based Risk Factor table establishes a match between the Secondary Risk Factor(s) and other job duties, using the evidence based columns for the established diagnosis, the case is likely work-related based on evidence. If none of the evidence categories matches the worker, causation based solely on evidence from research has not been established.

Step 5. If an evidence based causation relationship, based on Steps 1-4, has not been established and the worker has one Secondary Risk Factor from the Risk Definition table, the physician may consult the last column of the Diagnosis Based Risk Factor table entitled "Additional Risk Factors." This category describes medically accepted physiologic risk factors for the diagnosis and risk factors which demonstrated an association with the diagnosis in lower quality studies that did not meet our standards of evidence. Some of the additional risk factors have less clear definitions due to lack of definition in the lower quality studies. These risk factors were added only when the medical consensus of the multi-disciplinary group agreed they were physiologically plausible. When a Secondary Risk Factor has been identified that does not meet the evidence based definitions in the Diagnosis Based Risk Factor Tables, physicians may use the other "Additional Risk Factors", as appropriate, to establish the presence of combined risk factors and establish causation. The worker must have met at least one of the Secondary Risk Factor definitions from the Risk Factor Definition table and that risk factor must be physiologically related to the diagnosis, in order to use the "Additional Risk Factors" in the Diagnosis Based Risk Factor table. Additional Risk factors that duplicate the conditions in the Secondary Risk Factor identified for the case may not be used. Any conclusions using this methodology are not strictly evidence-based and therefore the physician should include a discussion of why the Additional Risk Factors are pertinent in the particular case.

Algorithmic Steps for Causation Assessment



Algorithmic Steps for Causation Assessment Step 4



Risk Factor Definitions

RISK FACTOR DEFINITIONS

CAUSATION MAY BE ESTABLISHED BY THE PRESENCE OF 1) A DIAGNOSIS-RELATED SOLE PRIMARY RISK FACTOR WHICH IS PHYSIOLOGICALLY RELATED TO THE DIAGNOSIS OR; 2) AT LEAST ONE SECONDARY RISK FACTOR THAT MEETS THE REQUIREMENTS FROM THE DIAGNOSIS-BASED RISK FACTOR TABLE

NOTE: Hours are calculated by totaling the cumulative exposure time to the risk over an 8 hour day. Breaks or periods of inactivity or performing other types of work tasks are not included.

Category	As a Primary Risk Factor	Secondary Risk Factor	
<u>Force and</u> <u>Repetition/Duration</u>	6 hrs. of: > 50% of individual maximum force with task cycles 30 seconds or less or force is used for at least 50% of a task cycle- maximum force for most individuals is 3-5 kg of force.	4 hrs. of: > 50% of individual maximum force with task cycles 30 seconds or less or force is used for at least 50% of a task cycle-maximum force for most individuals is 3-5 kg of force.	
	6 hrs. of: lifting 10 lbs > 60x per hour.	4 hrs. of: lifting 10 lbs > 60x per hour. *	
	6 hrs. of: use of hand held tools weighing 2 lbs or greater.	4 hrs. of: use of hand held tools weighing 2 lbs or greater.	
<u>Awkward Posture</u> <u>and</u> <u>Repetition/Duration</u>	4 hrs. of: Wrist flexion > 45 degrees, extension > 30 degrees, or ulnar deviation > 20 degrees.		
	6 hrs. of: Elbow - flexion > 90 degrees.	4 hrs. of: Elbow - flexion > 90 degrees.	
	6 hrs. of: Supination/pronation with task cycles 30 seconds or less or posture is used for at least 50% of a task cycle.	4 hrs. of: Supination/pronation with task cycles 30 seconds or less or posture is used for at least 50% of a task cycle.*	

RISK FACTOR DEFINITIONS

CAUSATION MAY BE ESTABLISHED BY THE PRESENCE OF 1) A DIAGNOSIS-RELATED SOLE PRIMARY RISK FACTOR WHICH IS PHYSIOLOGICALLY RELATED TO THE DIAGNOSIS OR; 2) AT LEAST ONE SECONDARY RISK FACTOR THAT MEETS THE REQUIREMENTS FROM THE DIAGNOSIS-BASED RISK FACTOR TABLE

NOTE: Hours are calculated by totaling the cumulative exposure time to the risk over an 8 hour day. Breaks or periods of inactivity or performing other types of work tasks are not included.

Category	As a Primary Risk Factor	Secondary Risk Factor
<u>Computer Work</u>	Note: Up to 7 hours per day at an ergonomically correct workstation is not a risk factor.	
<u>Use of handheld</u> <u>vibratory power</u> <u>tools and Duration</u>	6 hrs. for more common types of vibration exposure.	2 hrs. When accompanied by other risks.
<u>Cold Working</u> <u>Environment</u>		Ambient temperature of 45F or less for 4 Hrs. or more, such as handling frozen foods that are 10 degrees.

Diagnosis Based Risk Factors

	Evidence FOR Specific Risk Factors			Non Fridance Board	
Diagnosis				Evidence	Additional Risk
	Strong Multiple high quality studies	Good One high quality study or multiple adequate studies	Some One adequate study	AGAINST Specific Risk Factors	Factors to Consider. These factors must be present for at least 4 hours of the work day, and may not overlap evidence risk factors. ¹
<u>Aggravated</u> <u>Osteoarthritis</u> <u>of the Wrist</u>	Ν	No Quality Eviden	ce Available		Awkward Posture (depending on the joint involved)
					Repetition of activities affecting the joint involved for 4 hrs.
					Prior Injury.
<u>Carpal</u> <u>Tunnel</u> <u>Syndrome</u>		Combination of force, repetition, and vibration.	Wrist bending or awkward posture for 4 hrs.	Good evidence - Keyboarding less than or equal to 7 hrs. in good ergonomic	High repetition defined as task cycle times of less than 30 seconds or performing the same task for more than 50% of the total cycle time.
		Combination of repetition and force for 6 hours.		position is NOT RELATED.	
		Combination repetition and forceful tool use with awkward posture for 6 hours – Deboning study.	Mouse use more than 4 hours.	Good evidence- Repetition alone less than or equal to 6 hrs. is NOT RELATED.	Tasks using a hand grip.

	Evidence F	OR Specific Risk			
Diagnosis			Evidence	Non-Evidence-Based Additional Risk	
	Strong Multiple high quality studies	Good One high quality study or multiple adequate studies	Some One adequate study	AGAINST Specific Risk Factors	Factors to Consider. These factors must be present for at least 4 hours of the work day, and may not overlap evidence risk factors. ¹
		Combination force, repetition, and awkward posture.	Combination cold and forceful repetition for 6 hours - Frozen food handling.		Extreme wrist radial/ulnar positions or elbows in awkward postures.
<u>Cubital</u> <u>Tunnel</u> <u>Syndrome</u>			Combination forceful tool use, repetition and probably posture for 6 hours - Holding a tool in position with repetition.		Wrist bending and/or full elbow flexion/extension, repetition for 4 hours, vibration. Repetitive pronation of forearm. ³ Sustained pressure at the cubital tunnel.
<u>DeQuervain's</u> <u>Disease</u> <u>DeQuervain's</u> (cont)		Combination force, repetition, & posture.			Wrist in ulnar deviation. ³ Repetitive thumb abduction and extension. ³ Wrist bending in extreme postures. Precise hand motions
					e.g. dental hygienists.

	Evidence FOR Specific Risk Factors				Non-Evidence-Based
	Strong Multiple high quality studies	Good One high quality study or multiple adequate studies	Some One adequate study	Evidence AGAINST Specific Risk Factors	Additional Risk Factors to Consider. These factors must be present for at least 4 hours of the work day, and may not overlap evidence risk factors. ¹
					Repetitive hitting.
Epicondvlitis Lateral -		Combination – awkward posture (forearm supination past 45 degrees) and forceful lifting. Combination force and possible awkward posture – study used repetition and turning and screwing. Combination – force & repetition, force and wrist and hand repetition.		Some evidence keyboard use is NOT RELATED.	Wrist posture in extension and repetitive supination of the forearm and/or elbow extension. ³

Diagnosis	Evidence FOR Specific Risk Factors			Evidence AGAINST	<u>Non-Evidence-Based</u> Additional Risk Factors to Consider.
Diagnosis					
	Strong Multiple high quality studies	Good One high quality study or multiple adequate studies	Some One adequate study	Specific Risk Factors	These factors must be present for at least 4 hours of the work day, and may not overlap evidence risk factors. ¹
<u>Epicondylitis</u> <u>Lateral (cont)</u>			Combination repetition and awkward posture including static posture.		
<u>Epicondylitis</u> <u>Medial</u>		Combination - force & repetition, force and wrist and hand repetition. Combination - forceful exertion and repetition 6 hours.		Some evidence keyboard use is NOT RELATED.	Wrist posture in flex and repetitive pronation and/or elbow extension. ³

Diagnosis	Evidence F	OR Specific Risk	Evidence AGAINST	Non-Evidence-Based Additional Risk Factors	
	Strong Multiple high quality studies	Good One high quality study or multiple adequate studies	Some One adequate study	Specific Risk Factors	to Consider. These factors must be present for at least 4 hours of the work day, and may not overlap evidence risk factors. ¹
Extensor tendon		Combination force,			Sustained tool use.
disorders of the Wrist		repetition, & posture.			Awkward posture. ³
					No relationship to keyboard use is expected in a good ergonomic workstation.
					Wrist bending in extreme postures.
					Repetitive hitting.
<u>Flexor tendon</u> disorders of		Combination force,			Sustained tool use.
<u>the Wrist</u>	repeti postur	repetition, & posture.			Awkward posture. ³
					No relationship to keyboard use is expected in a good ergonomic workstation.

Diagnosis	Evidence FOR Specific Risk Factors			Evidence AGAINST	Non-Evidence-Based Additional Risk Factors
	Strong Multiple high quality studies	Good One high quality study or multiple adequate studies	Some One adequate study	Specific Risk Factors	to Consider. These factors must be present for at least 4 hours of the work day, and may not overlap evidence risk factors. ¹
					Wrist bending in extreme postures.
					Repetitive hitting.
<u>Guvon Canal</u>	N	Ulnar wrist posture and flexion. Direct pressure on the wrist.			
<u>Posterior</u> <u>Interroseus</u> <u>Nerve</u> <u>Entrapment</u>	Refer to lateral ep N				
<u>Pronator</u> <u>Syndrome</u>	Refer to medial ep N				
<u>Trigger</u> <u>Finger</u>			Hand tool use – 6 hours.		Repeated digital flexion.
			Repetition		
			and force - force of 1 kg		Repetitive Supination.

Hours are calculated by totaling the cumulative exposure time to the risk over an 8 hour day. Breaks or periods of inactivity or performing other types of work tasks are not included. Unless the hours are specifically stated below, "combination" of factors described below uses the Risk Factor Definitions found in the Secondary Risk Factor column.

Diagnosis	Evidence FOR Specific Risk Factors			Evidence AGAINST	Non-Evidence-Based Additional Risk Factors	
	Strong Multiple high quality studies	Good One high quality study or multiple adequate studies	Some One adequate study	Specific Risk Factors	to Consider. These factors must be present for at least 4 hours of the work day, and may not overlap evidence risk factors. ¹	
<u>Radial</u> <u>Tunnel</u> <u>Syndrome</u>			with cycle time < 1 minute or awkward posture (static posture) elbow > 90 degrees.		Extension of the elbow from 0 to 45 degrees.	
<u>Triangular</u> <u>Fibrocartilage</u> <u>Compression</u>	N	o Quality Eviden	ce Available.		Usually from traumatic hyperextension which may become symptomatic over time. Wrist posture in extension and repetitive supination of the forearm and/or elbow extension.	
					For occupational, usually unilateral with ulnar wrist pain while supinating and extending the wrist as part of the regular work duty.	
¹ Physiological risk factors are those generally agreed upon by the medical community to cause the specific condition described. Other risk factors described are those identified in lower quality studies that are possibly						

related. These are consensus risk factors.

² Combined factors refer to the Secondary Risk Factor definitions found in the Risk Factor Definition Table.

Hours are calculated by totaling the cumulative exposure time to the risk over an 8 hour day. Breaks or periods of inactivity or performing other types of work tasks are not included. Unless the hours are specifically stated below, "combination" of factors described below uses the Risk Factor Definitions found in the Secondary Risk Factor column.

Diagnosis	Evidence FOR Specific Risk Factors			Evidence AGAINST	Non-Evidence-Based Additional Risk Factors
	Strong Multiple high quality studies	Good One high quality study or multiple adequate studies	Some One adequate study	Specific to Consider. The Risk factors must be Factors for at least 4 ho work day, and to overlap evidence factors. ¹	to Consider. These factors must be present for at least 4 hours of the work day, and may not overlap evidence risk factors. ¹

³ <u>Caution</u>: These additional risk categories may not be used when awkward posture, using a similar definition, has been cited as a Secondary Risk Factor.

⁴ Evidence rated as strong by NIOSH 1997 criteria are placed in the "good" category.

⁵ Due to small case size and a definition of low force/high repetition jobs that likely included many jobs qualifying for a force risk from the "Risk Definitions" table, this study does not support repetition as a sole risk factor.

E. Follow-up Diagnostic Imaging and Testing Procedures

One diagnostic imaging procedure may provide the same or distinctive information as does another procedure. Therefore, the prudent choice of a single diagnostic procedure, a complement of procedures or a sequence of procedures will optimize diagnostic accuracy; maximize cost effectiveness (by avoiding redundancy), and minimize potential adverse effects to patients.

All diagnostic imaging procedures have a significant percentage of specificity and sensitivity for various diagnoses. None is specifically characteristic of a certain diagnosis. Clinical information obtained by history-taking and physical examination should be the basis for selection and interpretation of imaging procedure results.

When a diagnostic procedure, in conjunction with clinical information, provides sufficient information to establish an accurate diagnosis, the second diagnostic procedure will become a redundant procedure. At the same time, a subsequent diagnostic procedure can be a complementary diagnostic procedure if the first or preceding procedures, in conjunction with clinical information, cannot provide an accurate diagnosis. Usually, preference of a procedure over others depends upon availability, a patient's tolerance, and/or the treating practitioner's familiarity with the procedure.

E.1 Electrodiagnostic (EDX) Studies

This section does not include automated electrodiagnostic testing such as neurometers and portable automated electrodiagnostic devices. These testing devices are not adequate to determine peripheral neuropathies or unusual nerve compression syndromes and should not be used. Neurometers and portable electrodiagnostic testing devices may not be used to make a diagnosis and are not recommended in treatment settings. Refer also to Section E. 5 a. i. and ii. (Electroneurometer and Portable Automated Electrodiagnostic Devices).

a. Electrodiagnostic (EDX) studies are well-established and widely accepted for evaluation of patients suspected of having peripheral nerve pathology. Studies may confirm the diagnosis or direct the examiner to alternative disorders. Studies may require clinical correlation due to the occurrence of false positive and false negative results. Symptoms of peripheral nerve pathology may occur with normal EDX studies, especially early in the clinical course.

Because EDX studies may be falsely negative early in the clinical course, they are usually delayed until the patient has been symptomatic for 4 to 6 weeks. Refer to Sections F and G, on specific diagnoses for details.

When polyneuropathy is suspected it may be worthwhile to perform electrodiagnostic testing in the lower extremities.

b. To assure accurate testing, temperature should be maintained at 30 to 34C preferably recorded from the hand/digits. For temperature below 30C the hand should be warmed.

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c. All studies must include normative values for their laboratories.

E.2 Imaging Studies

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a. Radiographic Imaging: of the upper extremities is a generally accepted, well-established and widely used diagnostic procedure when specific indications based on history and/or physical examination is present. It should not be routinely performed for cumulative trauma injuries. It may be useful when clinical findings suggest a fracture, arthritis, avascular necrosis or ligament or cartilage injuries involving the carpals or pain persists after initial treatment. The mechanism of injury and specific indications for the radiograph should be listed on the request form to aid the radiologist and x-ray technician. For additional specific clinical indications, see Sections F and G "Specific Musculoskeletal/Peripheral Nerve Diagnosis, Testing and Treatment." Indications for initial imaging may include any of the following:

b. MRI: May show increased T2-weighted signal intensity of the common extensor tendon in lateral epicondylitis, but this finding has commonly been found in the asymptomatic contralateral elbow and is not sufficiently specific to warrant the use of MRI as a diagnostic test for epicondylitis. MRI may be helpful to diagnoses triangular fibrocartilage complex tears and other suspected ligament or bone pathology when clinical findings suggest these diagnoses. Its routine use for CTCs are not recommended.

c. Computed Axial Tomography (CT): is generally accepted and provides excellent visualization of bone. It is rarely needed for cumulative trauma conditions. When clinical findings suggest possible bone pathology it may be used to further evaluate bony masses and suspected fractures not clearly identified on radiographic window evaluation. Instrument scatter reduction software provides better resolution when metallic artifact is of concern.

d. Diagnostic Sonography: is an accepted diagnostic procedure to rule out mass lesions. It is rarely appropriate for CTC diagnoses; however, may be used to rule out ganglions, other space occupying lesions and flexor tendon injuries. It should not be used to diagnosis carpal tunnel syndrome. The performance of sonography is operator dependent, and is best when done by a specialist in musculoskeletal radiology.

e. Bone Scans: Recommended to diagnose occult scaphoid fracture, or for elbow pain to assist in the diagnosis of osteonecrosis when clinical suspicion is high despite negative x-rays.

E.3 Joint Aspiration

Joint aspiration is a generally accepted, well-established and widely used procedure when specifically indicated and performed by individuals properly trained in these techniques. It is rarely indicated for cumulative trauma conditions but may be needed when history and/or physical examination are of concern for a septic joint or bursitis and for some acute injuries. Persistent or unexplained effusions may be examined for evidence of infection, rheumatologic, or inflammatory processes. The presence of fat globules in the effusion strongly suggests occult fracture.

E.4 Personality/Psychological/Psychosocial Evaluations

Personality/Psychological/Psychosocial Evaluations are generally accepted and well-established diagnostic procedures with selective use in the CTC population, but have more widespread use in sub-acute and chronic pain populations.

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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:

- Employment history;
- Interpersonal relationships both social and work;
- Leisure activities;
- Current perception of the medical system;
- Results of current treatment;
- Perceived locus of control; and
- Childhood history, including abuse and family history of disability.

This information should provide clinicians with a better understanding of the patient, thus allowing for a more effective rehabilitation. The evaluation will determine the need for further psychosocial interventions, and in those cases, a Diagnostic Statistical Manual for Mental Disorders (DSM) 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 1 to 2 hours. When issues of chronic pain are identified, the evaluation should be more extensive and follow testing procedures as outlined in the Department's Chronic Pain Disorder Medical Treatment Guidelines.

• Frequency: 1 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 2 hours of professional time.

E.5 Adjunctive Testing

Adjunctive testing these tests are not used to establish a diagnosis. They may be used to follow the progress of the patient, depending on their diagnosis or to conduct research.

a. Automated Electrodiagnostic Testing:

- 1. Electroneurometer: Not recommended as a diagnostic tool because it requires patient participation, cannot distinguish between proximal and distal lesions, and does not have well validated reference values.
- 2. Portable Automated Electrodiagnostic Devices: Measures distal median nerve motor latency and F-wave latency at the wrist and has been tested in research settings. It performed well in this setting following extensive calibration of the device. Motor nerve latency compared favorably with conventional electrodiagnostic testing, but F-wave latency added little to diagnostic accuracy. It remains an investigational instrument whose performance in a primary care setting is as yet not established, and is not recommended as a substitute for conventional electrodiagnostic testing in clinical decision making.

b. Pinch and Grip Strength Measurements: Not generally accepted as a diagnostic tool for CTC's. Strength is defined as the muscle force exerted by a muscle or group of muscles to overcome a resistance under a specific set of circumstances. Pain, the perception of pain secondary to abnormal sensory feedback, and/or the presence of abnormal sensory feedback affecting the sensation of the power used in grip/pinch may cause a decrease in the force exerted and thereby not be a true indicator of strength. When a bell-shaped curve is present, these measures provide a method for quantifying strength that can be used to follow a patient's progress and to assess response to therapy. In the absence of a bell-shaped curve, clinical reassessment is indicated. These measurements may also be useful to determine an individual's fitness for duty or as a reassessment after therapy and/or surgery.

c. Quantitative Sensory Testing (QST): May be used as an assessment tool to monitor the patient's progress throughout treatment. Results of tests and measurements of sensory integrity are integrated with the history and review of systems findings and the results of other tests and measures. QST tests the entire sensory pathway, limiting its ability to localize a deficit precisely. It depends on the patient's report of perception and may not be objective. Cutaneous conditions may alter sensory thresholds.

QST may be useful for peripheral polyneuropathy but not for isolated nerve injury or compression syndromes. Although it is not useful diagnostically, it may be used post-operatively for surgically treated mononeuropathies.

- 1. Threshold tests measure topognosis, the ability to exactly localize a cutaneous sensation, and pallesthesia, the ability to detect mechanical sensation using vibration discrimination testing (quickly adapting fibers); and/or Semmes-Wienstein monofilament testing (slowly adapting fibers);
- 2. Density tests also measure topognosis and pallesthesia using static two-point discrimination (slowly adapting fibers); and/or moving two-point discrimination (quickly adapting fibers).

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E.6 Special Tests

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, physical work demand classifications, and tolerance. The procedures in this subsection are listed in alphabetical order.

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, and effectiveness of treatment. These evaluations should not be used as a major determinant of 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: 1 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 and financial status, as well as psychosocial aspects of competitive employment may be evaluated. Components of this evaluation may include: (a) musculoskeletal screen; (b) cardiovascular profile/aerobic capacity; (c) coordination; (d) lifting/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 unable to return to the pre-injury position and further information is desired to determine permanent work restrictions. Prior authorization is required for FCEs performed during treatment.

c. Jobsite Evaluations and Alterations: Ergonomic alterations must be done early to assure that appropriate changes are accomplished early in the treatment program.

Whenever a case is identified as a work-related cumulative trauma condition, job alterations are an expected treatment. These may be in the form of: 1) instructing the worker how specific duties might be performed to meet ergonomic standards; 2) actual job worksite or duty changes; and/or 3) a formal jobsite evaluation at the worksite.

Jobsite evaluation and alteration should include input from a health care professional with experience in ergonomics or a certified ergonomist; the employee, and the employer. The

employee must be observed performing all job functions in order for the jobsite evaluation to be a valid representation of a typical workday.

A formal jobsite evaluation is a comprehensive analysis of the physical, mental and sensory components of a specific job and may be important initially to determine causation. 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) environmental requirements of a job; (j) repetitiveness; and (k) essential functions of a job.

Ergonomic changes that provide a therapeutic benefit or relieve the patient's ongoing symptoms are part of the required medical treatment for cumulative trauma conditions and therefore, it is assumed that the insurer will be responsible for paying for such jobsite alterations.

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. Refer to Jobsite Alterations, Section I. 4, for specific ergonomic recommendations.

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

- 1. To determine if there is potential contributing factors to the person's condition and/or for the physician to assess causality;
- 2. To make recommendations for, and to assess the potential for ergonomic changes;
- 3. To provide a detailed description of the physical and cognitive job requirements;
- 4. 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; and/or
- 5. To give detailed work/activity restrictions.
 - Frequency: 1 time with additional visits as needed for follow-up per jobsite.

d. Vocational Assessment: Once an authorized practitioner has determined that a patient will not be able to return to his/her former employment and can prognosticate final restrictions, implementation of a timely vocational assessment can be performed. 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 effectiveness of vocational rehabilitation may be enhanced when performed in combination with work hardening or work conditioning. If prognosis for return to former occupation is determined to be poor, except in the most extenuating circumstances,

vocational assessment should be implemented within 3 to 12 months post-injury. Declaration of MMI should not be delayed solely due to lack of attainment of a vocational assessment.

• Frequency: 1 time with additional visits as needed for follow-up.

e. Work Tolerance Screening (Fitness for Duty): is a determination of an individual's tolerance for performing a specific job as based on a job activity or task. It may include a test or procedure to specifically identify and quantify work-relevant cardiovascular demands, physical fitness, and postural tolerance. It may also address ergonomic issues affecting the patient's return-to-work potential. May be used when a full FCE is not indicated.

F. Specific Cumulative Trauma Conditions Diagnosis, Testing and Treatment Procedures

Cumulative trauma related conditions (CTCs) comprise a number of specific diagnoses with specific diagnostic findings and treatment. Cumulative trauma disorder itself is not a diagnosis and cannot be treated or evaluated until the specific diagnosis is identified. Refer to Section C., Definitions and Mechanisms of Injury for details.

CTCs often involve several diagnoses and conservative treatment of all applicable diagnoses should be treated simultaneously. See Section G for peripheral neuropathies.

F.1 Aggravated Osteoarthritis

a. Description/Definition:

Degenerative joint disease (DJD) is most commonly caused by osteoarthrosis (OA). While osteoarthritis is the more common name for this entity, osteoarthrosis is more technically precise as there is no classic inflammation. Other types of arthritic disorders that cause DJD include inflammatory autoimmune disorders (e.g. rheumatoid arthritis, systemic lupus erythematosus, psoriasis) and crystal diseases (e.g., gout, pseudogout, apatites).

As these latter disorders are non-occupational, they are not included in this discussion. The common pathway for OA includes destruction of the joint such that it may be indistinguishable on x-ray, although at times suggestive differences appear on x-ray. Thus, a technically correct interpretation of an x-ray may include DJD, but not OA. There is a predisposition for patients who already have OA in one or two joints to develop OA in other joint groups. Several genetic factors have been identified.

Internal wrist joint pathology is accompanied by cartilage loss. Pain usually is in the carpalmetacarpal joints; or in metacarpal-phalangeal joints.

Hand and finger osteoarthrosis is extraordinarily common affecting over 50% of the aged population. These are believed to be largely non-occupational issues, but some may be covered under some workers' compensation jurisdictions, usually under fairly limited circumstances. This is particularly true for mono-articular arthrosis as a consequence of an occupational injury.

b. Occupational Relationship: Unilateral cases arising in a joint that sustained a prior fracture is often considered to be work-related. Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

Regardless of cause, symptoms usually consist of gradual onset of stiffness and non-radiating pain. Gradual joint enlargement is often present, although frequently unnoticed by the patient. Swelling, erythema, warmth and other signs of infection or inflammation are not present, and if present signal an inflammatory, crystalline arthropathy, septic arthritis or other cause. The history should include symptoms affecting any other joints in the body, presence of other potential causes (e.g., psoriasis, rheumatoid arthritis, gout) to help ascertain the correct diagnosis.

Mild cases may show few, if any abnormalities. However, as the disease progresses, more findings develop. Boney enlargement of the affected joint(s) is present on inspection and range of motion is usually reduced. Boney enlargement of the distal interphalangeal joints is termed "Heberden's nodes" while of the proximal interphalangeal joints is called "Bouchard's nodes." Crepitus on range of motion is often present. Joints are generally not warm, have no significant joint effusion and are usually non-tender.

The most common joint affected is the first carpal metacarpal (CMC) joint. The thumb metacarpal-phalangeal joint may also be involved. The "grind test" consists of applying an axial load to the first metacarpal and rotating it medially and laterally. A positive test results in pain and/or crepitus. Subluxation of the metacarpal may be induced in advanced cases. Swelling, reduced motion, and angular deformities may be present.

When a patient presents with pain at the base of the thumb, tests for de Quervain's, flexor carpi radialis tendonitis and scaphoid pathology should all be considered.

d. Diagnostic Testing Procedures: X-ray, diagnostic injection and/or aspiration. Eaton and Littler developed a radiographic x-ray scheme to stage thumb carpal metacarpal arthritis described below.

Stage 1 - articular contours normal, joint space may be widened with less than 1/3 subluxation of articular surfaces on any view.

Stage 2 - slight narrowing of joint space with osteophytes measuring less than 2mm, articular contours are normal and there may be more than 1/3 subluxation on stress radiographs.

Stage 3 - CMC joint space narrowing with sclerotic or cystic changes and osteophytes greater than 2mm with scaphotrapezial-trapezoid joint intact.

Stage 4 – Pan-trapezial arthrosis with both CMC and scaphoid trapezio-trapezoid (STT) joints showing severe articular degeneration.

e. Non-operative Treatment Procedures:

<u>i. Initial Treatment</u>: There is good evidence that custom splints used nocturnally for 1 year decrease pain and increase function. Historically, both hand-based and forearm-based splints have been used effectively and the type of splint should probably be based on patient preference as this will also influence long-term compliance. Splinting may be used nocturnally and for protection during specific activities. It should maintain neutral wrist mechanics to avoid nerve stretch and/or ligamentous changes to the extensor or transverse carpal ligament. Self application of heat and ergonomic changes of the jobsite are recommended.

Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC): Most common outcome measure other than standard pain ratings and VAS pain ratings. It combines subjective ratings of pain with activities, stiffness, physical function, social function and emotional function measures

<u>ii. Medications</u> such as analgesics (including NSAIDs) and over the counter medications for symptomatic relief may be helpful. Topical salicylates and nonsalicylates have been shown to be effective in relieving pain in acute and chronic musculoskeletal conditions. Capsaicin is

recommended for chronic osteoarthristis or acute flares of osteoarthritis. There is good evidence that diclofenac gel reduces pain and improves function in mild-to-moderate hand osteoarthritis. At the time of this guidelines writing, diclofenac gel has been FDA approved for acute pain due to minor strains, pains, and contusions; and for relief of pain due to osteoarthritis of the joints amenable to topical treatment, such as those of the knees and hands. There is some evidence that topical ketoprofen patches are more effective than placebo in reducing pain of upper extremity tendonitis; however, the need for continuous skin application may limit overall use. Use of ketoprofen topical patch for the disorders described in these guidelines has not been FDA approved at the time of this guideline writing. Liver enzymes should be monitored when using topical NSAIDs.

Non-prescription glucosamine and chondroitin are sold in the United States as dietary supplements. Their dosage, manufacture, and purity, are not regulated by the Food and Drug Administration. Effectiveness for mild disease is unknown.

When osteoarthritis is identified as a contributing factor to a work-related injury pharmaceutical grade glucosamine and chondroitin may be tried.

S-adenosyl methionine (SAM-e), like glucosamine and chondroitin, is sold as a dietary supplement in the United States, with a similar lack of standard preparations of dose and manufacture. SAM-e is not currently recommended due to lack of availability of pharmaceutical quality, systemic effects, and loss of potency with storage.

Refer to medication discussions in Section I. 5, Medications and Medical Management for further details.

<u>iii. Patient education should include instruction in self-management techniques</u>, ergonomics, and home therapy program. One study demonstrated a 70% reduction in the number of patients desiring surgery when they were provided with 3 sessions of hand therapy explaining the use of splints; accessories such as fitted scissors, book support, pen handles; and modification of their work environment.

It is strongly suggested that all patients receive hand therapy support before considering surgery, especially if the job requirements place a high demand on fine hand activities.

iv. Jobsite evaluations and alterations. Ergonomic alterations must be done early to assure that appropriate changes are accomplished early in the treatment program.

Whenever a case is identified as a work-related cumulative trauma condition, job alterations are an expected treatment. These may be in the form of: 1) instructing the worker how specific duties might be performed to meet ergonomic standards; 2) actual job worksite or duty changes; and/or 3) a formal jobsite evaluation at the worksite. Suggested ergonomic changes are usually applicable to uninjured workers in the same job position. Refer to Section E.6.c., Jobsite Evaluation and H.4., Jobsite Alteration.

v. Benefits may be achieved through therapeutic rehabilitation and rehabilitation interventions. They include range of motion (ROM), active therapies, and a home exercise program. Active therapies include restoring normal joint mechanics and function of adjacent structures. Passive as well as active therapies may be used for control of pain and swelling. Therapy should progress to strengthening and an independent home exercise program targeted to further improve ROM, strength, and normal joint mechanics influenced by distal and proximal structures. Refer to Section I., Therapeutic Procedures, Non-operative.

Passive modalities are most effective as adjunctive treatments to improve the results of active treatment. They may be used as found in Section I., Therapeutic Procedures, Non-operative.

<u>vi. Steroid injections</u> may decrease inflammation and allow the therapist to progress with rehabilitation therapy. Steroid injections under significant pressure should be avoided, as the needle may be penetrating the tendon and injection into the tendon can cause possible tendon breakdown, tendon degeneration, or rupture.

Steroid injections may be useful in early stage osteoarthritis when used with a splint.

- Time to Produce Effect: 1 to 2 injections. If the first injection is unsuccessful and symptoms continue, the second injection should be performed by a specialist with expertise in the anatomy of the upper extremity.
- Optimum Frequency: 3 injections in 1 year spaced at least 4 to 8 weeks apart.
- Maximum Frequency: 6 per year in the presence of severe osteoarthritis.

Steroid injections should be used cautiously in diabetic patients. Diabetic patients should be reminded to check their blood glucose levels at least daily for 2 weeks after injections.

<u>vii. Viscosupplementation injections</u>. There is no convincing evidence that hyaluronate injections are superior to steroid injections for CMC thumb arthritis.

Viscosupplementation/Intracapsular acid salts involve the injection of hyaluronic acid and its derivatives into the joint space. Hyaluronic acid is secreted into the joint space by the healthy synovium and has functions of lubrication and cartilage protection.

There is some evidence that intra-articular injection of high-molecular weight hyaluronic acid is more effective than saline in improving function and pain at 6 months for osteoarthritis at the base of the thumb. There is no evidence that hyaluronate injections are superior to steroid injections for CMC thumb arthritis. They may be tried after 3 months of conservative therapy, including when steroid injections have failed. At the time of this guidelines writing, hylan G-F 20 has been FDA approved for the treatment of pain due to osteoarthritis of the knee in patients who have failed to respond adequately to conservative non-pharmacologic therapy and simple analgesic

- Time to Produce Effect: 1 injection.
- Optimum Frequency: 2 injections per year.

<u>viii. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. Refer to Section I. 9, Return-to-Work.

<u>ix. Other therapies in Section i. Therapeutic Procedures, Non-operative may be employed in</u> individual cases.

f. Surgical Indications/Considerations: Since cumulative trauma conditions often involve several areas in an upper extremity, surgical treatment of one problem should be performed in conjunction with conservative treatment of other problems in the upper extremity.

1. The patient may be a good surgical candidate when functional deficits interfere with activities of daily living and/or job duties after at least 3 months of active patient participation in non-operative therapy including jobsite changes, medication, injections and splints.

One study demonstrated a 70% reduction in the number of patients desiring surgery after 7 months when they were provided with 3 sessions of hand therapy explaining the use of splints; accessories such as fitted scissor, book support, pen handles; and modification of their work environment. It is strongly suggested that all patients receive hand therapy support and jobsite alterations before considering surgery.

2. Thumb carpal-metacarpal joint arthritis.

A) The most common current procedures for thumb CMC arthritis are trapeziectomy with or without suspension procedures including ligament reconstruction and/or tendon interposition. There is good evidence that these procedures have similar outcomes at 1 year. Longer follow-up time is required to establish whether trapeziectomy alone is equivalent (in terms of functional outcomes) to trapeziectomy with a suspension procedure. Osteotomies may be additional procedures in some cases and fusions are occasionally performed, usually in younger active patients.

The ligament and tendon procedures are thought to protect the other carpal joints from earlier deterioration and allow greater stability for the thumb. Most patients have not been followed long enough to compare rates of subsequent arthritis and resulting functional deficits between those having a simple trapeziectomy and those with suspension procedures. There is good evidence that simple trapeziectomy is associated with fewer post-operative complications in the first year compared to ligament reconstruction and tendon interposition (LRTI) but the functional consequences of these complications are unclear, and many of them resolve as time passes. Due to the complexity of the wrist joint and the lack of clear superiority of any one procedure, the choice of the type of procedure for an individual patient must be made on a case-by-case basis by the surgeon and patient.

B) The use of implants or spacers remains highly controversial. Most long-term studies of these have shown unacceptable levels of subsidence, subluxation or breakage. Due to the lack of evidence, implant procedures should only be considered after a second opinion by a hand surgeon specializing in the techniques and thorough understanding of the patient regarding expectation from the procedure, recovery time and possible complications.

3. Arthritis at other joints.

Scaphotrapezio-trapezoid joint arthritis resistant to conservative treatment is usually

treated with fusion, although trapezoidectomy has also been used. Fusion may be recommended for thumb metacarpal-phalangeal arthritis when surgery is necessary.

- 4. 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 and the patient should agree to comply with the pre- and post-operative treatment plan including home exercise. The provider should be especially careful to make sure that the patient understands the amount of post-operative therapy required and the length of partial- and full-disability expected post-operatively.
- 5. Because smokers have a higher risk of delayed bone healing and post-operative costs, it is recommended that insurers cover a smoking cessation program peri-operatively. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures: Trapeziectomy with or without suspension procedures including ligament reconstruction and/or tendon transposition; trapezoidectomy; fusion; osteotomy, rarely implant.

h. Post-operative Treatment:

- 1. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and the therapist is important to the timing of exercise progressions.
- 2. Hand therapy should be started early to prevent loss of motion of adjacent joints. Treatment may include the following: splinting, restricted activities and other active therapy with or without passive therapy. Exact treatment regimes are based on the surgeon's recommendation and may include other therapies from Section I., Therapeutic Procedures, Non-operative.
- 3. Continuous passive motion after metacarpal-phalangeal (MCP) joint arthroplasty is not supported by scientific evidence and therefore is not recommended.
- 4. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

F.2 De Quervain's Disease

a. Description/Definition: Pain and swelling in the over the first dorsal extensor compartment (anatomical snuffbox) and/or over the radial styloid; pain radiating into the hand and forearm; pain worsened by thumb abduction and/or extension.

b. Occupational Relationship: Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings: de Quervain's disease affects the first dorsal extensor compartment.

- 1. Required elements for diagnosis of de Quervain's disease are at least one of the following:
 - Pain worsened by resisted thumb abduction and/or extension with or without resistance;
 - Positive Finkelstein's. The Finkelstein test is positive when localized pain results from ulnar wrist deviation with the thumb adducted.
- 2. Crepitus may be present and tenderness over the first dorsal compartment is common.
- 3. Less common and examiner-dependent findings include thickening of the first dorsal tendon sheath, swelling in the same area.

d. Diagnostic Testing Procedures: X-ray and other imaging may be performed to rule out other differential diagnoses or when there is an indication additional pathology, such as a space-occupying lesion, may be present.

e. Non-operative Treatment Procedures:

i. Initial Treatment: Over-the-counter medications for symptomatic relief, thumb spica, ice, and restriction of activities.

ii. Patient education should include instruction in self-management techniques, ergonomics, and a home therapy program.

iii. Jobsite evaluations and alterations. Ergonomic alterations must be done early to assure the appropriate changes are accomplished early in the treatment program.

Whenever a case is identified as a work-related cumulative trauma condition, job alterations are an expected treatment. These may be in the form of: 1) instructing the worker how specific duties might be performed to meet ergonomic standards; 2) actual job worksite or duty changes; and/or 3) a formal jobsite evaluation at the worksite. Suggested ergonomic changes are usually applicable to uninjured workers in the same job position. Refer to Section E.6.c., Jobsite Evaluation and H.4., Jobsite Alteration.

iv. Steroid injections may decrease inflammation and allow the therapist to progress with rehabilitation therapy. Steroid injections under significant pressure should be avoided as the needle may be penetrating the tendon and injection into the tendon can cause possible tendon breakdown, tendon degeneration, or rupture. Injections for patients under 30 years of age should be used with caution.

Observational studies suggest that steroid injections may be beneficial even when splints are not used. Injection into the abductor pollicis longus and extensor pollicis brevis compartments is more effective but sometimes inaccurately performed. These injections are best performed by a specialist.

- Time to Produce Effect: 1 to 2 injections. If the first injection is unsuccessful and symptoms continue, the second injection should be performed by a specialist with expertise in the anatomy of the upper extremity.
- Optimum Frequency: 3 injections in 1 year spaced at least 2 to 8 weeks apart injection.
- Maximum Frequency: 4 per year if injections result in functional benefit without local reactions or complications.

Steroid injections should be used cautiously in diabetic patients. Diabetic patients should be reminded to check their blood glucose levels at least daily for 2 weeks after injections. v. Return to work with appropriate restrictions should be considered early in the course of treatment. Refer to Section I. 9, Return to Work.

vi. Other therapies

in Section I., Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations: Since cumulative trauma conditions often involve several areas in an upper extremity, surgical treatment of one problem should be performed in conjunction with conservative treatment of other problems in the upper extremity.

First extensor compartment release is rarely necessary. Most cases resolve spontaneously over a number of months. Surgery may be performed to achieve functional gains for those with the required diagnostic exam findings who continue to have significant ongoing impaired activities of daily living after 8 weeks of treatment which include job modifications, injections, and other therapy.

Smoking may affect soft tissue healing through tissue hypoxia. Patients should be strongly encouraged to stop smoking and be provided with appropriate counseling by the physician. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels. The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures: First extensor compartment release.

h. Post-operative Treatment:

i. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progression. Treatment may include the following: splinting and other active therapy with or without passive therapy.

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ii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

F.3 Epicondylitis - Lateral Epicondylalgia

a. Description/Definition: Lateral epicondylitis is also known as tennis elbow, lateral elbow pain, rowing elbow, tendonopathy of the common extensor origin, and peri-tendonopathy of the elbow. It is characterized by elbow pain and tenderness over the lateral epicondyle of the humerus. Patients describe tenderness to palpation slightly anterior and distal to the lateral epicondyle and/or over the bony prominence of the lateral epicondyle. Patients frequently complain of pain with grasping when the elbow is extended and pronated.

b. Occupational Relationship: Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

i. Required elements for the diagnosis of lateral epicondylitis are as follows:

A) The patient must report tenderness to palpation at/near lateral epicondyle; and

B) In addition, at least one of the following examiner maneuvers must result in pain over the

lateral epicondyle and/or extensor mass of the forearm:

- Active or resisted wrist extension;
- Active or resisted middle finger extension;
- Active or resisted supination.

ii. Pain may also increase with gripping. Swelling, erythema, and warmth are generally not seen in this condition.

d. Diagnostic Testing Procedures: The clinical diagnosis of lateral epicondylitis is made by the combination of patient complaints and required objective physical findings. Additional studies such as plain radiographs, MRI, and sonogram examinations are not routinely ordered to establish the diagnosis of lateral epicondylitis, but may be used to rule out other conditions that may produce similar symptoms, including radial tunnel syndrome, cervical radiculopathy, osteochondral radiocarpal lesion, posterolateral elbow plica, and posterolateral elbow instability. X-rays may be normal or demonstrate spur formation over the involved epicondyle.

e. Non-operative Treatment Procedures:

<u>i. Initial Treatment</u>: Over-the-counter medications for symptomatic relief, ice, bracing, and restriction of activities. Topical NSAIDs may also be effective.

Literature indicates that over 80% of cases improve with conservative therapy only. The natural history of epicondylitis supports an expectation of improvement within 3 months of using patient education and modified activities.

<u>ii. Patient education</u> should include instruction in self-management techniques, ergonomics, and home therapy program.

<u>iii. Bracing</u>: Rationale for braces is to rest the wrist extensor muscles while reducing tension at the extensor origin, allowing healing of the muscle and tendon.

Brace types include proximal forearm band/sleeve, cock-up wrist splint, forearm/hand splint, and dynamic extensor brace.

There is some evidence that certain braces may improve the short-term ability to perform daily activities.

Braces may be used in patients who are able to tolerate wearing the brace during activity and do not experience worsening pain and/or additional symptoms due to brace, but should be discontinued in the event of adverse effects.

There is no evidence that one brace type is superior to other

types. However, some brace types may be impractical for use in most workers. For example, surgical technicians and food handlers would be unable to use most braces involving the wrist due to incompatibility with occupational function. The forearm band brace type appears to be the least cumbersome brace option and may be the best tolerated.

Selecting the appropriate brace type is a decision that should be made by both patient and treating physician and should include appropriate patient education and follow-up. Braces which restrict range of motion should not be used continuously as this may result in permanent loss of motion. Compression straps should not be positioned in a manner which would irritate branches of the radial nerve. Braces should achieve maximum function and patient comfort.

iv. Jobsite evaluations and alterations. Ergonomic alterations must be done early to assure the appropriate changes are accomplished early in the treatment program.

Whenever a case is identified as a work-related cumulative trauma condition, job alterations are an expected treatment. These may be in the form of: 1) instructing the worker how specific duties might be performed to meet ergonomic standards; 2) actual job worksite or duty changes; and/or 3) a formal jobsite evaluation at the worksite. Suggested ergonomic changes are usually applicable to uninjured workers in the same job position. Refer to Section E.6.c., Jobsite Evaluation and H.4., Jobsite Alteration.

v. Steroid injections may decrease inflammation, pain, and allow the therapist to progress with rehabilitation therapy. There is strong evidence that steroid injection decreases pain in the first few weeks but has a worse outcome at 52 weeks than PT or more conservative therapy including bracing, platelet-rich plasma injections, heat or cold therapy, and change in activities. The potential for negative long-term effects should be strongly considered. Steroid injections under significant pressure should be avoided as the needle may be penetrating the tendon and injection into the tendon can cause possible tendon breakdown, tendon degeneration, or rupture. Injections for patients under 30 years of age should be used with caution.

- Time to Produce Effect: 1 to 2 injections. If the first injection is unsuccessful and symptoms continue, the second injection should be performed by a specialist with expertise in the anatomy of the upper extremity.
- Optimum Frequency: 3 injections in 1 year spaced at least 2 to 8 weeks apart injection.
- Maximum Frequency: 4 to 6 per year if injections result in functional benefit without local reactions or complications.

There is some evidence recommending Bupivacaine, as an adjuvant for glucocorticoid injections.

Steroid injections should be used cautiously in diabetic patients. Diabetic patients should be reminded to check their blood glucose levels at least daily for 2 weeks after injections.

<u>vi. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. Refer to Section I. 9, Return to Work.

<u>vii. Botulinum toxin injection</u>: Rationale for botulinum toxin treatment is that it reversibly paralyzes the extensor muscles and thereby prevents repetitive micro-trauma of the tendonous fibers at their origin from the osseous lateral epicondyle. The unit dosage varies significantly depending on the brand used. Usage for lateral and medial epicondylitis is not FDA approved at the time of this guideline writing. There is good evidence that botulinum toxin A injection may provide short-term pain relief from pain due to chronic (3 months or longer) lateral epicondylitis. However, the long-term functional benefits are unknown. There is also good evidence that botulinum toxin A injections cause weakness in finger extension and/or digit paresis. Additional complications may include: allergic reaction to medications, increased risk of systemic effects in patients with motor neuropathy or disorders of the neuromuscular junction.

Botulinum toxin injection is known to cause short-term third (middle) finger strength deficits and possible digit paresis, which may persist for up to 3 to 4 months. Botulinum toxin injection should only be used in patients whose occupational performance will be unaffected by this side effect, and should not be used in patients with physically demanding job descriptions.

It should not be considered a first line of treatment. Other conservative measures should be tried first. A single botulinum toxin type A injection may provide pain reduction for up to 3 to 4 months in patients with chronic lateral epicondylitis which has persisted after 3 months of treatment.

Botulinum toxins are manufactured at different potencies, and units of the different manufacturers are not equivalent. Careful botulinum toxin dosing should be used to avoid complete paresis and allow maintained functionality and return to work.

The decision to use botulinum toxin for pain relief from chronic lateral epicondylitis symptoms should be made carefully by both patient and treating physician, with knowledge of the known side effects and consideration of the individual occupational demands of the patient.

Botulinum injection should only be performed by a physician or surgeon who has expertise in the anatomy of the upper extremity and who is experienced in the use of this agent. Prior authorization is required.

• Maximum: One injection episode

viii. Other injections:

A) Prolotherapy and polidocanol have all been used in studies too small and/or inadequate to make any recommendations. Due to lack of evidence of their effectiveness and the cost involved, prolotherapy and polidocanol are not recommended.

B) Autologous Whole Blood Injections/Platelet-Rich Plasma Injections:

1) Autologous Whole Blood Injections: are inexpensive treatments and may be used in patients

who have not made sufficient functional progress with initial therapy for lateral or medial epicondylitis after 10 to 12 weeks.

There is some evidence that for patients with symptoms lasting 6 months or more, autologous blood injections result in better pain and functional outcomes after 1 year than steroid injections.

• Optimum Frequency: 2 injections may be required.

2) Platelet-Rich Plasma Injections: There is good evidence that for patients with symptoms lasting 6 months or more, platelet-rich plasma injections result in better pain and functional outcomes after 1 year than steroid injections.

• Optimum Frequency: 2 injections may be required.

ix. There is no clinical evidence or sound physiologic rationale for <u>magnets or diathermy</u>, therefore, they are not recommended.

x. There is good evidence that <u>low level laser</u> is not more effective than placebo for lateral epicondylitis, and its use is not recommended.

xi. Extracorporeal shock wave therapy (ESWT).

Large studies have not provided evidence that this intervention provides long-term benefit. The natural history of epicondylitis supports an expectation of improvement within 3 months using patient education and modified activities.

There is some evidence that highly motivated patients may show up to a 35% additional improvement over no other treatment, when administered low energy shock wave treatment without local anesthesia. There is some evidence that using the same treatment with local anesthetic is not effective and therefore no use of local anesthetic is recommended. There is some evidence that radial shock wave therapy may also be effective. There is some evidence that ESWT results in better long-term functional and pain outcomes than steroid injections, for patients who have failed after 6 months of other treatment. Patients who have experienced some positive response to other therapy but continue to have functional deficits after 10 to 12 weeks may be considered for this treatment. Peripheral vascular disease, upper extremity neuropathy and diabetes are all relative contraindications. Diagnostic testing may be needed to rule out these conditions.

Refer to SectionIH.12, Therapeutic procedures, non-operative, for information on available evidence, time parameters, and other details.

xii. There is some evidence to support the use of <u>acupuncture</u>.

<u>xiii. Other therapies</u> in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

• Ultrasound, phonophoresis, and iontophoresis may be used occasionally to facilitate other therapy but there is no evidence that they alter long-term function.

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• Neither deep tissue massage nor manipulation alone, have sufficient evidence to support their routine isolated use. Both may be used in conjunction with a complete upper extremity therapy program when functional progress is demonstrated within the time to effect found in Section I., Therapeutic Procedures, Non-operative.

There is good evidence that physical therapy using manipulation, home exercise and supervised exercise reduced pain at 6 weeks but not at 52 weeks. This may be appropriate therapy to hasten return to work.

- Time to Produce Effect: 4 treatments.
- Optimum Frequency: 8 treatments over 6 weeks.

f. Surgical Indications/Considerations: Since cumulative trauma conditions often involve several areas in an upper extremity, surgical treatment of one problem should be performed in conjunction with conservative treatment of other problems in the upper extremity. Lateral epicondyle release/debridement is generally accepted; however, over 80% of cases improve with conservative therapy only. Intermittent discomfort may recur over 6 months to 1 year after initial conservative treatment.

The patient may be a good surgical candidate when the diagnosis is confirmed on physical exam (Refer to Section D.1.d) and functional deficits interfere with activities of daily living and/or job duties after at least 3 months of active patient participation in non-operative therapy including worksite changes, medication, splints, and injections or other therapy noted above.

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 and the patient should agree to comply with the pre- and post-operative treatment plan including home exercise. The provider should be especially careful to make sure the patient understands the amount of post-operative therapy required and the length of partial- and full-disability expected post-operatively.

Smoking may affect soft tissue healing through tissue hypoxia. Patients should be strongly encouraged to stop smoking and be provided with appropriate counseling by the physician. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels. The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures: Lateral epicondyle release/debridement. There is no evidence to support radiofrequency microtenotomy and it is not recommended.

h. Post-operative Treatment:

i. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progressions. Treatment may include the following: bracing, and active therapy with or without passive therapy.

ii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

F.4 Epicondylitis - Medial (Epicondylalgia)

a. Description/Definition: Pain emanating from the medial elbow; mild grip weakness; medial elbow pain exacerbated by repetitive wrist motions.

b. Occupational Relationship: Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

i. Required elements for the diagnosis of medial epicondylitis are as follows:
A) The patient must report tenderness to palpation at/near medial epicondyle; and
B) In addition, at least one of the following examiner maneuvers must result in pain or

B) In addition, at least one of the following examiner maneuvers must result in pain over the medial epicondyle and/or flexor mass of the forearm:

- Active or resisted wrist flexion;
- Active or resisted pronation.

ii. The exam may include elements for diagnosing cubital tunnel syndrome if appropriate.

d. Diagnostic Testing Procedures: X-ray, sonogram, and other imaging may be performed to rule out other differential diagnoses or when there is an indication additional pathology may be present. X-rays may be normal or demonstrate spur formation over the involved epicondyle.

e. Non-operative Treatment Procedures:

<u>i. Initial Treatment</u>: Over the counter medications for symptomatic relief, ice, wrist bracing and restriction of activities. Braces which restrict range of motion should not be used continuously as this may result in permanent loss of motion. A forearm band may be used. Compression straps should not be positioned in a manner which would irritate the branches of the ulnar nerve. Literature on lateral epicondylitis indicates that over 80% of cases improve with conservative therapy only. Literature on lateral epicondylitis indicates that the natural history of lateral epicondylitis supports an expectation of improvement within 3 months of using patient education and modified activities.

<u>ii. Patient education</u> should include instruction in self-management techniques, ergonomics, and a home therapy program.

<u>iii. Jobsite evaluations and alterations</u>. Ergonomic alterations must be done early to assure the appropriate changes are accomplished early in the treatment program.

Whenever a case is identified as a work-related cumulative trauma condition, job alterations are an expected treatment. These may be in the form of: 1) instructing the worker how specific duties might be performed to meet ergonomic standards; 2) actual job worksite or duty changes; and/or 3) a formal jobsite evaluation at the worksite. Suggested ergonomic changes are usually

applicable to uninjured workers in the same job position. Refer to Section E.6.c., Jobsite Evaluation and H.4., Jobsite Alteration.

<u>iv. Steroid injections</u> may decrease inflammation, pain and allow the therapist to progress with rehabilitation therapy. There is strong evidence in literature on lateral epicondylitis that steroid injection decreases pain in the first few weeks but has a worse outcome at 52 weeks than PT or more conservative therapy including bracing, platelet-rich plasma injections, heat or cold therapy, and change in activities. The potential for negative long-term effects should be strongly considered.

Steroid injections under significant pressure should be avoided as the needle may be penetrating the tendon and injection into the tendon can cause possible tendon breakdown, tendon degeneration, or rupture. Injections for patients under 30 years of age should be used with caution.

- Time to Produce Effect: 1 to 2 injections. If the first injection is unsuccessful and symptoms continue, the second injection should be performed by a specialist with expertise in the anatomy of the upper extremity.
- Optimum Frequency: 3 injections in 1 year spaced at least 2 to 8 weeks apart injection.
- Maximum Frequency: 4 to 6 per year if injections result in functional benefit without local reactions or complications.

There is some evidence recommending Bupivacaine, as an adjuvant for glucocorticoid injections.

Steroid injections should be used cautiously in diabetic patients. Diabetic patients should be reminded to check their blood glucose levels at least daily for 2 weeks after injections.

<u>v. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. Refer to Section I. 9, Return to Work.

<u>vi. Botulinum toxin injection</u>: Rationale for botulinum toxin treatment is that it reversibly paralyzes the flexor muscles and thereby prevents repetitive microtrauma of the tendonous fibers at their origin from the osseous medial epicondyle. The unit dosage varies significantly depending on the brand used. Usage for lateral and medial epicondylitis is not FDA approved at the time of this guideline writing. There is good evidence in literature on lateral epicondylitis, that botulinum toxin A may provide short-term pain relief from pain due to chronic (3 months or longer) lateral epicondylitis. However, the long-term functional benefits are unknown. There is also good evidence in literature on lateral epicondylitis, that botulinum toxin A injections cause weakness in finger extension and/or digit paresis. Therefore, weakness could be anticipated for finger flexion with use at the medial epicondyle. Additional complications may include: allergic reaction to medications, increased risk of systemic effects in patients with motor neuropathy or disorders at the neuromuscular junction.

Botulinum toxin injection is known to cause short-term third (middle) finger strength deficits and

possible digit paresis, which may persist for up to 3 to 4 months. Botulinum toxin injection should only be used in patients whose occupational performance will be unaffected by this side effect, and should not be used in patients with physically demanding job descriptions.

It should not be considered a first line of treatment. Other conservative measures should be tried first. A single botulinum toxin type A injection may provide pain reduction for up to 3 to 4 months in patients with chronic lateral epicondylitis which has persisted after 3 months of treatment.

Botulinum toxins are manufactured at different potencies, and units of the different manufacturers are not equivalent. Careful botulinum toxin dosing should be used to avoid complete paresis and allow maintained functionality and return to work.

The decision to use botulinum toxin for pain relief from chronic medial epicondylitis symptoms should be made carefully by both patient and treating physician, with knowledge of the known side effects and consideration of the individual occupational demands of the patient.

Botulinum injection should only be performed by a physician or surgeon who has expertise in the anatomy of the upper extremity and who is experienced in the use of this agent. Prior authorization is required.

• Maximum: One injection episode

vii. Other injections:

A) <u>Prolotherapy</u>, <u>polidocanol</u>, <u>and autologous whole blood</u>, have all been used in studies too small and/or inadequate to make any recommendations. Due to lack of evidence of their effectiveness and the cost involved prolotherapy, and polidocanol are not recommended.

B) Autologous Whole Blood/Platelet-Rich Plasma Injections:

1) Autologous whole blood injections: are an inexpensive treatment and may be used in patients who have not made sufficient functional progress with initial therapy for lateral and medial epicondylitis after 10 to 12 weeks.

There is some evidence in literature on lateral epicondylitis, that for patients with symptoms lasting 6 months or more, autologous blood injections result in better pain and functional outcomes after 1 year than steroid injections.

• Optimum Frequency: 2 injections may be required.

2) Platelet-Rich Plasma Injections: There is good evidence in literature on lateral epicondylitis, that for patients with symptoms lasting 6 months or more, platelet-rich plasma injections result in better pain and functional outcomes after 1 year than steroid injections.

• Optimum Frequency: 2 injections may be required.

viii. There is no clinical evidence, nor sound physiologic rationale for <u>magnets or diathermy</u>, therefore, they are not recommended.

ix. There is good evidence that <u>low level laser</u> is not more effective than placebo for lateral epicondylitis; therefore, its use is not recommended for medial epicondylitis.

x. Extracorporeal Shock Wave Therapy (ESWT):

Studies on lateral epicondylitis have shown the following: Large studies have not provided evidence that this intervention provides long-term benefit. The natural history of epicondylitis supports an expectation of improvement within 3 months using patient education and modified activities.

Other studies on lateral epicondylitis have indicated the following: There is some evidence that highly motivated patients may show up to a 35% additional improvement over no other treatment, when administered low energy shock wave treatment without local anesthesia. There is some evidence that using the same treatment with local anesthetic is not effective and therefore no use of local anesthetic is recommended. There is some evidence that radial shock wave therapy may also be effective. There is some evidence that ESWT results in better long-term functional and pain outcomes than steroid injections, for patients who have failed after 6 months of other treatment. Patients who have experienced some positive response to other therapy but continue to have functional deficits after 10 to 12 weeks may be considered for this treatment. Peripheral vascular disease, upper extremity neuropathy and diabetes are all relative contraindications. Diagnostic testing may be needed to rule out these conditions. Some devices used in ESWT may not be FDA approved for the above-mentioned indications. Refer to Section I.12, Therapeutic Procedures, Non-operative, for information on available evidence, time parameters, and other details.

xi. There is some evidence, in literature on lateral epicondylitis, to support the use of <u>acupuncture</u>

<u>xii. Other therapies</u> in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

A) Ultrasound, phonophoresis, and iontophoresis may be used occasionally to facilitate other therapy but there is no evidence, as indicated in studies on lateral epicondylitis, that they alter long-term function.

B) Studies from literature on lateral epicondylitis indicate that neither deep tissue massage, nor manipulation alone have sufficient evidence to support their routine isolated use. Both may be used in conjunction with a complete upper extremity therapy program when functional progress is demonstrated within the time to effect found in Section I, Therapeutic Procedures, Non-operative.

There is good evidence in literature on lateral epicondylitis that physical therapy using manipulation, home exercise and supervised exercise reduces pain at 6 weeks but not at 52 weeks. This may be appropriate therapy to hasten return to work.

- Time to Produce Effect: 4 treatments.
- Optimum Frequency: 8 treatments over 6 weeks.

f. Surgical Indications/Considerations: Since cumulative trauma conditions often involve several areas in an upper extremity, surgical treatment of one problem should be performed in conjunction with conservative treatment of other problems in the upper extremity.

Medial epicondyle release/debridement is generally accepted; however, the majority of cases improve with conservative therapy. Intermittent discomfort may recur over 6 months to 1 year after initial conservative treatment.

The patient may be a good surgical candidate when the diagnosis is confirmed on physical exam (Refer to Section D.1,d) and functional deficits interfere with activities of daily living and/or job duties after at least 3 months of active patient participation in non-operative therapy including worksite changes, medication, splints, and injections or other therapy noted above.

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 and the patient should agree to comply with the pre- and post-operative treatment plan including home exercise. The provider should be especially careful to make sure the patient understands the amount of post-operative therapy required and the length of partial- and full-disability expected post-operatively.

Smoking may affect soft tissue healing through tissue hypoxia. Patients should be strongly encouraged to stop smoking and be provided with appropriate counseling by the physician. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels. The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures: Medial epicondyle release/debridement.

Medial Epicondylectomy is recommended in select cases of medial epicondylalgia: Patients who fail to improve after a minimum of 6 months of care that includes at least 3-4 different types of conservative treatment.

h. Post-operative Treatment:

i. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-Operative. In all cases, communication between the physician and therapist is important to the timing of exercise progressions. Treatment may include the following: bracing, and active therapy with or without passive therapy.

ii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

F.5 Extensor Tendon Disorders of the Wrist

a. Description/Definition: Pain localized to the affected tendon(s) pain worsened by active and/or resisted wrist or finger extension.

b. Occupational Relationship: Refer to Section D. 3, Medical Causation Assessment. To

perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

i. Required elements for the diagnosis of extensor tendon disorders of the wrist are the following: pain and/or tenderness with active or resisted wrist/digit extension, specific to the extensor mechanism involved.

ii. Other common findings include creaking/crepitus with wrist extension and swelling along the dorsal aspects of the hand/wrist/forearm.

d. Diagnostic Testing Procedures: X-ray and other imaging may be performed to rule out other differential diagnoses or when there is an indication additional pathology may be present.

e. Non-operative Treatment Procedures:

<u>i. Initial Treatment</u>: Over the counter medications for symptomatic relief; wrist splinting, and restriction of activities.

<u>ii. Patient education</u> should include instruction in self-management techniques, ergonomics, and a home therapy program.

<u>iii. Jobsite evaluations and alterations</u>. Ergonomic alterations must be done early to assure the appropriate changes are accomplished early in the treatment program.

Whenever a case is identified as a work-related cumulative trauma condition, job alterations are an expected treatment. These may be in the form of: 1) instructing the worker how specific duties might be performed to meet ergonomic standards; 2) actual job worksite or duty changes; and/or 3) a formal jobsite evaluation at the worksite. Suggested ergonomic changes are usually applicable to uninjured workers in the same job position. Refer to Section E.6.c., Jobsite Evaluation and H.4., Jobsite Alteration.

<u>iv. Steroid injections may decrease inflammation, pain, and allow the therapist to progress with</u> rehabilitation therapy. Steroid injections under significant pressure should be avoided as the needle may be penetrating the tendon and injection into the tendon can cause possible tendon breakdown, tendon degeneration, or rupture. Injections for patients under 30 years of age should be used with caution.

- Time to Produce Effect: 1 to 2 injections. If the first injection is unsuccessful and symptoms continue, the second injection should be performed by a specialist with expertise in the anatomy of the upper extremity.
- Optimum Frequency: 3 injections in 1 year spaced at least 2 to 8 weeks apart.
- Maximum Frequency: 3 to 4 per year if injections result in functional benefit without local reactions or complications.

Steroid injections should be used cautiously in diabetic patients. Diabetic patients should be reminded to check their blood glucose levels at least daily for 2 weeks after injections.

<u>v. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. Refer to Section I. 9, Return to Work.

vi. Other therapies in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations: Since cumulative trauma conditions often involve several areas in an upper extremity, surgical treatment of one problem should be performed in conjunction with conservative treatment of other problems in the upper extremity. Surgery is indicated when a tendon is ruptured.

Surgery may be performed to achieve functional gains for those with the required diagnostic exam findings who continue to have significant ongoing impaired activities of daily living after 8 weeks of treatment which included job modifications, injections and other therapy.

Smoking may affect soft tissue healing through tissue hypoxia. Patients should be strongly encouraged to stop smoking and be provided with appropriate counseling by the physician. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels. The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures: Tenosynovectomy, Repair, and/or reconstruction of the extensor tendon.

h. Post-operative Treatment:

i. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progressions. Treatment may include the following: splinting, and active therapy with or without passive therapy.

ii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

F.6 Flexor Tendon Disorders of the Wrist

a. Description/Definition: Pain and/or tenderness localized to the affected tendons; pain in the affected tendons associated with wrist/digit flexion and ulnar deviation, especially against resistance.

b. Occupational Relationship: Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

i. Required elements for the diagnosis of general wrist flexion tendon disorders include the following:

- A) Reproduction of pain with active or resisted wrist/digit flexion; or
- B) Ulnar deviation specific to flexor mechanism involved.
- ii. Crepitus with active motion of the flexor tendons may also be present.

d. Diagnostic Testing Procedures: X-ray and other imaging may be also performed to rule out other differential diagnoses or when there is an indication additional pathology may be present.

e. Non-operative Treatment Procedures:

<u>i. Initial Treatment</u>: Over-the-counter medications for symptomatic relief, wrist splints for wrist flexors and splinting.

<u>ii. Patient education</u> should include instruction in self-management techniques, ergonomics, home therapy program and intermittent splinting for contractures.

<u>iii. Jobsite evaluations and alterations</u>. Ergonomic alterations must be done early to assure the appropriate changes are accomplished early in the treatment program. Whenever a case is identified as a work-related cumulative trauma condition, job alterations are an expected treatment. These may be in the form of: 1) instructing the worker how specific duties might be performed to meet ergonomic standards; 2) actual job worksite or duty changes; and/or 3) a formal jobsite evaluation at the worksite. Suggested ergonomic changes are usually applicable to uninjured workers in the same job position. Refer to Section E.6.c., Jobsite Evaluation and H.4., Jobsite Alteration.

<u>iv. Steroid Injections</u> may decrease inflammation, pain, and allow the therapist to progress with rehabilitation therapy. Steroid injections under significant pressure should be avoided as the needle may be penetrating the tendon and injection into the tendon can cause possible tendon breakdown, tendon degeneration, or rupture. Injections for patients under 30 years of age should be used with caution.

- Time to Produce Effect: 1 to 2 injections. If the first injection is unsuccessful and symptoms continue, the second injection should be performed by a specialist with expertise in the anatomy of the upper extremity.
- Optimum Frequency: 3 injections in 1 year spaced at least 2 to 8 weeks apart.
- Maximum Frequency: 3 to 4 per year if injections result in functional benefit without local reactions or complications.

Steroid injections should be used cautiously in diabetic patients. Diabetic patients should be reminded to check their blood glucose levels at least daily for 2 weeks after injections.

<u>v. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. Refer to Section I. 9, Return to Work.

<u>vi. Other therapies</u> in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

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f. Surgical Indications/Considerations: Since cumulative trauma conditions often involve several areas in an upper extremity, surgical treatment of one problem should be performed in conjunction with conservative treatment of other problems in the upper extremity. Surgery is rarely necessary. Any decision for surgical intervention should be based on a hand surgeon's evaluation of need and the existence of a clear functional deficit that can be corrected by surgical intervention.

Smoking may affect soft tissue healing through tissue hypoxia. Patients should be strongly encouraged to stop smoking and be provided with appropriate counseling by the physician. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels. The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures: The surgical procedures will depend on the specific deficit.

h. Post-operative Treatment:

i. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progressions. Treatment may include the following: splinting, and active therapy with or without passive therapy.

ii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

F.7 Hand Arm Vibration Syndrome

a. Decription/ Definition: constellation of adverse physiological responses causally associated with low-frequency, high-amplitude vibratory forces, such as those experienced through the use of various hand tools including pneumatic drills, riveters and chain saws or from vibratory rich activities such as driving off-road vehicles. Other terms commonly used to describe these responses include Raynaud's phenomenon of occupational origin, white fingers, dead fingers, traumatic vasospastic disease (TVD), and "vibration-induced white finger."

The adverse effects of HAVS are characterized by circulatory disturbances associated with digital arteriole sclerosis and manifest as vasospasm with local finger blanching; sensory and motor disturbances manifest as numbness, loss of finger coordination and dexterity, clumsiness and inability to perform intricate tasks; and musculoskeletal disturbances manifest as swelling of the fingers, bone cysts and vacuoles. There are also several reports of association of CTS with HAVS and exposure to vibration.

b. Occupational Relationship: Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections. Work-relatedness is based on confirmation of the diagnosis and a mechanism of occupational injury where there is an appropriate exposure which is generally low frequency high amplitude vibration.

Epidemiologic evidence indicates there is a latency period of from 1 to 16 years of exposure before onset of HAVS, with a trend for decreasing prevalence as changes in work-practice and anti-vibratory tools and dampening actions have been implemented.

According to the International Organization for Standardization, the risk for developing HAVS is proportional to the total vibration energy measured in magnitude, duration, and frequency. The range of vibration frequencies thought to be harmful is 4Hz to 5000Hz dependent on the intensity, and whether or not it is oscillatory or impact force, with impact vibratory force thought to be more hazardous.

c. Specific Physical Exam Findings:

Initial assessment for HAVS is a detailed history and examination focusing on vibratory exposure and sensorineural or vascular symptoms. The clinical symptoms may include episodic tingling, numbness, blanching white fingers, pain and paresthesia, burning sensation, clumsiness, poor coordination, sleep disturbance, hand weakness measured in grip strength, and diffuse muscle, bone and joint pain from the fingers to the elbow.

Differential diagnosis should consider other causes of Raynaud's phenomenon, including the connective tissue diseases of scleroderma, systemic lupus erythematosus, rheumatoid arthritis, dermatomyositis, and polyarteritis nodosa.

HAVS can manifest as vasospasm with local finger blanching; sensory and motor disturbances such as numbness, loss of finger coordination and dexterity, clumsiness and inability to perform intricate tasks; and musculoskeletal disturbances such as swelling of the fingers, bone cysts, and vacuoles.

A complete examination should include close attention to motor, sensory and vascular functions of the affected extremities. Evaluation should be extended to the shoulder and neck for upper extremity symptoms including tests for vascular insufficiency. Particular note should be made for blanching, coordination of movement, grip strength, tenderness and swelling of the digits and forearm tissue, and trophic changes of the skin.

d. Diagnostic Testing Procedures: Currently there is no "gold standard" for the diagnosis and staging of hand-arm vibration syndrome (HAVS).

e. Non-operative Treatment Procedures:

i) Initial Treatment:

The most prudent form of treatment is to first remove or reduce the exposure to vibration, particularly in the earlier stages of symptom presentation. Smoking has been identified as a risk factor for HAVS. By inference, smoking cessation is a frequent recommendation to patients with HAVS. As a risk factor, smoking cessation is recommended.

Other common advice based on the proposed pathophysiology of vasospasm includes avoidance of beta-blockers, sympathetic stimulants including caffeine, decongestants, amphetamines and even cocaine as they may act as potential triggers. Further, maintenance of hand and body temperature in cold environments may help avoid or reduce the risk of symptoms.

<u>ii) Medications</u> such as analgesics and anti-inflammatories may be helpful. Use of calcium channel blockers (nifedipine) for treatment of vascular symptoms similar to Raynaud's phenomenon is recommended for advanced subacute or chronic HAVS.

Refer to medication discussions in Section I. 5, Medications and Medical Management for further details.

<u>iii) Patient education should include instruction in self-management techniques, ergonomics, body mechanics, home exercise, joint protection, smoking cessation, and weight management.</u>

iv) Jobsite evaluations and alterations. Ergonomic alterations must be done early to assure the appropriate changes are accomplished early in the treatment program.

Whenever a case is identified as a work-related cumulative trauma condition, job alterations are an expected treatment. These may be in the form of: 1) instructing the worker how specific duties might be performed to meet ergonomic standards; 2) actual job worksite or duty changes; and/or 3) a formal jobsite evaluation at the worksite. Suggested ergonomic changes are usually applicable to uninjured workers in the same job position. Refer to Section E.6.c., Jobsite Evaluation and H.4., Jobsite Alteration.

v) Return to work with appropriate restrictions should be considered early in the course of treatment. For patients with HAVS, it is recommended that their work be restricted to those tasks that do not involve high-amplitude, low-frequency vibration exposures from hand-held tools. For select patients with HAVS, it is recommended that their work be restricted to those tasks that do not involve cold exposures. Refer to Section I.9, Return to Work. vi) Other therapies in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations: Since cumulative trauma conditions often involve several areas in an upper extremity, surgical treatment of one problem should be performed in conjunction with conservative treatment of other problems in the upper extremity. There are no surgical recommendations for HAVS.

F.8 Triangular Fibrocartilage Complex Tear (TFCC)

a. Description/Definition: tear of the fibrocartilage between the radius and the ulna with symptoms mainly on the ulnar side of the wrist.

b. Occupational Relationship: Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

i. Required elements for the diagnosis of TFCC are:

A) Tenderness over the TFCC complex; and

B) One other positive provocative test with localizing pain, clicking or findings of abnormal motion. Provocative tests include:

- Forced supination and pronation with axial pressure on an ulnar deviated wrist;
- The patient pushes up from a seating position using the hand; and/or
- Ballottement of the distal ulna with the wrist supinated causes abnormal motion as compared to the asymptomatic side.

ii. Crepitus is frequently present;

iii. Extensor or flexor carpi ulnaris tendinitis may also be confused with TFCC.

d. Diagnostic Testing Procedures: X-ray and MRI or MRI arthrography. As with knee degenerative changes, many patients with TFCC tears are asymptomatic. In one study of patients with a history of TFCC and related falls, ligament disruptions were commonly found in the opposite asymptomatic hand over 50% of the time. It may be reasonable to also image the opposite wrist if it is asymptomatic. Those with a corresponding abnormality in the opposite wrist should have an especially rigorous diagnostic review before proceeding to a surgical intervention.

e. Non-operative Treatment Procedures:

<u>i. Initial Treatment</u>: Rest, splinting, ice and later heat.

<u>ii. Medications</u> such as analgesics and over-the-counter medications for symptomatic relief may be helpful. Refer to medication discussions in Section I. 5, Medications and Medical Management.

<u>iii. Patient education should include instruction in self-management techniques, ergonomics, and a home therapy program.</u>

<u>iv. Jobsite evaluations and alterations</u>. Ergonomic alterations must be done early to assure the appropriate changes are accomplished early in the treatment program.

Whenever a case is identified as a work-related cumulative trauma condition, job alterations are an expected treatment. These may be in the form of: 1) instructing the worker how specific duties might be performed to meet ergonomic standards; 2) actual job worksite or duty changes; and/or 3) a formal jobsite evaluation at the worksite. Suggested ergonomic changes are usually applicable to uninjured workers in the same job position. Refer to Section E.6.c., Jobsite Evaluation and H.4., Jobsite Alteration.

<u>v. Steroid injections</u> may decrease inflammation, pain, and allow the therapist to progress with functional exercise and range of motion rehabilitation therapy. Steroid injections under significant pressure should be avoided as the needle may be penetrating the tendon and injection into the tendon can cause possible tendon breakdown, tendon degeneration, or rupture. Injections for patients under 30 years of age should be used with caution.

• Time to Produce Effect: 1 to 2 injections. If the first injection is unsuccessful and symptoms continue, the second injection should be performed by a specialist with expertise in the anatomy of the upper extremity.

- Optimum Frequency: 3 injections in 1 year spaced at least 2 to 8 weeks apart injection.
- Maximum Frequency: 4 per year if injections result in functional benefit without local reactions or complications.

<u>vi. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. Refer to Section I. 9, Return to Work.

<u>vii. Other therapies</u> in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations: Since cumulative trauma conditions often involve several areas in an upper extremity, surgical treatment of one problem should be performed in conjunction with conservative treatment of other problems in the upper extremity. A patient may be a surgical candidate if there are concomitant fractures, instability, or if symptoms continue to interfere with ADLs or job duties after non-surgical interventions for 2 to 3 months.

<u>i. Non-surgical interventions should include</u>: rest from inciting factors, ergonomic job changes, and steroid injections. Pathology is usually identified on MRI and there should not be another diagnosis which better explains the patient's complaints.

Those with a corresponding abnormality in the opposite wrist should have an especially rigorous diagnostic review before proceeding to a surgical intervention.

<u>ii. Prior to surgical intervention</u>, 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 and the patient should agree to comply with the pre- and post-operative treatment plan including home exercise. The provider should be especially careful to make sure the patient understands the amount of post-operative therapy required and the length of partial- and full-disability expected post-operatively.

<u>iii. For surgery involving soft tissue only</u>: smoking may affect soft tissue healing through tissue hypoxia. Patients should be strongly encouraged to stop smoking and be provided with appropriate counseling by the physician.

For both non-union and soft-tissue: because smokers have a higher risk of non-union and postoperative costs, if a treating physician recommends a specific smoking cessation program perioperatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels.

The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures: Numerous procedures including arthroscopy debridement and/or repair, ulna shortening and wafer procedure when there is a carpal detachment or detachment off of the radius.

h. Post-operative Treatment:

i. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I., Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progressions.

ii. Wrist splints are usually required for 6 weeks and power grip and axial loading are discouraged. Range of motion is usually begun at 2 weeks.

iii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon. Usually light activity only is recommended for 3 months.

F.9 Trigger Finger

a. Description/Definition: Difficulty extending and flexing the digit which may be accompanied by a history of the finger "catching" or "triggering."

b. Occupational Relationship: Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings: required elements for the diagnosis of trigger digits include one of the following:

- Tenderness at the A1 pulley with finger motion;
- Triggering of the digit;
- A history of difficulty flexing and extending the digit with a palpable nodule.

Active range of motion deficit, usually only in severe cases.

d. Diagnostic Testing Procedures: X-ray and other imaging may be performed to rule out other differential diagnoses or when there is an indication additional pathology may be present.

e. Non-operative Treatment Procedures:

i. Initial Treatment: Over the counter medications for symptomatic relief, splinting at night.

<u>ii. Patient education</u> should include instruction in self-management techniques, ergonomics, home therapy program and intermittent splinting for contractures.

<u>iii. Jobsite evaluations and alterations</u>. Ergonomic alterations must be done early to assure the appropriate changes are accomplished early in the treatment program.

Whenever a case is identified as a work-related cumulative trauma condition, job alterations are an expected treatment. These may be in the form of: 1) instructing the worker how specific duties might be performed to meet ergonomic standards; 2) actual job worksite or duty changes; and/or 3) a formal jobsite evaluation at the worksite. Suggested ergonomic changes are usually applicable to uninjured workers in the same job position. Refer to Section E.6.c., Jobsite Evaluation and H.4., Jobsite Alteration. <u>iv. Steroid injections for trigger finger may provide decreased symptoms for up to one year.</u> Steroid injections may decrease inflammation, pain, and allow the therapist to progress with rehabilitation therapy. Steroid injections under significant pressure should be avoided as the needle may be penetrating the tendon and injection into the tendon can cause possible tendon breakdown, tendon degeneration, or rupture. Injections for patients under 30 years of age should be used with caution.

- Time to Produce Effect: 1 to 2 injections. If the first injection is unsuccessful and symptoms continue, the second injection should be performed by a specialist with expertise in the anatomy of the upper extremity.
- Optimum Frequency: 3 to 5 injections in 1 year spaced at least 2 to 8 weeks apart.
- Maximum Duration: if additional injections are being considered referral to a hand specialist should be considered.

Steroid injections should be used cautiously in diabetic patients. Diabetic patients should be reminded to check their blood glucose levels at least daily for 2 weeks after injections.

<u>v. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. Refer to Section I.9, Return to Work.

<u>vi. Other therapies in Section I. Therapeutic Procedures, Non-operative may be employed in</u> individual cases.

f. Surgical Indications/Considerations: Since cumulative trauma conditions often involve several areas in an upper extremity, surgical treatment of one problem should be performed in conjunction with conservative treatment of other problems in the upper extremity.

Trigger finger/thumb release open or percutaneous may be indicated when: 1) diagnosis has been verified; and 2) symptoms persist after conservative management including steroid injections over at least 4 weeks. Surgery should be performed to achieve functional gains on those with significant ongoing impaired activities of daily living or work-related functions.

Smoking may affect soft tissue healing through tissue hypoxia. Patients should be strongly encouraged to stop smoking and be provided with appropriate counseling by the physician. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels. The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures: Trigger finger/thumb release.

h. Post-operative Treatment:

i. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I., Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of

exercise progressions. Treatment may include the following: splinting, and active therapy with or without passive therapy.

ii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

F.10 Thoracic Outlet Syndrome

a. Description/Definition: 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.

b. Occupational Relationship:

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. 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. 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. Specific Physical Exam Findings:

i. Neurogenic TOS:

Symptoms: 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.
- 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.

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.

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). 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. 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.

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.
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 pollicus brevis often demonstrates more involvement and atrophy than the intrinsic interosseous muscles.

ii. Vascular TOS:

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Symptoms:

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.

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.

<u>iii. Physical Exam</u> - 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. 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. Diagnostic Testing Procedures:

Routine roentgenographic evaluation of the cervical spine is frequently unnecessary early in the course of treatment for non-specific TOS.

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. EMG/NCV

Anterior Scalene or Pectoralis Muscle Blocks

e. Non-operative Treatment Procedures:

<u>i) Initial Treatment</u>: 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. Most literature of conservative therapy for TOS suggest benefit for patients with non-specific TOS.

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 emphasis proper breathing techniques and posture, nerve gliding and core body therapeutic exercise.

<u>ii) Medications</u> such as analgesics and anti-inflammatories may be helpful. Thrombolytic agents will be required for some vascular TOS conditions. Refer to medication discussions in Section, Medications and Medical Management.

<u>iii) Patient education should include instruction in self-management techniques, ergonomics, body mechanics, home exercise, joint protection, and weight management.</u>

iv) Benefits may be achieved through <u>therapeutic rehabilitation</u> and rehabilitation interventions. Manual therapy may also be used. Therapy will usually include range-of-motion (ROM), active therapies, and a home exercise program. Active therapies include, proprioception training, restoring normal joint mechanics, and clearing dysfunctions from adjacent structures. Passive as well as active therapies may be used for control of pain and swelling. Therapy should progress to strengthening and an independent home exercise program targeted to further improve ROM, strength, and normal joint mechanics influenced by distal and proximal structures. Refer to Section., Therapeutic Procedures, Non-operative.

Passive modalities are most effective as adjunctive treatments to improve the results of active treatment. They may be used as found in Section, Therapeutic Procedures, Non-operative.

v) Injections:

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.

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- 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.

<u>vi) Return to work with appropriate restrictions should be considered early in the course of treatment.</u> Refer to Section G.9, Return to Work.

<u>vii) Other therapies in Section G. Therapeutic Procedures, Non-operative may be employed in individual cases.</u>

f. Surgical Indications/Considerations:

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.)

After failed conservative therapy, the following criteria must be fulfilled:

- <u>i.</u> True neurogenic or non-specific TOS: see criteria in the preceding subsection; and
- <u>ii.</u> A positive upper limb tension test; and
- <u>iii.</u> Failed 3 months of active participation in non-operative therapy including worksite changes; and
- <u>iv.</u> Disabling symptoms interfering with work, recreation, normal daily activities, sleep; and
- <u>v.</u> 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.

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.

It is critically important that all other pathology, especially shoulder disorders, be treated prior to surgical intervention for TOS.

Smoking may affect soft tissue healing through tissue hypoxia. Patients should be strongly

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encouraged to stop smoking and provided with appropriate counseling.

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.

g. Operative Procedures:

First rib resection Anterior and middle scalenectomy Anterior scalenectomy Combined first rib resection and scalenectomy Pectoralis minor tenotomy.

h. Post-operative Treatment:

i) An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section, Therapeutic Procedures, Non-operative.ii) Generally, progressive resistive exercise no earlier than 2 months post-operatively with gradual return to full-activity at 4 to 6 months.

iii) Range of motion may begin when allowed by the surgeon, depending on wound healing.iv) Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

G. Specific Peripheral Nerve Diagnosis, Testing and Treatment Procedures

G.1 Carpal Tunnel Syndrome

a. Description/Definition: The median nerve is vulnerable to compression and injury in the region of the wrist and palm. In this area, the nerve is bound by the wrist bones and the transverse carpal ligament. The most common site of compression is at the proximal edge of the flexor retinaculum (an area near the crease of the wrist). Stenosing tenosynovitis may occur proximal and distal to carpal tunnel area. There is often a myofascial component in the patient's presentation. This should be considered when proceeding with the diagnostic workup and therapeutic intervention.

The differential diagnosis for carpal tunnel syndrome (CTS) particularly includes pronator syndrome; C6 and C7 cervical radiculopathies; and other neurological entrapments located between the spinal cord and median nerve in the carpal canal including thoracic outlet syndrome, diabetic neuropathy, neuropathy from alcohol, other systemic neuropathies, stroke, other cerebrovascular events, and central nervous system tumors. Most other causes may be eliminated or the probability reduced by conducting a careful history, physical examination, or focused testing.

The following elements are commonly associated with carpal tunnel syndrome. i. The diagnosis is most frequently made from the patient's history of numbness, tingling, pain, and/or burning of the hand involving the distal median nerve distribution; however, distribution of the sensory symptoms may vary considerably between individuals.

Although the classic median nerve distribution is to the palmar aspect of the thumb, the index finger, the middle finger and radial half of the ring finger, patients may report symptoms in any or all of the fingers.

The Katz Hand diagram may be useful in documenting the distribution of symptoms.

ii. Nocturnal symptoms often disrupt sleep and consist of paresthesias and/or pain in the hand and/or arm.

iii. The "flick sign" or shaking the symptomatic hand to relieve symptoms is frequently reported.

iv. Pain in the wrist occurs frequently and may even occur in the forearm, elbow or shoulder.

v. While proximal pain is not uncommon, its presence warrants evaluation for other pathology in the cervical spine, shoulder and upper extremity.

vi. There may be some difficulty performing specific job duties and activities of daily living. Clumsiness of the hand or dropping objects is often reported, but may not be present early in the course. There may be weakness with pinching or grasping keys/pens/other small objects,

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grasping telephone receivers or cups or other similar sized objects, and opening jars.

vii. The following areas should also be addressed in the history.

a. Exacerbating and alleviating factors of the reported symptoms. The physician should explore and report on non-work related, as well as work-related activities.

b. Prior occupational and non-occupational injuries to the same area including specific prior treatment and any prior bracing devices.

c. Discussion of any symptoms present in the unexposed extremity.

Katz Hand Diagram:



b. Occupational Relationship: Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings: No one test is predictive of carpal tunnel syndrome. Multiple tests should be recorded with the patient's exact response. Final diagnosis is dependent on a correlation of symptoms, physical exam findings and NCV testing as any of these alone can be false positive or false negative. Phalen's and Tinel's appear to have similar predictive values as the flick test between 73 and 87% for the positive predictive value and negative predictive values between 35 and 40%.

i. The clinical diagnosis is confirmed by a 1) patient's history of paresthesia in two of the following digits: thumb, index and middle finger; and 2) at least one of the physical exam signs listed below. Provocative tests must recreate symptoms in the median nerve distribution.

- Phalen's sign.
- Tinel's sign over the carpal tunnel.
- Closed fist test holding fist closed for 60 seconds reproducing median nerve paresthesia.
- Compression test applying compression over the median nerve for 30 to 60 seconds reproducing symptoms.
- Thenar atrophy may be present, usually late in the course.
- Weakness of the abductor pollicis brevis.
- Sensory loss to pinprick, light touch, two-point discrimination or Semmes Weinstein monofilament tests in a median nerve distribution.

ii. Physicians should be aware that both NCV-diagnosed CTS and physician-diagnosed CTS fluctuate over time in both directions for individual cases.

iii. Evaluation of the contralateral wrist is recommended due to the frequency of bilateral involvement.

iv. Evaluation of the proximal upper extremity and cervical spine for other conditions cervical radiculopathy, thoracic outlet syndrome, other peripheral neuropathies, and other musculoskeletal conditions.

v. Assessment for signs of underlying medical disorders associated with CTS (e.g., diabetes mellitus, arthropathy, and hypothyroidism).

vi. Myofascial findings requiring treatment may present in additional soft tissue areas these should be identified and treated in accordance with medical treatment guidelines.

d. Diagnostic Testing Procedures:

i. Diagnostic Steroid injections: Classic findings of CTS include subjective numbness or

dysesthesias confined to the median nerve distribution, worsening of symptoms at night, and positive exam findings. When the diagnosis is in question, steroid injection into the carpal tunnel is a strongly supportive test if it is followed by significant relief of symptoms. A negative diagnostic steroid injection does not eliminate the diagnosis of CTS.

<u>ii. Electrodiagnostic (EDX) Testing</u>: are well-established and widely accepted for evaluation of patients suspected of having CTS. The results are sensitive and specific for the diagnosis when clinical symptoms are present. Studies may confirm the diagnosis or direct the examiner to alternative conditions. When polyneuropathy is suspected, it may be worthwhile to perform electrodiagnostic testing in the lower extremities. Studies require clinical correlation due to the occurrence of false positive and false negative results. Symptoms of CTS may occur with normal EDX studies, especially early in the clinical course.

EDX studies are imperfect indicators of the outcome of treatment of CTS, since they may be only weakly correlated with functional scores. However, they may provide useful information when symptomatic and functional recovery after treatment has not occurred.

EDX findings in CTS reflect slowing of median motor and sensory conduction across the carpal tunnel region due to demyelination. Axonal loss, when present, is demonstrated by needle electromyography in median nerve supplied thenar muscles.

A) Needle electromyography of a sample of muscles innervated by the C5 to T1 spinal roots, including a thenar muscle innervated by the median nerve of the symptomatic limb, is frequently required.

B) The following EDX studies are not recommended to confirm a clinical diagnosis of CTS. 1) Due to low sensitivity and specificity compared to other EDX studies, multiple median F wave parameters, median motor nerve residual latency, and sympathetic skin response are not recommended.

2) Investigational studies: Evaluation of the effect on median nerve conduction with limb ischemia, dynamic hand exercises, and brief or sustained wrist positioning are not recommended.3) Electroneurometer: This is not recommended as a diagnostic tool because it requires patient participation, cannot distinguish between proximal and distal lesions, and does not have well-validated reference values.

4) Portable Automated Electrodiagnostic Device: Measures distal median nerve motor latency and F-wave latency. It remains an investigational instrument whose performance in a primary care setting is as yet not established, and is not recommended as a substitute for conventional electrodiagnostic testing in clinical decision making. Refer to Follow-up Diagnostic Procedures section for details.

C) To assure accurate testing, temperature should be maintained at 30 to 34C preferably recorded from the hand/digits. For temperature below 30C the hand should be warmed.

D) Positive Findings – Any of these nerve conduction study findings must be accompanied by median nerve symptoms to establish the diagnosis.

1) Slowing of median distal sensory and/or motor conduction through the carpal tunnel region.

2) Electromyographic changes in the median thenar muscles in the absence of proximal abnormalities.

3) Suggested guidelines for the upper limits of normal latencies:

a) Median distal motor latency (DML) - 4.5msec/8cm

b) Median distal sensory peak latency (DSL) -3.6msec/14cm.

c) Median intrapalmar peak latency (palm/wrist) -2.2msec/8cm

d) Median-ulnar palmar sensory latency difference greater than - 0.3msec.

e) The Combined Sensory Index (also known as Robinson's index) may be useful when any of the above specific studies are not diagnostic. It is the sum of the differences between the median peak latency minus the ulnar or radial peak latency for the ring finger, the thumb and the palm. A normal finding is 0.9ms or less.

4) Because laboratories establish their own norms, a degree of variability from the suggested guideline values [as described in 3 above] is acceptable.

E) In all cases, normative values are to be provided with the neuro-diagnostic evaluation.

F) Suggested grading scheme by electrodiagnostic criteria for writing a consultation or report may be:

1) Mild CTS - prolonged (relative or absolute) median sensory or mixed action potential distal latency (orthodromic, antidromic, or palmar).

2) Moderate CTS - abnormal median sensory latencies as above and prolongation (relative or absolute) of median motor distal latency.

3) Severe CTS - prolonged median motor and sensory distal latencies, with either absent sensory or palmar potential, or low amplitude or absent thenar motor action potential. Needle examination reveals evidence of acute or chronic denervation with axonal loss.

G) Frequency of Studies/Maximum Number of Studies:

1) Indications for Initial Testing:

a) Patients with clinically significant CTS who do not improve symptomatically or functionally with conservative measures for carpal tunnel syndrome over a 3 to 4 week period.

b) Patients in whom the diagnosis is in question.

c) Patients for whom surgery is contemplated.

d) To rule out other nerve entrapments, or alternative radiculopathy.

2) Repeated studies may be performed:

a) At 3 months or longer when the initial studies were normal and CTS is still suspected.

b) At 8 to 12 weeks for inadequate improvement with non-surgical treatment.

c) Post-operative 3 to 6 months for persistent or recurrent symptoms following carpal tunnel release, unless an earlier evaluation is required by the surgeon.

<u>iii. Laboratory Tests</u>: In one study of carpal tunnel patients seen by specialists, 9% of patients were diagnosed with diabetes, 7% with hypothyroidism, and 15% with chronic inflammatory disease including spondyloarthropathy, arthritis, and systemic lupus erythematosus. Up to two thirds of the patients were not aware of their concurrent disease. Estimates of the prevalence of hypothyroidism in the general population vary widely, but data collected from the Colorado Thyroid Disease Prevalence Study revealed subclinical hypothyroidism in 8.5% of participants not taking thyroid medication. The prevalence of chronic joint symptoms in the Behavioral Risk

Factor Surveillance System (BRFSS) from the Centers for Disease Control (CDC) was 12.3%. If initial history suggests concomitant disease or after 2 to 3 weeks the patient is not improving, the physician should strongly consider the following laboratory studies: thyroid function studies, rheumatoid screens, chemical panels, and others if clinically indicated. There is some evidence that diabetic patients with upper extremity disorders are more likely to be under poor diabetic control. Therefore, it is appropriate to order a hemoglobin A1c for any diabetic patients with a CTC.

Laboratory testing for cumulative trauma conditions may be required periodically to monitor patients on chronic medications.

iv. Other Tests:

A) Imaging, MRI, and sonography are not recommended unless a space occupying lesion is suspected.

B) Electroneurometer and other portable automated electro-diagnostic devices are not recommended. Refer to Section E. Follow-up Diagnostic Imaging and Testing Procedures.

e. Non-operative Treatment Procedures:

i. Initial Treatment: Medications such as analgesics and over the counter medications for symptomatic relief; wrist splint at night, and restriction of activities such as forceful gripping, awkward wrist posture, and repetitive wrist motion.

A number of studies have followed patients with mild clinical carpal tunnel symptoms. Approximately 40 to 50% of patients improved over time, most of whom receive conservative treatment. However, patients with positive

Phalen's at 30 seconds, symptoms lasting 10 months, over 50 years of age, or bilateral symptoms were less likely to improve.

<u>ii. Patient education</u> should include instruction in self-management techniques including sleeping postures which avoid excessive wrist flexion; ergonomics; and a home therapy program.

<u>iii.</u> Jobsite evaluations and alterations. Ergonomic alterations must be done early to assure that appropriate changes are accomplished early in the treatment program. In a 2007 published study it was noted that 73% of mild cases referred for carpal tunnel surgery received splints, 23% steroid injections and only 15% modification in activities recommendations. This emphasizes the need for basic initial care including jobsite modification for all patients, especially in milder cases that may not require surgery.

Whenever a case is identified as a work related cumulative trauma condition, job alterations are an expected treatment. These may be in the form of: 1) instructing the worker how specific duties might be performed to meet ergonomic standards; 2) actual job worksite or duty changes; and/or 3) a formal jobsite evaluation at the worksite.

Suggested ergonomic changes are usually applicable also to uninjured workers in the same job position. Refer to Section E.6.c., Jobsite Evaluation and H. 4. Jobsite Alteration.

<u>iv. Medications and Medical Treatment</u>: Use of medications in the treatment of carpal tunnel syndrome is appropriate for controlling acute and chronic pain and inflammation. All drugs should be used according to patient needs. 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.

Use of non-steroidal anti-inflammatory medications (NSAIDs), oral steroids, and diuretics, have not been shown to have significant long-term beneficial effect in treating carpal tunnel syndrome. Although NSAIDs are not curative, they and other analgesics may provide symptomatic relief.

<u>Vitamin B6</u>: Randomized trials have demonstrated conflicting results. Higher doses may result in development of a toxic peripheral neuropathy. In the absence of definitive literature showing a beneficial effect, use of Vitamin B6 cannot be recommended. However, it may be appropriate for patients on medications that interfere with the effects of Vitamin B6, or for those with significant nutritional problems.

<u>Oral Steroids</u>: have been shown to have short-term symptomatic benefit but no long-term functional benefit. There is good evidence that local steroid injection is superior to oral steroids at 3 months. Given this and the problematic

systemic effects of oral steroids, they are not recommended. It may occasionally be appropriate to use them for patients with severe CTS symptoms who refuse injections and who have no risk factors for adverse effects. Refer to Section I.5 for other medications.

v. Orthotics/Immobilization with Splinting: There is some evidence that splinting leads to more improvement in symptoms and hand function than watchful waiting alone. Because of limited patient compliance with day and night splinting in published studies, evidence of effectiveness is limited to nocturnal splinting. Splints should be loose and soft enough to maintain comfort while supporting the wrist in a relatively neutral position. This can be accomplished using a soft or rigid splint with a metal or plastic support. Some splints include immobilization of the metacarpal-phalangeal joints. Splint comfort is critical and may affect compliance. Although off-the-shelf splints are usually sufficient, custom thermoplastic splints may provide a better fit for certain patients.

Splints may be effective when worn at night or during portions of the day, depending on activities. Most studies show that full time night splinting for a total of 4 to 6 weeks is the most effective protocol. Depending on job activities, intermittent daytime splinting can also be helpful. Splint use is rarely mandatory. Providers should be aware that over-usage is counterproductive, and should counsel patients to minimize daytime splint use in order avoid detrimental effects such as stiffness and dependency over time.

Splinting is generally effective for milder cases of CTS. Long-term benefit beyond 3 months has not been established. An effect should be seen in 2 to 4 weeks. It is more likely to have some long-term benefit in patients who have less severe paresthesias at night (less than 6/10) and who have had symptoms for less than 1 year.

- Time to Produce Effect: 1 to 4 weeks. If after 4 weeks, the patient has partial improvement, continue to follow since neuropathy may worsen, even in the face of diminished symptoms.
- Frequency: Nightly. Daytime intermittent, depending on symptoms and activities.
- Optimum Duration: 4 to 8 weeks.
- Maximum Duration: 2 to 4 months. If symptoms persist, consideration should be given to either repeating electrodiagnostic studies or to more aggressive treatment.

<u>vi. Steroid injections</u>: may decrease inflammation and allow the therapist to progress with rehabilitation therapy. Steroid injections under significant pressure should be avoided as the needle may be penetrating the tendon and injection into the tendon can cause possible tendon breakdown, tendon degeneration, or rupture. Injections should be used with caution for patients under 30 years of age.

After steroid injections, some patients can have improved symptoms for one year. One case series showed up to 16 month improvement in mild CTS cases with nerve conduction changes after an injection. However, it is not clear that this is a better long-term option for patients with moderate or severe neuro-conduction changes since improvement in nerve conduction may be minimal or later deteriorate.

Lower doses of steroids appear to be as effective as higher doses. There is good evidence that injections have better results at 3 months than oral steroids. If following the first injection, symptomatic relief is followed by recurrent symptoms, the decision to perform a second injection must be weighed against alternative treatments such as surgery. Surgery may give more definitive relief of symptoms.

Steroid injections should be used cautiously in diabetic patients. Diabetic patients should be reminded to check their blood glucose levels at least daily for 2 weeks after injections.

- Time to Produce Effect: 1 to 2 injections. If the first injection is unsuccessful and symptoms continue, the second injection should be performed by a specialist with expertise in the anatomy of the upper extremity.
- Maximum Frequency: 3 injections in one year.

vii. Other Injections:

Botulinum injections are not recommended for treatment of chronic CTS, as supported by some evidence.

Intramuscular injections for CTS are not recommended for treatment of chronic CTS, as supported by some evidence.

<u>viii. Nerve Gliding</u>: exercises consist of ROM of the upper extremity and neck that produce tension and longitudinal movement along the length of the median and other nerves of the upper extremity.

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These exercises are based on the principle that the tissues of the peripheral nervous system are designed for movement, and that tension and glide (excursion) of nerves may have an effect on neurophysiology through alterations in vascular and axoplasmic flow. The exercises are simple to perform and can be done by the patient after brief instruction. Biomechanical principles have been more thoroughly studied than clinical outcomes. Large, well-designed randomized trials have been lacking. There is some evidence from a systematic review that nerve gliding is more effective than no treatment.

- Time to Produce Effect: 2 to 4 weeks.
- Frequency: Up to 5 times per day by patient (patient-initiated).
- Optimum Duration: 2 provider-directed sessions.
- Maximum Duration: 3 provider-directed sessions.

<u>ix.</u> <u>Manual Therapy Techniques</u>: There is no clear evidence supporting carpal bone mobilization or manual therapy. However, other myofascial components that may occur with CTS may be treated with manual therapy. Refer to Section I., Therapeutic Procedures Non-operative.

<u>x. Massage</u>: recommended for select patients with acute, subacute, or chronic CTS who have significant myofascial pain. Generally, the patient should have failed other treatments including splints and glucocorticosteroid injection. Frequency: Three to 4 appointments. Objective evidence of improvement should be followed. Additional 3 or 4 treatments should be based on improvement in objective measures

<u>xi. Therapeutic Touch</u>: considered an alternative healing technique, involves the use of the practitioner's hands to focus and facilitate healing. It has not been shown to be efficacious and other treatments have documented benefit, thus therapeutic touch is not recommended for the treatment of CTS, as supported by some evidence.

<u>xii. Ultrasound</u>: There is some evidence that ultrasound may be effective in symptom relief and in improving nerve conduction in mild-to-moderate cases of CTS. No studies have demonstrated long-term functional benefit. This treatment may be used in conjunction with an active therapy program for non-surgical patients who do not improve with splinting and activity modification. It is not known if there are any long-term deleterious neurological effects from ultrasound. It is suggested that treatment be limited to 12 sessions over 6 weeks.

<u>xiii. Low Level Laser</u>: There is no evidence that low level laser therapy alone is beneficial in changing the outcome for patients with carpal tunnel syndrome and therefore it is not recommended.

<u>xiv. Yoga</u>: There is some evidence that Hatha yoga instruction may reduce pain, improve grip strength, and decrease response to Phalen's maneuver for motivated patients, as compared to patients receiving only wrist splints. This, as other complementary/alternative exercise, should be done with oversight of a physician or other appropriate healthcare professional.

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

<u>xv. Ionotophoresis</u>: has not yet been shown to be effective for CTS but may be an appropriate option for patients refusing surgery and injections.

• Optimum and Maximum Frequency: 6 to 9 sessions over 5 weeks.

xvi. There is no evidence for the use of <u>magnets</u>, <u>laser acupuncture</u>, <u>or chiropractic</u>. Therefore, these interventions are not recommended.

<u>xvii. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. Refer to Section I.9 Return to Work.

<u>xviii. Other therapies</u> in Section I may be used for myofascial symptoms accompanying carpal tunnel syndrome.

f. Surgical Indications/Considerations: Since cumulative trauma conditions often involve several areas in an upper extremity, surgical treatment of one problem should be performed in conjunction with conservative treatment of other problems in the upper extremity.

Overall it is probably reasonable to expect that 40 to 50% of patients with mild exam findings may improve or remain stable overtime.

There is strong evidence that surgery is more effective than splinting or injections in producing long-term symptom relief and normalization of median nerve conduction velocity for those patients with clinically significant CTS with positive NCV findings. There is also a positive cost utility for surgery over conservative care for patients with positive nerve conduction studies. There is good evidence that surgery improves symptoms more effectively than steroid injection for up to five months.

In one prospective study, duration of symptoms prior to surgery, up to 5 years, did not affect the ability to achieve symptom or functional outcome success with surgery. Patients with more severe symptoms and longer duration of symptoms showed significant improvement with surgery. Patients with thenar atrophy, weakness of the abductor pollicis brevis, and fixed sensory deficits may still improve with surgery. Patients with mild symptoms and functional deficits demonstrated the smallest changes from pre- to post-operative scores. However, their post-operative scores were higher than the post-operative scores of those with more severe symptoms. i. Surgery should be considered as an initial therapy in situations where clinical evidence of carpal tunnel syndrome is present based on the criteria below.

- A) Median nerve trauma has occurred; "acute carpal tunnel syndrome", or
- B) Thenar atrophy is present and due to median nerve compression; or
- C) Electrodiagnostic evidence of moderate to severe neuropathy is present. EMG findings

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showing evidence of acute or chronic motor denervation suggest the possibility that irreversible damage may be occurring. There is good evidence that surgery is more beneficial than non-surgical treatment for patients with a motor latency of more than 5.0 ms.

ii. For cases with positive EDX findings and with a motor latency less than 5.0ms, non-surgical treatment may be beneficial in some cases; therefore, conservative management, including job alterations, should be tried over 4 to 6 weeks before surgery is considered.

iii. Surgery may be considered in cases where electrodiagnostic testing is normal and initial nonoperative therapy has failed. A second opinion from a hand surgeon is strongly recommended. The following criteria should be considered in deciding whether to proceed with surgery:

A) The patient's signs and symptoms are specific for carpal tunnel syndrome; AND

B) The patient experiences significant temporary relief following steroid injection into the carpal tunnel.

iv. Smoking may affect soft tissue healing through tissue hypoxia. Patients should be strongly encouraged to stop smoking and be provided with appropriate counseling by the physician. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels. The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

v. Pre-incisional antibiotics are recommended for consideration for patients with risk factors (e.g., diabetes mellitus, susceptibility to infections). Thresholds for use in other patients should be generally low. Institutions may also mandate use through policies.

g. Operative Procedures:

i. Open and endoscopic carpal tunnel release techniques: Endoscopic and open carpal tunnel release have low rates of serious complications. The most commonly seen serious complications are incomplete transection of the transverse carpal ligament and inadvertent nerve or vessel injuries. Choice of technique should be left to the discretion of the surgeon.

ii. Small incision technique with lighted blade: A minimal access technique using a battery operated trans-illuminating light source through a small proximal or distal incision is an additional surgical option for CTS.

There is some evidence that this procedure results in less scar tenderness than traditional open procedures. There is good evidence that the procedure has similar functional and symptomatic outcomes as an open procedure.

iii. Complications: Serious complications are rare and include permanent nerve damage and infection. Pillar pain may persist for 20 months; a burning sensation and scar tenderness are also common, up to 18% of cases. Reoccurrence is possible although reoperation usually occurs in less than 5% of the population.

iv. Neurolysis: has not been proven advantageous for carpal tunnel syndrome. Internal neurolysis should never be done. Very few indications exist for external neurolysis.

v. Tenosynovectomy: For routine cases of CTS, tenosynovectomy has not proven to be of benefit in carpal tunnel syndrome. Although achy pain in the wrist and forearm commonly may accompany CTS, paresthesias tend to be the predominant complaint. In occasional cases, pain may be the predominant complaint. If a patient with documented CTS experiences pain along the volar wrist, hand, and/or distal forearm as the predominant symptom, clearly overshadowing the paresthesias, there may be a significant component of tenosynovitis. Tenosynovectomy should be considered in these unusual cases at the time of carpal tunnel release.

vi. Epineurotomy is moderately not recommended. While there may be limited indications for epineurotomy, its routine use is not recommended for treatment of subacute or chronic CTS.

vii. Flexor retinacular lengthening: is moderately not recommended. While there may be limited indications for flexor retinacular lengthening, its routine use is not recommended for treatment of subacute or chronic CTS

viii. Ulnar bursal preservation: moderately not recommended.

ix. The mini palmar incision using the ring finger as a guide does not require any special changes in the location of the incision. Therefore, altering the location of the incision to "superficial nerve-sparing incision" is not recommended, as supported by some evidence.

x. As discussed above, an incision that is placed too far ulnarly may result in damage to the ulnar nerve or artery; therefore, an ulnar incisional approach is not recommended, as supported by some evidence.

xi. Biopsy of abnormal tenosynovium is recommended for treatment of subacute or chronic CTS. Indications – Abnormal appearing tenosynovium, including potential amyloidosis, infectious agents, or evidence for inflammatory conditions.

h. Post-operative Treatment:

i. Limited use of opioids for a few days to control pain is recommended for select patients who have undergone recent carpal tunnel release and have large incisions or encountered complications

ii. Patients should receive a home therapy protocol involving stretching, ROM, scar management and resistive exercises. Patients should be encouraged to use the hand as much as possible for daily activities, allowing pain to guide their activities.

iii. There is some evidence showing that immediate mobilization of the wrist following surgery is associated with less scar pain, and faster return to work. Final decisions regarding the need for splinting post-operatively should be left to the discretion of the treating physician based upon the surgical technique used and the specific conditions of the patient.

iv. An individualized rehabilitation program may be helpful in patients who do not show functional improvements post-operatively or in patients with heavy or repetitive job activities. There is good evidence that routine use of hand therapy after surgery does not improve pain, function, or return to work in carpal tunnel syndrome uncomplicated by endocrine disease, arthritis, or advanced median nerve disease. However, workers compensation patients may have slower return to work and therefore at least 2 visits with the therapist are recommended to insure appropriate scar management and return to function.

The rehabilitation program should be based upon communication between the surgeon and the therapist and using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progressions.

v. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

Time Frame	Activity Level
2 Days	Return to work with restrictions on utilizing the affected extremity
2 to 3 Weeks	Sedentary and non-repetitive work
4 to 6 Weeks	Case-by-case basis
6 to 12 Weeks	Heavy labor, forceful and repetitive

Suggested parameters for return-to-work are:

Note: All return-to-work decisions are based upon clinical outcome.

<u>Considerations for repeat surgery</u>: The single most important factor in predicting symptomatic improvement following carpal tunnel release is the severity of preoperative neuropathy. Patients with moderate electrodiagnostic abnormalities have better results than those with either very severe and/or mild findings. Incomplete cutting of the transverse carpal ligament or iatrogenic injury to the median nerve are rare.

If median nerve symptoms do not improve following initial surgery or symptoms improve initially and then recur, but are unresponsive to non-operative therapy. (See section I, Therapeutic Procedures, Non-operative) consider the following:

- Recurrent synovitis;
- Repetitive work activities may be causing "dynamic" CTS;
- Scarring;

• Work-up for systemic diseases.

A second opinion by a hand surgeon and repeat nerve conduction studies are required if repeat surgery is contemplated. The decision to undertake repeat surgery must factor in all of the above possibilities. Results of surgery for recurrent carpal tunnel syndrome vary widely depending on the etiology of recurrent symptoms.

G.2 Cubital Tunnel Syndrome

a. Description/Definition: The following are typical symptoms of cubital tunnel syndrome:

- Activity related pain/paresthesias involving the 4th and 5th fingers coupled with discomfort near the medial aspect of the elbow;
- Pain/paresthesias worse at night;
- Decreased sensation of the 5th finger and ulnar half of the ring finger (including dorsum 5th finger);
- Progressive inability to separate fingers;
- Loss of power grip and dexterity.

b. Occupational Relationship: Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings: Required elements for the diagnosis include paresthesias or dull, aching in the 4th and 5th digits and at least one of the following exam findings:

- Diminished sensation of the fifth and ulnar half of the ring fingers, which may sometimes include sensory loss to pinprick, light touch, two-point discrimination or Semmes Weinstein monofilament tests in an ulnar nerve distribution;
- Positive elbow flexion/ulnar compression test. The combination flexion pressure test can be performed by fully flexing the elbow in supination and applying pressure to the ulnar nerve proximal to the cubital tunnel for 60 seconds. Reproduction of symptoms is a positive test;
- Later stages manifested by intrinsic atrophy and ulnar innervated intrinsic weakness. Specific physical signs include clawing of the ulnar 2 digits (Benediction posture), ulnar drift of the 5th finger (Wartenberg's sign), or flexion at the thumb IP joint during pinch (Froment's sign).

d. Diagnostic Testing Procedures: Electrodiagnostic (EDX) studies are well-established and widely accepted for evaluation of patients suspected of having peripheral nerve pathology. Studies may confirm the diagnosis or direct the examiner to alternative disorders. When

polyneuropathy is suspected, it may be worthwhile to perform electrodiagnostic testing in the lower extremities. Studies require clinical correlation due to the occurrence of false positive and false negative results. Symptoms of peripheral nerve pathology may occur with normal EDX studies, especially early in the clinical course.

To assure accurate testing, temperature should be maintained at 30 to 34C preferably recorded from the hand/digits. For temperature below 30C the hand should be warmed.

All studies must include normative values for their laboratories.

During the study the elbow should be maintained in moderate flexion usually 70-90 degrees. Positive findings in this position include:

i. Absolute motor nerve conduction velocity from above elbow to below elbow less than 50m/s ii. Above to below elbow segment more than 10m/s slower than the below elbow to wrist segment.

iii. Decrease in compound muscle action potential (CMAP) negative peak amplitude from below the elbow to above the elbow of 20%.

iv. Significant change in CMAP configuration at the above elbow site compared to below elbow. v. Nerve action potential recoding can sometimes be useful; however, there are technical issues with interpretation.

vi. When results are inconclusive from the above, other techniques may be used, including an inching study which explores multiple locations.

vii. Indications for testing

A) Initial testing:

1) Patients with clinically significant cubital tunnel findings who do not improve

symptomatically or functionally with conservative measures, including jobsite alteration over a 3 to 4 week period.

2) Patients in whom the diagnosis is in question.

3) Patients for whom surgery is contemplated.

4) To rule out other nerve entrapments, or alternative radiculopathy.

B) Other studies may be performed:

1) At 3 months or longer when the initial studies were normal and cubital tunnel syndrome is still suspected.

2) At 8 to 12 weeks for inadequate improvement with non-surgical treatment.

3) Post-operative 3 to 6 months for persistent or recurrent symptoms following ulnar nerve surgery, unless an earlier evaluation is required by the surgeon.

e. Non-operative Treatment Procedures:

<u>i. Initial Treatment</u>: Medications such as analgesics and over the counter medications for symptomatic relief; elbow pad anteriorly at 30 to 60 degrees or towel around elbow at night, optional posterior pad for daywear, and restriction of activities.

ii. Patient education should include instruction in self-management techniques including

avoidance of excessive or repetitive elbow flexion, ergonomics: and a home therapy program. There is some evidence to support the effectiveness of education, regarding nerve anatomy and how to avoid pronation, as first line therapy.

<u>iii. Jobsite evaluations and alterations</u>. Ergonomic alterations must be done early to assure the appropriate changes are accomplished early in the treatment program. Whenever a case is identified as a work-related cumulative trauma condition, job alterations are an expected treatment. These may be in the form of: 1) instructing the worker how specific duties might be performed to meet ergonomic standards; 2) actual job worksite or duty changes; and/or 3) a formal jobsite evaluation at the worksite. Workers should avoid repetitive full flexion or extension or posterior pressure on the elbow. Suggested ergonomic changes are usually applicable to uninjured workers in the same job position. Refer to Section E.6.c., Jobsite Evaluation and H.4., Jobsite Alteration.

<u>iv. Steroid injections may</u> decrease inflammation and allow the therapist to progress with rehabilitation therapy. Steroid injections under significant pressure should be avoided as the needle may be penetrating the tendon and injection into the tendon can cause possible tendon breakdown, tendon degeneration or rupture. Injections should be used with caution for patients under 30 years of age.

- Time to Produce Effect: 1 injection.
- Maximum Frequency: 3 injections in 1 year spaced at least 4 to 8 weeks apart.

Steroid injections should be used cautiously in diabetic patients. Diabetic patients should be reminded to check their blood glucose levels at least daily for 2 weeks after injections.

<u>v. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. Refer to Section I.9 Return to Work.

<u>vi. Other therapies</u> in Section i. Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations: Since cumulative trauma conditions often involve several areas in an upper extremity, surgical treatment of one problem should be performed in conjunction with conservative treatment of other problems in the upper extremity.

Surgery may be considered when 1) findings on history and objective evidence correlate specifically with the diagnosis; 2) jobsite alteration and other conservative measures have not alleviated the symptoms; and 3) functional deficits persist after 6 to 8 weeks. Subjective complaints should be localized and appropriate to the diagnosis, neurologic complaints should be consistent with the nerve distribution in question, and physical exam findings should correlate with the history. Objective evidence should be present and include: positive physical exam findings as described in section 2 c.; positive electrodiagnostic (EDX) studies; diagnostic peripheral nerve block which eradicates the majority of the patient's symptoms; or a motor deficit commensurate with the suspected neurologic lesion. In general, patients with minimal symptoms or without objective findings of weakness tend to respond better to conservative

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treatment.

Surgery may be considered as an initial therapy in situations where there is clinical and electrodiagnostic evidence of severe or progressive neuropathy.

Smoking may affect nerve healing through tissue hypoxia. Patients should be strongly encouraged to stop smoking and be provided with appropriate counseling by the physician. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels. The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

A second opinion by a hand surgeon and repeat nerve conduction studies are required if repeat surgery is contemplated.

g. Operative Procedures: simple decompression or transposition with or without, medial epicondylectomy, anterior subcutaneous transfer, and submuscular or intramuscular transfer. The complications and complexity of these procedures varies. Patients should understand the risks of each procedure, expected recovery, and need for follow-up therapy before consenting to the procedure.

Approximately 80% of patients will experience decreased symptoms post-operatively and around 35% will have some residual symptoms at the site. Simple decompression appears to be effective even in patients with more severe disease and it has fewer complications. There may be a subset of patients not yet identified by the current literature who would benefit more from a transposition. There is strong evidence that both anterior transposition and simple decompression are similarly effective for cubital tunnel.

h. Post-operative Treatment: An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progressions. Treatment may include the following: splinting, scar management, nerve gliding, and active therapy with or without passive therapy.

Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

G.3 Guyon Canal (Tunnel) Syndrome

a. Description/Definition: Paresthesias in the ulnar nerve distribution (ring and small fingers) distal to the wrist and/or weakness digital adductors and abductors or lumbricals, without proximal ulnar complaints, are typical symptoms/findings of Guyon's canal syndrome.

b. Occupational Relationship: Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings: Required elements for the diagnosis must include at least one of the following exam findings:

- Positive Tinel's at hook of hamate.
- Numbness or paresthesias of the palmar surface of the ring and small fingers without proximal ulnar complaints.
- Later stages or types may affect ulnar innervated intrinsic muscle strength.

Five types have been described that present with differing neurological signs. Testing should include strength of the adductor pollicis, abductor digiti minimi, and lumbricals. Testing the ability of the long finger to cross the index finger is useful.

d. Diagnostic Testing Procedures: Nerve conduction velocity studies of both sides for comparison to normal side. EMGs may be needed to rule out radiculopathy or more proximal ulnar nerve compression. When polyneuropathy is suspected it may be worthwhile to perform electrodiagnostic testing in the lower extremities. Several sites of ulnar nerve entrapment at the wrist may be documented with electrodiagnostic testing.

MRI or sonogram may be used to rule out space occupying lesions.

Diagnostic injections may be done to confirm the diagnosis.

e. Non-operative Treatment Procedures:

<u>i. Initial Treatment</u>: Medications such as analgesics and over the counter medications for symptomatic relief, wrist bracing, splints, restriction of activities and ergonomic changes.

<u>ii. Patient education</u> should include instruction in self-management techniques, ergonomics, and a home therapy program.

<u>iii. Jobsite evaluations and alterations</u>. Ergonomic alterations must be done early to assure the appropriate changes are accomplished early in the treatment program.

Whenever a case is identified as a work-related cumulative trauma condition, job alterations are an expected treatment. These may be in the form of: 1) instructing the worker how specific duties might be performed to meet ergonomic standards; 2) actual job worksite or duty changes; and/or 3) a formal jobsite evaluation at the worksite. Suggested ergonomic changes are usually applicable to uninjured workers in the same job position. Refer to Section E.6.c., Jobsite Evaluation and H.4., Jobsite Alteration.

<u>iv. Steroid injections</u> may decrease inflammation and allow the therapist to progress with rehabilitation therapy. Steroid injections under significant pressure should be avoided as the needle may be penetrating the tendon and injection into the tendon can cause possible tendon breakdown, tendon degeneration, or rupture. Injections should be used with caution for patients under 30 years of age.

- Time to Produce Effect: 1 injection.
- Maximum Frequency: 3 injections in 1 year spaced at least 4 to 8 weeks apart.

Steroid injections should be used cautiously in diabetic patients. Diabetic patients should be reminded to check their blood glucose levels at least daily for 2 weeks after injections.

<u>v. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. Refer to Section I.9 Return to Work.

<u>vi. Other therapies</u> in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations: Since cumulative trauma conditions often involves several areas in an upper extremity surgical treatment of one problem should be performed in conjunction with conservative treatment of other problems in the upper extremity.

Surgery may be considered when: 1) findings on history and objective evidence correlate specifically with the diagnosis; 2) jobsite alteration and other conservative measures have not alleviated the symptoms; and 3) functional deficits persist after 6 to 8 weeks. Subjective complaints should be localized and appropriate to the diagnosis, neurologic complaints should be consistent with the nerve distribution in question, and physical exam findings should correlate with the history. Objective evidence should be present and includes: positive physical exam findings as described in section 3 c; positive electrodiagnostic (EDX) studies, diagnostic peripheral nerve block which eradicates the majority of the patient's symptoms, or a motor deficit commensurate with the suspected neurologic lesion.

Surgery may be considered as an initial therapy in situations where there is clinical and electrodiagnostic evidence of severe or progressive neuropathy.

Smoking may affect nerve healing through tissue hypoxia. Patients should be strongly encouraged to stop smoking and be provided with appropriate counseling by the physician. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels. The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures: Ulnar nerve decompression at the wrist (ulnar tunnel release or Guyon's Canal release).

h. Post-operative Treatment: An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progressions. Treatment may include the following: bracing, scar management, and active therapy with or without passive therapy.

Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

G.4 Posterior Interosseous Nerve Entrapment (PIN)

a. Description/Definition: weakness of finger and thumb extension. Complaints of pain not usually present.

b. Occupational Relationship: Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings: Required exam findings include:

• Weakness or inability to extend fingers or thumb.

Radial deviation occurs with wrist extension. Weakness of thumb abduction usually occurs. If paresthesias in the radial nerve distribution or significant weakness of the wrist, suspect other diagnoses. Testing the ability of the long finger to cross the index finger is useful.

d. Diagnostic Testing Procedures: Nerve conduction velocity studies of both sides for comparison to normal side. EMGs may be needed to rule out radiculopathy. When polyneuropathy is suspected, it may be worthwhile to perform electrodiagnostic testing in the lower extremities. MRI can be done if space occupying lesions are suspected.

e. Non-operative Treatment Procedures:

<u>i. Initial Treatment</u>: Medications such as analgesics and over the counter medications for symptomatic relief, splints, restriction of activities, ergonomic changes, stretching and exercise.

<u>ii. Patient education</u> should include instruction in self-management techniques, ergonomics, and a home therapy program.

<u>iii. Jobsite evaluations and alterations</u>. Ergonomic alterations must be done early to assure the appropriate changes are accomplished early in the treatment program. Whenever a case is identified as a work-related cumulative trauma condition, job alterations are an expected treatment. These may be in the form of: 1) instructing the worker how specific duties might be performed to meet ergonomic standards; 2) actual job worksite or duty changes; and/or 3) a formal jobsite evaluation at the worksite. Suggested ergonomic changes are usually applicable to uninjured workers in the same job position. Refer to Section E.6.c., Jobsite Evaluation and H.4., Jobsite Alteration.

<u>iv. Steroid injections may decrease inflammation and allow the therapist to progress with</u> rehabilitation therapy. Steroid injections under significant pressure should be avoided as the needle may be penetrating the tendon and injection into the tendon can cause possible tendon breakdown, tendon degeneration, or rupture. Injections should be used with caution for patients under 30 years of age.

- Time to Produce Effect: 1 injection.
- Maximum Frequency: 3 injections in 1 year spaced at least 4 to 8 weeks apart

Steroid injections should be used cautiously in diabetic patients. Diabetic patients should be reminded to check their blood glucose levels at least daily for 2 weeks after injections.

<u>v. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. Refer to Section I.9 Return to Work.

<u>vi. Other therapies in Section I. Therapeutic Procedures</u>, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations: Since cumulative trauma conditions often involve several areas in an upper extremity, surgical treatment of one problem should be performed in conjunction with conservative treatment of other problems in the upper extremity.

Surgery may be considered when 1) findings on history and objective evidence correlate specifically with the diagnosis; 2) jobsite alteration and other conservative measures have not alleviated the symptoms; and 3) functional deficits persist after 8 to 10 weeks. Subjective complaints should be localized and appropriate to the diagnosis, neurologic complaints should be consistent with the nerve distribution in question, and physical exam findings of weakness should correlate with the history. Objective evidence should be present and may include: positive physical exam findings as described in section 6.c; positive electrodiagnostic (EDX) studies; or a motor deficit commensurate with the suspected neurologic lesion.

Surgery may be considered as an initial therapy in situations where there is clinical and electrodiagnostic evidence of severe or progressive neuropathy.

Smoking may affect nerve healing through tissue hypoxia. Patients should be strongly encouraged to stop smoking and be provided with appropriate counseling by the physician. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels. The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures: Nerve Decompression.

h. Post-operative Treatment: An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progressions. Treatment may include the following: bracing, scar management and active therapy with or without passive therapy. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

G.5 Pronator Syndrome

a. Description/Definition: Pain/paresthesias in median nerve distribution distal to elbow.

b. Occupational Relationship: Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings: Required elements for the diagnosis include paresthesias in the median nerve distribution and at least one of the following related exam findings:

- Tingling in median nerve distribution on resisted pronation with elbow flexed at 90 degrees or elbow extended. When symptoms are reproduced with resisted elbow flexion in supination the lacertus fibrosis may be responsible. The flexor digitorum superficialis may be responsible if symptoms are reproduced with resisted flexion of the proximal interphalangeal joint of the long finger.
- Positive Tinel's at the proximal edge of the pronator teres muscle over the median nerve.

There may be sensation loss over the palm and over the thenar eminence which is not present with carpal tunnel syndrome.

d. Diagnostic Testing Procedures: X-rays of the elbow may be useful to rule out other conditions. Nerve conduction velocity tests of both extremities for comparison to normal; however, findings are frequently negative. EMG should always be included to test median nerve innervated muscles below and above the wrist to rule out carpal tunnel syndrome. When polyneuropathy is suspected, it may be worthwhile to perform electrodiagnostic testing in the lower extremities.

e. Non-operative Treatment Procedures:

<u>i. Initial Treatment</u>: Medications such as analgesics and over the counter medications for symptomatic relief; posterior elbow splint, wrist splint, and restriction of activities such as forceful gripping, and repetitive elbow flexion or forearm pronation.

<u>ii. Patient education</u> should include instruction in self-management techniques, ergonomics, and a home therapy program.

<u>iii. Jobsite evaluations and alterations</u>. Ergonomic alterations must be done early to assure the appropriate changes are accomplished early in the treatment program.

Whenever a case is identified as a work-related cumulative trauma condition, job alterations are an expected treatment. These may be in the form of: 1) instructing the worker how specific duties might be performed to meet ergonomic standards; 2) actual job worksite or duty changes; and/or 3) a formal jobsite evaluation at the worksite. Suggested ergonomic changes are usually applicable to uninjured workers in the same job position. Refer to Section E.6.c., Jobsite Evaluation and H.4., Jobsite Alteration.

<u>iv. Steroid injections</u> may decrease inflammation and allow the therapist to progress with rehabilitation therapy. Steroid injections under significant pressure should be avoided as the needle may be penetrating the tendon and injection into the tendon can cause possible tendon breakdown, tendon degeneration, or rupture. Injections should be used with caution for patients under 30 years of age.

- Time to Produce Effect: 1 injection.
- Maximum Frequency: 3 injections in 1 year spaced at least 4 to 8 weeks apart.

Steroid injections should be used cautiously in diabetic patients. Diabetic patients should be reminded to check their blood glucose levels at least daily for 2 weeks after injections.

<u>v. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. Refer to Section I.9 Return to Work.

<u>vi. Other therapies</u> in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations: Since cumulative trauma conditions often involve several areas in an upper extremity, surgical treatment of one problem should be performed in conjunction with conservative treatment of other problems in the upper extremity.

Most patients with this condition recover with conservative therapy. Surgery may be considered when: 1) findings on history and objective evidence correlate specifically with the diagnosis; and 2) jobsite alteration and other conservative measures have not alleviated the symptoms; and 3) functional deficits persist after 8 to 10 weeks. Subjective complaints should be localized and appropriate to the diagnosis, neurologic complaints should be consistent with the nerve distribution in question, and physical exam findings should correlate with the history. Objective evidence should be present and includes: positive physical exam findings as described in section 4c; positive electrodiagnostic (EDX) studies; or a diagnostic peripheral nerve block which eradicates the majority of the patient's symptoms. Surgery may be considered as an initial therapy in situations where there is clinical and electrodiagnostic evidence of severe or progressive neuropathy.

When no objective evidence is present and the patient continues to have signs and symptoms consistent with the diagnosis after 6 months of conservative treatment including a psychological evaluation, a second opinion should be obtained before operative treatment is considered.

Electrodiagnostic (EDX) studies may show delayed median nerve conduction in the forearm. If nerve conduction velocity is normal with suggestive clinical findings, the study may be repeated after a 3 to 6 month period of continued conservative treatment. If the study is still normal, the decision on treatment is made on the consistency of clinical findings and the factors noted above.

Smoking may affect nerve healing through tissue hypoxia. Patients should be strongly encouraged to stop smoking and be provided with appropriate counseling by the physician. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels. The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures: Median nerve decompression in the forearm (pronator teres or flexor digitorum superficialis release).

h. Post-operative Treatment: An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I,

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Therapeutic Procedures, Non-operative. Some motion is usually allowed 1 week after surgery. In all cases, communication between the physician and therapist is important to the timing of exercise progressions. Treatment may include the following: bracing, scar management, and active therapy with or without passive therapy.

Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

G.6 Radial Nerve Entrapment at the Wrist

a. Description/Definition: Radial nerve palsies affecting the hand and wrist usually occur at points along the course of the arm and forearm, well proximal to the wrist. Upper arm lesions are generally associated with humeral fractures and related trauma or subsequent callous formation. Radial Tunnel Syndrome, (see this section, 7. Radial Tunnel Syndrome) or posterior interosseous nerve entrapment (see this section , 4. Posterior Interosseous Nerve Entrapment) occurs in the proximal forearm. Wartenberg's Syndrome, or radial sensory nerve entrapment in the distal forearm, is uncommon.

Compression of the radial sensory nerve has been attributed to wearing a tight wrist or forearm band, anomalous brachioradialis tendon, repeated wrist flexion and ulnar deviation, external compression and trauma, or from mass or bony lesions. Case studies have also hypothesized an association with de Quervain's tenosynovitis, which occurs in roughly 50% of cases diagnosed with Wartenberg Syndrome.

b. Occupational Relationship: Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections. Radial neuropathy at the wrist is reportedly caused by local mechanical compression of the nerve at the wrist from external trauma, a tight wrist or forearm band, or anomalous brachioradialis tendon. It has been attributed to repeated wrist flexion and ulnar deviation, however, there is no quality epidemiological evidence and thus when occurring in the absence of trauma, work-relatedness is speculative. There may be a better basis for work-relatedness for radial neuropathy with entrapment just above the wrist in the context of concomitant de Quervain's tenosynovitis that is considered work-related.

c. Specific Physical Exam Findings:

Radial nerve entrapment usually presents as radial nerve palsies affecting the hand and wrist, most commonly occurring at points along the course of the arm and forearm, well proximal to the wrist. The medical history should include a search for sensory symptoms. Symptoms may also include pain over the course of the nerve.

Successful localization of radial nerve entrapment can frequently be accomplished through a careful history and physical exam. The medical history should search for sensory symptoms including paresthesias with precision of the location of the paresthesias to a typical radial nerve distribution on the dorsal hand, particularly in the first dorsal web space. Symptoms may also include pain over the nerve. Distinguishing from other sources of sensory symptoms is usually possible, particularly including radiculopathies and other entrapment syndromes. An assessment of motor symptoms, including wrist extensor weakness as well as wrist drop, are also helpful,

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particularly in conjunction with absence of weakness in other distributions.

The physical examination attempts to localize the site of nerve entrapment. The examination should include sensory (especially sensation) and motor components (movement, range of motion, strength, reflexes) to localize the entrapment. Comparisons to the unaffected limb should be made. Differentiation from de Quervain's tenosynovitis is a primary differential diagnostic consideration, yet Finkelstein's is not particularly helpful as it may be positive with both conditions.

d. Diagnostic Testing Procedures: Electrodiagnostic testing is recommended to confirm clinical suspicion of a radial nerve motor neuropathy.

e. Non-operative Treatment Procedures:

<u>i. Initial Treatment</u>: Medications such as analgesics and over the counter medications for symptomatic relief; restriction of activities and ergonomic changes. The use of a wrist extension or thumb spica splint is recommended for treatment of acute, subacute, or chronic radial nerve compression neuropathy. Most cases should respond to conservative treatment.

<u>ii. Patient education</u> should include instruction in self-management techniques, ergonomics, and a home therapy program.

<u>iii. Jobsite evaluations and alterations</u>. Ergonomic alterations must be done early to assure the appropriate changes are accomplished early in the treatment program. Whenever a case is identified as a work-related cumulative trauma condition, job alterations are an expected treatment. These may be in the form of: 1) instructing the worker how specific duties might be performed to meet ergonomic standards; 2) actual job worksite or duty changes; and/or 3) a formal jobsite evaluation at the worksite. Suggested ergonomic changes are usually applicable to uninjured workers in the same job position. Refer to Section E.6.c., Jobsite Evaluation and H.4., Jobsite Alteration.

<u>iv. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. Removal from job tasks thought to have caused radial neuropathy at the wrist is recommended. Refer to Section I.9 Return to Work.

<u>v. Other therapies</u> in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations: Since cumulative trauma conditions often involve several areas in an upper extremity, surgical treatment of one problem should be performed in conjunction with conservative treatment of other problems in the upper extremity.

Surgery may be considered when: 1) findings on history and objective evidence correlate specifically with the diagnosis; 2) jobsite alteration and other conservative measures have not alleviated the symptoms; and 3) functional deficits persist after 8 to 10 weeks. Subjective complaints should be localized and appropriate to the diagnosis, neurologic complaints should be consistent with the nerve distribution in question, and physical exam findings should correlate

with the history. Objective evidence should be present and includes: positive physical exam findings as described in section 5.c.; positive electrodiagnostic (EDX) studies, or diagnostic peripheral nerve block which eradicates the majority of the patient's symptoms.

When no objective evidence is present and the patient continues to have signs and symptoms consistent with the diagnosis after 6 months of conservative treatment including a psychological evaluation, a second opinion should be obtained before operative treatment is considered.

Most cases improve with conservative treatment. Surgery should only be performed to achieve functional gains on those with significant ongoing impaired activities of daily living.

Surgical release is recommended for subacute or chronic cases of radial nerve compression neuropathy that persist despite other interventions.

Surgery is recommended for select patients who failed trials of other non-operative treatments or if space occupying lesions are present.

Smoking may affect nerve healing through tissue hypoxia. Patients should be strongly encouraged to stop smoking and be provided with appropriate counseling by the physician. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels. The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures: Radial nerve decompression.

h. Post-operative Treatment:

i. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progressions.

ii. Treatment may include the following: bracing, scar management and active therapy with or without passive therapy. Stretching is usually started early and strengthening may be begun between the 3 to 6 weeks. Longest recovery would be expected to be 4 months.

ii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

G.7 Radial Tunnel Syndrome

a. Description/Definition: Pain over the lateral posterior forearm. May occur in conjunction with and must be distinguished from lateral epicondylitis. May include paresthesias over the dorsal radial hand and wrist.

b. Occupational Relationship: Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings: The following two elements are required for the clinical

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diagnosis:

i. Tenderness over the radial nerve near the proximal edge of the supinator muscle. This may be tested by applying pressure along the radial nerve at points corresponding to the diameter of a half dollar beginning just distal to the elbow. At the third pressure point no symptoms should be reproducible. There may be subtle weakness of finger extension but weakness of wrist extension suggests nerve compression proximal to the radial tunnel as do sensation changes.
ii. Resisted supination or resisted middle finger extension with the forearm pronated and extended reproduces symptoms.

d. Diagnostic Testing Procedures: Nerve conduction velocity studies of both sides for comparison to normal side. EMGs may be needed to rule out radiculopathy. When polyneuropathy is suspected it may be worthwhile to perform electrodiagnostic testing in the lower extremities. Electrodiagnostic (EDX) studies are helpful when positive, but negative studies do not exclude the diagnosis.

i. MRI may be done if space occupying lesions are suspected.

ii. X-rays may be normal or demonstrate spur formation over the involved epicondyle.

Diagnostic lidocaine injections may be used to confirm the diagnosis if surgery is being considered, as EMGs are frequently normal in this condition.

e. Non-operative Treatment Procedures:

<u>i. Initial Treatment</u>: Medications such as analgesics and over the counter medications for symptomatic relief; restriction of activities and ergonomic changes. Most cases should respond to conservative treatment.

<u>ii. Patient education</u> should include instruction in self-management techniques, ergonomics, and a home therapy program.

<u>iii. Jobsite evaluations and alterations</u>. Ergonomic alterations must be done early to assure the appropriate changes are accomplished early in the treatment program.

Whenever a case is identified as a work-related cumulative trauma condition, job alterations are an expected treatment. These may be in the form of: 1) instructing the worker how specific duties might be performed to meet ergonomic standards; 2) actual job worksite or duty changes; and/or 3) a formal jobsite evaluation at the worksite. Suggested ergonomic changes are usually applicable to uninjured workers in the same job position. Refer to Section E.6.c., Jobsite Evaluation and H.4., Jobsite Alteration.

iv. Return to work with appropriate restrictions should be considered early in the course of treatment. Refer to Section I.9 Return to Work.

<u>v. Other therapies</u> in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations: Since cumulative trauma conditions often involve several areas in an upper extremity, surgical treatment of one problem should be performed in conjunction with conservative treatment of other problems in the upper extremity.

Surgery may be considered when: 1) findings on history and objective evidence correlate specifically with the diagnosis; 2) jobsite alteration and other conservative measures have not alleviated the symptoms; and 3) functional deficits persist after 8 to 10 weeks. Subjective complaints should be localized and appropriate to the diagnosis, neurologic complaints should be consistent with the nerve distribution in question, and physical exam findings should correlate with the history. Objective evidence should be present and includes: positive physical exam findings as described in section 5.c.; positive electrodiagnostic (EDX) studies, or diagnostic peripheral nerve block which eradicates the majority of the patient's symptoms.

When no objective evidence is present and the patient continues to have signs and symptoms consistent with the diagnosis after 6 months of conservative treatment including a psychological evaluation, a second opinion should be obtained before operative treatment is considered.

Most cases improve with conservative treatment. Surgery should only be performed to achieve functional gains on those with significant ongoing impaired activities of daily living.

Radial nerve decompression is reported to have good success; however, approximately 30% of cases may have residual pain and others may suffer wrist and finger extension weakness due to damage to the posterior interosseous nerve.

Smoking may affect nerve healing through tissue hypoxia. Patients should be strongly encouraged to stop smoking and be provided with appropriate counseling by the physician. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels. The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures: Radial nerve decompression.

h. Post-operative Treatment:

i. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progressions.

ii. Treatment may include the following: bracing, scar management and active therapy with or without passive therapy. Stretching is usually started early and strengthening may be begun between the 3 to 6 weeks. Longest recovery would be expected to be 4 months.

iii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

H. Specific Musculoskeletal Disorders (MSDs) Diagnosis, Testing and Treatment Procedures

H.1 Amputations and Indications for Replantation

a. Initial Treatment: The decision for amputation or replantation should be made by a physician who has training and experience in treating amputations and replantations. The key for the initial physician or health care provider is to reduce the warm ischemia time of the amputated part – the time without any preparation of the amputated part. This is best done by washing the amputated part in saline and wrapping it in saline soaked gauze, putting it into a plastic bag if possible, and then placing it onto cardboard that is laid over ice in a cooler or jug. The part of the body where the amputation has occurred should be covered with a compression dressing. Vascular control is important. Attempts to use clamps to control bleeding often damage the neurovascular structures and should not be used.

b. Occupational Relationship:

Causation is based on the specific major incident that produced the injury. Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Surgical Indications/Considerations:

Indicators that are used to suggest replantation success include thumb amputation, multiple digit amputations, amputation at a metacarpal amputation, almost any body part amputated in a child, wrist or forearm amputation, and individual digit amputated distal to FDS insertion.

Contraindications may include ring avulsion injuries, severely crushed or mangled parts, amputations at multiple levels, amputations in patients with other serious injuries or diseases, arteriosclerotic vessels, mentally unstable patients, distal amputations (finger tip injuries), individual finger in adult proximal to the FDS insertion and prolonged warm ischemia. Prolonged warm ischemia is defined as more than 6 hours for proximal replantations (wrist), and 12 hours for digits, although some physicians will attempt replantation after 6 hours of warm ischemia, and 24 to 30 hours ischemia time (time from amputation until replant with the digit stored in cool container as described above) for digital replantations.

Because smokers have a higher risk of delayed bone healing and post-operative costs, it is recommended that insurers cover a smoking cessation program peri-operatively. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

d. Post-operative Treatment:

i. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progression. Treatment may include the following: splinting and other active therapy with or without passive therapy.

ii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

H.2 Biceps Tendinosis/Tendinitis and tears/ruptures

a. Description/Definition: A strain consists of a partial or complete disruption of a myotendinous junction. A biceps strain involves one or both tendons of the biceps brachii at the elbow. (Bicipital tendinosis involves the long head of the biceps at the shoulder.) Prior strains presumably increase the probability of a future strain or tear. A complete muscular tear of the biceps may occur.

While frequently considered two discrete entities of tendinosis vs.rupture, there is considerable overlap ranging from mild to moderate to severe ruptures. The greater the degree of rupture, the greater the likelihood surgery may be needed to attempt to restore the greatest degree of function, particularly in working age patients.

b. Occupational Relationship:

High-force activities generally cause biceps strains and tears, particularly when unaccustomed activities are involved. These injuries are considered acute injuries, although repeated unaccustomed use may have precipitated the event. Thus, the nature of the forceful unaccustomed use determines whether the condition is work-related.

Job analyses may be of benefit to prevent future occurrences in cases involving high force exertions.

Causation is based on the specific major incident that produced the injury. Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

Biceps tendinosis is diagnosed based on a combination of a typical inciting event combined with characteristic localized elbow pain to the affected myotendinous junctions as they insert in the distal biceps' tendon in the distal upper arm. Focal tenderness is present over the affected, disrupted junctions. Ecchymosis may be present and is generally proportionate to the degree of tear of the junctions and/or rupture.

Biceps ruptures involve a larger degree of tear of the myotendinous junctions up to, and including a complete rupture of one half or, rarely, both of the biceps brachii. These ruptures have a greater degree of associated weakness for elbow flexion. The physical examination also includes palpable abnormalities sometimes described as a "ropey" feeling biceps in the area of the insertion. An accompanying hematoma is often present.

d. Diagnostic Testing Procedures:

X-rays are recommended for biceps tendinosis or ruptures.

MRI is recommended for evaluation of biceps tendinosis or ruptures, particularly in those for

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whom the need for surgery is uncertain. Complete ruptures generally do not require MRI as it usually does not alter the need for surgery. Mild tears generally do not require MRI as it does not alter the treatment plan and prognosis.

Diagnostic ultrasound is recommended to diagnose biceps tendinosis or ruptures, particularly in whom the need for surgery is uncertain. Patients with complete ruptures generally do not require diagnostic ultrasound as it usually does not alter the need for surgery. Patients with mild tears generally do not require ultrasound as the test does not alter the treatment plan and the good prognosis. Ultrasound should generally not be performed in addition to MRI as it usually does not add additional information of benefit.

e. Non-operative Treatment Procedures:

i. Initial Treatment:

Patients with severe or complete ruptures should be referred to a surgeon to evaluate the need for surgical repair. Other patients should receive treatment including activity limitations and pain management strategies generally centering on NSAIDs.

Slings and splints are recommended for moderate to severely affected patients, especially for the first week. Generally splints should be used for less than 7 to 10 days with gradual reduction in use. Range of motion exercises of the elbow and shoulder are recommended several times daily for non-operative cases while using a sling or splint to prevent after complications from reduced ranges of motion.

ii. Medications such as analgesics and anti-inflammatories may be helpful.

Opioids are recommended for treatment of select patients with pain from moderately severe to severe biceps tendinosis, particularly with nocturnal sleep disruption. Post-operative patients are also candidates.

Refer to medication discussions in Section I. 5, Medications and Medical Management.

<u>iii. Patient education should include instruction in self-management techniques, ergonomics, body mechanics, home exercise, joint protection, and weight management.</u>

<u>iv. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. Biceps strains may not require work limitations if mild and the patient has the ability to avoid the high force activity. However, the more forceful the work and more significant the symptoms, the more likely work limitations will be needed for biceps strains. Biceps tears/ruptures require work limitations during the recovery phase that typically include no use for a period of at least a couple weeks followed by graded increase in activities. Refer to Section I.9, Return to Work.

<u>v. Other therapies</u> in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations:

These recommendations are for a distal biceps tendon rupture, not a (proximal) bicipital tendon rupture, which occurs in the bicipital groove at the shoulder and often does not require surgery.

Distal biceps ruptures generally occur in the setting of supramaximal use of force and require surgical repair in most employed patients.

Surgical repair of distal biceps ruptures is recommended for ruptures that are either complete, large or in select patients with moderately severe biceps tendinosis: Patients who fail to adequately progress with non-operative care with which they have demonstrated compliance. Patients with high job physical demands but only moderate tears are also candidates for surgery to attempt to regain sufficient function to return to those job tasks.

g. Operative Procedures:

Surgical repair of distal biceps ruptures.

h. Post-operative Treatment:

i. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progression. Treatment may include the following: splinting and other active therapy with or without passive therapy.

ii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

H.3 Crush Injuries and Compartment Syndrome

a. Description/Definition: Crush injuries as well as compartment syndrome are usually surgical emergencies. Mild cases of crush injuries may be treated similar to non-specific hand, wrist, forearm pain with particular emphasis on RICE (rest, ice, compression, elevation). Not all crush wounds, especially those more extensive and prone towards swelling are sutured as additional problems may ensue from suturing including possible tissue necrosis and the intervention may help to inhibit expansion to relieve pressure.

b. Occupational Relationship:

Causation is based on the specific major incident that produced the injury. Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

The physical examination ranges from mild abnormalities with mild injuries (e.g., contusions) to severe with fractures, limited range(s) of motion and neurovascular compromise. Patients have pain, and may have paresthesias. Those with vascular compromise may have a cool extremity compared with the unaffected limb. Crush injuries have clear mechanisms of injury on history. However, there are many causes of compartment syndrome including trauma, excessive traction from fractures, tight casts, bleeding disorders, burns, snakebites, intraarterial injections, infusions, and high-pressure injection injuries.

d. Diagnostic Testing Procedures:

X-rays are recommended for evaluating patients with crush injuries or compartment syndrome. MRI or CT is recommended for follow-up of select patients.

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e. Non-operative Treatment Procedures:

<u>i. Initial Treatment</u>: Patients with more severe injuries present with severe pain and may have vascular compromise. The initial assessment should focus on the degree of injury severity and if the injury requires surgical evaluation and treatment. Milder injuries may be managed non-operatively; however, the threshold for surgical consultation should be low. Those with milder injuries should be monitored for neurovascular compromise.

Elevation and relative rest are recommended for treatment of acute crush injuries or compartment syndrome.

Splinting is recommended after initial treatment for moderate or severe acute and subacute crush injuries or compartment syndrome. Splints are recommended particularly for patients with moderate to severe injuries. The type of splint required depends on the type of injury and subsequent debility. Splints are frequently custom made for patients with these injuries.

Self-application of ice is recommended for treatment of acute crush injuries or compartment syndrome. Other cryotherapies may be required in hospital settings for more severe cases.

<u>ii. Medications</u> such as analgesics and anti-inflammatories may be helpful. Refer to medication discussions in Section I. 5, Medications and Medical Management.

Over-the-counter medications may be helpful, but most patients require prescription medications for pain, particularly for moderate to severe injuries. Mannitol has been reported as a treatment.

NSAIDs or acetaminophen are recommended to control pain associated with acute or subacute crush injuries or compartment syndrome.

Opioids are recommended for select patients with pain due to moderate or severe acute or subacute crush injuries or compartment syndrome.

<u>iii. Patient education should include instruction in self-management techniques, ergonomics, body mechanics, home exercise, joint protection, and weight management.</u>

<u>iv. Job analyses may be of benefit to attempt to prevent future occurrences of these types of injuries (e.g., machine guarding, icy walkways, tool kickback). The job should generally be analyzed for root cause and potential remediation, as these injuries are generally viewed as critical incident cases.</u>

v. Hyperbaric Oxygen (HBO): There is some recommended for hyperbaric oxygen treatment of acute or subacute crush injuries or compartment syndrome depending on the nature of the injury. HBO is non-invasive and generally safe, although it is high cost. However, HBO is recommended for treatment of patients with moderate to severe crush injuries or compartment syndrome as risks are outweighed by benefits.

<u>vi. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. Refer to Section I. 9, Return to Work.

These injuries generally require work limitations depending on task demands. More severe cases
require time away from work for recovery from surgery, pain management, and generally require a gradual resumption of usual activities dependent on injury severity and rate of healing.

<u>vii. Other therapies</u> in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

Severe cases of compartment syndrome or crush injuries that have major medical complications and activity limitations may require dozens of appointments to evaluate, treat, advance activity limitations and otherwise monitor and actively facilitate clinical progress. Moderate and severe crush injuries and compartment syndrome usually require occupational or physical therapy for teaching mobilization and strengthening exercises. Therapy needs can be extensive.

f. Surgical Indications/Considerations:

Surgery is recommended for treatment of acute or subacute crush injuries or compartment syndrome depending on the nature of the injury.

Because smokers have a higher risk of delayed bone healing and post-operative costs, it is recommended that insurers cover a smoking cessation program peri-operatively. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures:

This frequently includes emergency fasciotomy for release of tension from compartment syndromes as well as other surgical procedures to address fractures and other remediable defects. Other procedures may be required based on remediable defects such as fractures, ligament tears, or other injuries.

h. Post-operative Treatment:

i. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progression. Treatment may include the following: splinting and other active therapy with or without passive therapy.

ii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

H.4 Distal Forearm Fractures

a. Description/Definition: There are several types of distal forearm fractures in adults, the most common being Colles' fracture. Because it is the most common, the eponym Colles' fracture is often mistakenly used as a generic reference term for all forearm or wrist fractures in adult populations. However, Colles' fracture specifically refers to a transverse fracture of the distal radial metaphysis, with or without extension into and disruption of the radiocarpal or radioulnar articular surfaces. The distinguishing feature for Colles' fracture is that fracture fragments are displaced or angulated dorsally on a lateral view x-ray. Other adult distal radial fractures include

displaced fracture fragments that have an anterior angulation and displaced fracture fragments that are displaced palmarly and may have an anterior angulation. A fracture of the distal radius with carpal displacement can be dorsal or palmar displaced, the latter being more common.

Some fractures are limited to the radial styloid and some are frequently associated with fracture of the ulnar styloid, 1 as well as a high incidence of triangular fibrocartilage complex (TFCC) disruption. Failure to recognize a torn TFCC may result in inadequate immobilization or surgical repair, resulting in distal radioulnar joint instability. Despite the severity of these injuries, with proper diagnosis and management most patients will have a satisfactory outcome.

b. Occupational Relationship:

Distal radial fractures are the result of traumatic forces, most commonly related to falling on the outstretched hand. Causation is based on the specific major incident that produced the injury. Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

Comprehensive physical examination for traumatic injuries at the wrist as well as elbow, shoulder, neck, head, and hip should be included. Examination of the injured wrist and hand should include neurological and vascular exam, as well as testing for tendon and ligament integrity. The ulnar styloid should be palpated for tenderness as well as the radial head. TFCC should be suspected for displaced or complex fractures, and DRUJ instability may be noted dependent on extent of pain and nature of fracture.

Wrist injuries associated with significant pain, swelling, ecchymosis, crepitance, or deformity should be considered to be fractured until proven otherwise. Forearm fractures may also result in concomitant vascular, neurological, ligament and tendon injuries. Further, as distal forearm fractures are the result of trauma, careful inspection for other traumatic injuries should be included, such as elbow, shoulder, neck, head, and hip. In general, most distal forearm fractures should be managed by an orthopedic or hand surgeon and consultation is recommended.

d. Diagnostic Testing Procedures:

X-rays in the posterior-anterior and lateral views are recommended as a first-line study for suspected distal forearm fractures.

MRI is recommended to diagnose suspected soft-tissue trauma after x-ray images confirm a complex displaced, unstable, or comminuted distal forearm fractures.

CT is recommended for investigation of occult and complex distal forearm fractures to gain greater clarity of fracture displacement, articular involvement, and subluxation of the distal radioulnar joint.

e. Non-operative Treatment Procedures:

i. Initial Treatment:

Immobilization of non-displaced or minimally displaced distal forearm fractures limited to 3 weeks is moderately recommended and has equivalent or superior functional outcomes than

periods greater than 3 weeks for non-displaced or minimally displaced distal radius fracture.

The use of functional bracing or splinting that will allow mobilization of the radial-carpal joint while maintaining stabilization of the fracture is moderately recommended over traditional casting to immobilize the forearm and wrist for non-displaced or minimally displaced Colles' fractures.

There is no recommendation for or against casting/bracing the forearm and wrist in pronation or supination for non-displaced or minimally displaced Colles' fractures.

<u>ii. Medications</u> such as analgesics and anti-inflammatories may be helpful. Refer to medication discussions in Section I. 5, Medications and Medical Management.

<u>iii. Patient education should include instruction in self-management techniques, ergonomics,</u> body mechanics, home exercise, joint protection, and weight management.

<u>iv. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. Functional restrictions of the affected extremity are limited by immobilization technique. Activities should be modified to allow for splinting and immobilization of the forearm. Return to work will likely be influenced by the patient and provider's subjective assessment of disability and perception of job difficulty. It may be helpful to refer the patient to an occupational therapist to address the appropriate activity modification, compensatory strategies, adaptive equipment, and environmental modification throughout the period of the patient's recovery and rehabilitation. Refer to Section I.9, Return to Work.

v. Routine referral for physical or occupational therapy after cast removal for Colles' fracture of otherwise healthy patients who are able to return to work is not recommended. Other therapies in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations:

Distal radial fractures with radiographic measurements of 10° or more of dorsal angulation, more than 2 mm of radial shortening or with any degree of radial shift require reduction to reduce the risk for deformity and disability. Closed reduction should result in no more than 5° of dorsal angulation and no more than 2mm of radial shortening. Unstable fractures are defined as fractures with bone loss or bone involvement that will not allow for structural integrity without the use of internal or external fixation of the bone. Examples include fractures with dorsal comminution or radial lateral shift of more than 2mm, have been proposed as limits for consideration of surgical intervention.

Manipulation and dynamic traction devices are recommended for closed reduction technique for displaced distal radial fractures as they have demonstrated equivalent ability to achieve initial reduction of injury.

Because smokers have a higher risk of delayed bone healing and post-operative costs, it is recommended that insurers cover a smoking cessation program peri-operatively. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be

covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures:

Closed reduction or external fixation is moderately recommended for treatment of severely displaced extra-articular fractures, and for comminuted, displaced intra-articular fractures of the distal forearm.

Cast immobilization is moderately recommended for treatment of extra-articular fractures or distal forearm fractures that include moderately displaced extra-articular fractures, non-comminuted or non-displaced intra-articular fractures.

External fixation is moderately recommended as a second option for fractures that fail reduction while immobilized.

Medullary pinning (k-wire or intramedullary fixation techniques) is recommended as an alternative to external fixation.

Remodellable bone cement (injected or open reduction) is recommended as an effective alternative to external fixation and casting.

Open reduction and internal fixation by either dorsal or volar plating is recommended if fracture remains unstable by other treatment methods.

REDUCTION ANALGESIA:

- Bier block analgesia is moderately recommended as a first-line technique for manipulation of acute displaced distal forearm fractures.
- Hematoma block analgesia is recommended for manipulation of acute displaced distal forearm fractures.
- Dynamic reduction is recommended as an alternative technique for distal forearm fractures as it may result in less reduction pain than hematoma block, and may have a lower neurologic complication rate than a hematoma block.

h. Post-operative Treatment:

i. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progression. Treatment may include the following: splinting and other active therapy with or without passive therapy.

ii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

H.5 Distal Phalanx Fractures and Subungual Hematoma

a. Description/Definition: Tuft fractures are most often usually due to a crush injury of the fingertip, resulting in comminuted or transverse fractures and are a common occupational injury. Often, they are accompanied with nail bed laceration and subungual hematoma. Tuft fractures are generally stable and heal uneventfully because of the soft tissue support of the fibrous septae and nail plate.

Mallet fracture or mallet finger is a common fracture-dislocation injury of the distal phalanx involving loss of continuity of the extensor tendon over the distal interphalangeal joint. This common hand injury results in a flexion deformity of the distal finger joint and may lead to an imbalance between flexion and extension forces more proximally in the digit.

b. Occupational Relationship:

Causation is based on the specific major incident that produced the injury. Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

Patients have swelling, reduced range of motion, and tenderness of the fingertip. Patients with accompanying subungual hematoma may have severe throbbing pain and obvious discoloration of the affected nail.

Tuft fracture should be suspected when a patient presents with a crush injury or perpendicular shearing force injury to the fingertip, particularly if there is a subungual hematoma. Injuries resulting in avulsion of the nail plate can also be associated with tuft fractures.

Physical examination should include inspection and identification of localized swelling and open wounds. Neurovascular status should be described. The DIP joint should be palpated in each plane to assess point tenderness over ligament insertions. Passive range of motion and joint stability should be assessed through dorsal, volar, and lateral stressing. An estimate of subungual hematoma size relative to the nail bed surface should be noted. The DIP joint should be evaluated for flexion and extension range of motion.

d. Diagnostic Testing Procedures: x-rays

e. Non-operative Treatment Procedures:

i. Initial Treatment:

Tuft fractures are initially treated by caring for accompanying soft tissue injury and splinting of the finger to prevent further discomfort or injury. Reduction of the relatively uncommon significantly displaced fractures should be attempted with dorsal traction followed by immobilization in a volar splint. In the small percentage of patients, reduction cannot be achieved and referral to an orthopedic surgeon for consideration of pinning may be indicated.

As subungual hematoma is often associated with nail bed laceration, many practitioners promote removing the nail and repairing the nail bed to avoid future cosmetic defects. The primary concern for this procedure is the potential to convert an underlying fracture into an open fracture.

Tuft fractures associated with nail avulsion may require reduction of the nail plate under the eponychium, or removal if reduction cannot be performed. As with the removal of the nail for other conditions, the eponychial space should be preserved by packing with petroleum gauze cut in the shape of the nail to prevent scarring of the nail bed and stunted nail growth. The nail or gauze should remain in place for 2 to 3 weeks to allow initial formation of a new nail plate. Full growth of the new nail takes approximately 4 to 5 months. Open fractures other than from subungual hematoma trephination of the distal phalanx require cleansing, debridement, and inspection for foreign bodies. Orthopedic assistance is usually not required for uncomplicated closures. Open fractures with extensive soft tissue damage frequently are associated with chronic pain and disability and generally require assistance from an orthopedic or hand surgeon.

Trephination is recommended for the management of subungual hematoma.

<u>ii. Medications</u> such as analgesics and anti-inflammatories may be helpful. For open fractures, it is recommended that tetanus immunization status to be updated as necessary. Refer to medication discussions in Section I. 5, Medications and Medical Management.

<u>iii. Patient education should include instruction in self-management techniques, ergonomics, body mechanics, home exercise, joint protection, and weight management.</u>

iv. Protective splinting of the distal phalanx to the PIP is recommended for fractures. Duration – Approximately 3 weeks.

<u>v. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. All work activities that can be accomplished while wearing a finger splint are appropriate. Athletes may return to sports after the initial swelling and pain have resolved, approximately 7 to 10 days. Activities requiring full distal joint mobility and forceful use may be delayed as long as 4 to 6 weeks. Residual tenderness may be present for up to 6 months. Refer to Section I.9, Return to Work.

<u>vii. Other therapies</u> in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations:

Distal phalangeal diaphyseal fractures rarely require operative fixation, except those that are extremely displaced, unable to be reduced or are unstable.

Crush fractures or avulsion fractures involving the proximal base of the distal phalanx however may also involve flexor or extensor tendons and may require surgical intervention.

Because smokers have a higher risk of delayed bone healing and post-operative costs, it is recommended that insurers cover a smoking cessation program peri-operatively. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels The surgeon will make the final determination as to whether smoking cessation is

required prior to surgery.

g. Operative Procedures:

Retrograde percutaneous Kirschner-wire fixation is the preferred internal fixation technique.

h. Post-operative Treatment:

i. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progression. Treatment may include the following: splinting and other active therapy with or without passive therapy.

ii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

H.6 Elbow Contusion

a. Description/Definition: Contusions result from blunt force trauma that ruptures blood vessels, without a break in the skin, producing bruises (ecchymoses).

b. Occupational Relationship:

Common occupational causes include falls, motor vehicle accidents, and being struck by objects. Causation is based on the specific major incident that produced the injury. Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

Local pain, range-of-motion is usually normal, soft tissue swelling.

d. Diagnostic Testing Procedures: none.

e. Non-operative Treatment Procedures:

i. Initial Treatment:

These are generally self-limited conditions absent underlying structural damage. Treatment usually consists of ice, acetaminophen, NSAIDs, and relative rest, compression, range-of-motion exercises, and avoidance of immobilization are recommended for elbow contusions.

Medical management of contusions is recommended to be directed at maintaining normal elbow function. With significant contusion-related injury, there is a risk of deep tissue involvement, potentially leading to scarring and limitation of motion.

Early mobilization should also be encouraged to prevent impairment and disability and can be best accomplished through instruction in the initial clinical visit. Range-of-motion exercises should primarily involve the elbow, but may also include the shoulder and wrist, particularly if a sling is prescribed.

<u>ii. Medications</u> such as analgesics and anti-inflammatories may be helpful. Refer to medication discussions in Section I. 5, Medications and Medical Management.

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<u>iii. Patient education should include instruction in self-management techniques, ergonomics, body mechanics, home exercise, joint protection, and weight management.</u>

iv. Return to work with appropriate restrictions should be considered early in the course of treatment. Refer to Section I.9, Return to Work.

<u>v. Other therapies</u> in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations:

Surgery is not indicated.

H.7 Elbow Dislocation

a. Description/Definition: Elbow dislocations are relatively uncommon and they usually result from a violent or highspeed collision or falls. The most common mechanism is falling onto an outstretched hand, resulting in a posterior dislocation (98% of cases). Pain is usually severe, associated with an inability to use the arm. Most other dislocations in adults occur due to either a congenital malformation of the elbow joint or recurrent dislocations associated with ligamentous laxity.

b. Occupational Relationship:

Elbow dislocations are consequences of significant trauma. The mechanism of the trauma determines whether the condition is work-related.

Causation is based on the specific major incident that produced the injury. Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

Dislocations are diagnosed based on a combination of typical inciting event (usually fall or trauma) combined with deformity and inability to use the arm. Persistent dislocation involves a complete inability to use the arm and

deformity. Those that spontaneously reduce are usually accompanied by ongoing, though reduced pain and may have hemarthrosis. Dislocations may be associated with visible, objective abnormal findings.

Severe pain and inability to use the elbow and hand are typical presenting complaints. Accompanying fractures and vascular and neurological problems are common, and a combination of fracture and dislocation is called complex or complex instability. Radial head fractures are present approximately 10% of the time. A combination of dislocation, radial head and ulnar coronoid process fractures is called the terrible triad injury.

d. Diagnostic Testing Procedures:

X-rays that include at least two to three views are recommended for elbow dislocation to rule-out fractures. Repeat x-rays after reduction are also recommended.

CT is recommended for evaluating patients following traumatic dislocations or arthroplastyassociated recurrent dislocations.

e. Non-operative Treatment Procedures:

i. Initial Treatment:

An evaluation of the motor, sensory, and vascular system is required to rule-out accompanying injuries. If the elbow remains dislocated, it should be reduced as soon as possible by a health care professional experienced in joint relocation. Injection of an anesthetic into the swollen joint space may help. The longer the elbow remains dislocated, the higher the probability that general anesthesia will be required to successfully reduce the elbow.

Post-reduction x-rays are necessary, as well as an exam to be sure that the reduction is successful and that there is no loose body present. A posterior splint is to be applied for 10 days.

<u>ii. Medications</u> such as analgesics and anti-inflammatories may be helpful. Opioids are recommended for treatment of select patients with pain from elbow dislocations with insufficient control from other means, including acetaminophen and NSAIDs or with contraindications for NSAIDs.

Refer to medication discussions in Section I. 5, Medications and Medical Management.

<u>iii. Patient education should include instruction in self-management techniques, ergonomics, body mechanics, home exercise, joint protection, and weight management.</u>

<u>iv. Injections</u>: Some patients with dislocations have been treated with anesthetic intraarticular injection(s) either pre-reduction or post-reduction for pain control. Opioids anesthetic intraarticular injection(s) are recommended either pre-reduction or post-

reduction for pain management.

<u>v. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. Functional restrictions of the affected extremity are limited by immobilization technique. Activities should be modified to allow for splinting and immobilization of the forearm. Return to work will likely be influenced by the patient and provider's subjective assessment of disability and perception of job difficulty. It may be helpful to refer the patient to an occupational therapist to address the appropriate activity modification, compensatory strategies, adaptive equipment, and environmental modification throughout the period of the patient's recovery and rehabilitation. Refer to Section I.9, Return to Work.

v. Range-of-motion exercises are recommended after immobilization. Range-of-motion exercises should primarily involve the elbow, but should also include the shoulder (to prevent frozen shoulder), and the wrist.

Other therapies in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations:

General anesthesia is recommended to facilitate reduction in select patients.

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Most patients do not require general anesthesia to obtain sufficient muscular relaxation for reduction. In cases where reduction is not obtained and intraarticular injection with anesthetics is insufficient to obtain reduction, general anesthesia is used.

Because smokers have a higher risk of delayed bone healing and post-operative costs, it is recommended that insurers cover a smoking cessation program peri-operatively. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures:

Surgery is recommended to repair elbow joints that either recurrently dislocate or are otherwise unstable after dislocation(s).

h. Post-operative Treatment:

i. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progression. Treatment may include the following: splinting and other active therapy with or without passive therapy.

ii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

H.8 Elbow Fractures including non-displaced radial head fractures

a. Description/Definition: Elbow fractures include both frank and stress fractures. All fractures involve an application of force that is beyond the bone strength. Nondisplaced radial head fractures are usually treated with slings and have excellent prognoses. Other fractures may require surgical fixation.

b. Occupational Relationship:

Elbow fractures most commonly occur from falls. Radial head fractures typically occur from falls onto an outstretched hand. Stress fractures are caused by repeated applications of unaccustomed force over hours to days.

Causation is based on the specific major incident that produced the injury. Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

A clinical impression is made upon history of appropriate injury mechanism and physical examination findings of substantial tenderness particularly focally over a bone. Findings of (in)ability of use the elbow should be sought, as well as inspection for signs of deformity. The elbow extension test (whether the elbow can be fully extended) has been reported to be 96.8% sensitive and 48.5% specific for detection of an elbow fracture in a series of 1,740 patients with an acute elbow injury. The negative predictive value was 98.4. The differential diagnosis

prominently includes elbow sprain and dislocation.

d. Diagnostic Testing Procedures:

X-rays that include at least two to three views are recommended to diagnose elbow fractures.

e. Non-operative Treatment Procedures:

i. Initial Treatment:

A) Elbow slings are recommended for treatment of non-displaced and occult radial head fractures.

- Indications Non-displaced radial head fractures and occult fractures. Occult fractures are not visible on x-rays but are suspected by including either the lack of full extension of the elbow or evidence of effusion on x-ray.
- Frequency/Duration Sling (or splint) use for non-displaced radial head fractures is for 7 days. (A shorter complete immobilization period of as little as 3 days may be used for non-displaced fractures that are clinically present but not visible on an x-ray.) After 7 days, gentle range-of-motion exercises within pain tolerance should begin, followed by progressive mobilization.

B) Casts are recommended for treatment of non-displaced or occult radial head fractures.

- Indications Minimally displaced fractures and other elbow fractures felt amenable to casting or post-open reduction internal fixation fractures.
- Frequency/Duration Casts are generally required for 6 weeks or until adequate healing is documented on x-ray.

C) After successful healing, they should be followed by progressive mobilization.

<u>ii. Medications</u> such as analgesics and anti-inflammatories may be helpful. Opioids are recommended for treatment of select patients with severe pain from elbow fracture with insufficient control from other means, including acetaminophen and NSAIDs or with contraindications for NSAIDs. Patients with more severe fractures or in the immediate post-operative period may require opioids for pain management.

Refer to medication discussions in Section I. 5, Medications and Medical Management.

<u>iii. Patient education should include instruction in self-management techniques, ergonomics, body mechanics, home exercise, joint protection, and weight management.</u>

<u>iv. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. Fractures require work limitations to avoid use of the fractured arm. Functional restrictions of the affected extremity are limited by immobilization technique. Activities should be modified to allow for splinting and immobilization of the forearm. Return to work will likely

be influenced by the patient and provider's subjective assessment of disability and perception of job difficulty. It may be helpful to refer the patient to an occupational therapist to address the appropriate activity modification, compensatory strategies, adaptive equipment, and environmental modification throughout the period of the patient's recovery and rehabilitation. Refer to Section I.9, Return to Work.

<u>v. Other therapies</u> in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations:

Indications to surgically fix elbow fractures are not well defined, and there is a suggestion that some patients are better candidates than others (e.g., widely displaced fragments, or requirement for earlier recovery such as in professional athletes, terrible triad patients). Until sufficient quality evidence becomes available, the decision to surgically treat elbow fractures is a decision between the orthopedist and patient.

If the fracture is large and displaced or comminuted (Type III) or there is a large fracture with a displaced fragment (Type II), surgical referral is indicated.

Capitellar fractures are rare and usually occur from falling on an outstretched hand. Nonoperative management is sometimes attempted, however most are believed to require surgical fixation. Surgical repairs are often performed for these fractures.

Because smokers have a higher risk of delayed bone healing and post-operative costs, it is recommended that insurers cover a smoking cessation program peri-operatively. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures:

Surgical fixation is recommended for displaced elbow fractures.

h. Post-operative Treatment:

i. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progression. Treatment may include the following: splinting and other active therapy with or without passive therapy.

ii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

H.9 Elbow Osteonecrosis [Avascular Necrosis (AVN)]

a. Description/Definition: Osteonecrosis involves impairment of the blood supply to the bone and may evolve to subsequent degeneration and ultimately collapse of the bone. It is particularly likely to occur in areas of tenuous blood supply that lacks collateral blood flow. The elbow is

rarely affected.

b. Occupational Relationship:

The most prominent occupational risk factor is barotraumas ("the bends"), which may occur both in diving, as well as working in compressed air environments (e.g., tunneling projects through unstable sediments requiring compressed air to maintain the workspace). Significant, discrete trauma is thought to be a risk factor. The impact of non-traumatic job physical factors is controversial.

Job analysis is generally not indicated for most cases, although where there are exposures such as decompression, job analysis to evaluate decompression protocols may be helpful.

Causation is based on the specific major incident that produced the injury. Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

The condition is painless in its early stages, but when it advances, patients generally present with pain and limitation of motion. Pain is usually exacerbated by use and relieved with rest.

d. Diagnostic Testing Procedures:

MRI is recommended for diagnosing osteonecrosis; it is considered the gold standard for evaluating osteonecrosis after x-rays.

Bone scanning is recommended for select use in acute, subacute or chronic elbow pain to assist in the diagnosis of osteonecrosis, particularly where there is more than one joint to be evaluated.

CT is recommended for evaluating patients with osteonecrosis, or for patients who need advanced imaging but have contraindications for MRI.

e. Non-operative Treatment Procedures:

<u>i. Initial Treatment</u>: Treatment is primarily based on reducing the implicated risk factor (e.g., alcohol, diabetes).

<u>ii. Medications</u> such as analgesics and anti-inflammatories may be helpful. Refer to medication discussions in Section I. 5, Medications and Medical Management.

<u>iii. Patient education should include instruction in self-management techniques, ergonomics, body mechanics, home exercise, joint protection, and weight management.</u>

<u>iv. Return to work with appropriate restrictions should be considered early in the course of</u> treatment. There is no evidence that work restrictions are helpful, yet as the condition often progresses, patients typically incur increasing degrees of disability with a progressive need for work limitations. Advanced cases generally require temporary removal from work and surgery, with return to work post-operatively. Patients with light to medium work may require no limitations, while those with medium to heavy work may require significant limitations. Refer to Section I.9, Return to Work.

<u>v. Other therapies</u> in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations:

Because smokers have a higher risk of delayed bone healing and post-operative costs, it is recommended that insurers cover a smoking cessation program peri-operatively. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures:

A surgical coring procedure (vascularized and unvascularized bone grafting and osteotomy) are sometimes utilized. Severe cases may require arthroplasty.

h. Post-operative Treatment:

i. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progression. Treatment may include the following: splinting and other active therapy with or without passive therapy.

ii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

H.10 Elbow Pain, Non-specific

a. Description/Definition: Pain originating from the elbow is usually felt in the center of the joint and generally does not radiate. Pain in the elbow may also be due to referred pain from cardiovascular or metastatic processes, cervical or upper thoracic disc herniation with neurological impingement, and chest disorders including arteriosclerotic disorders.

b. Occupational Relationship:

Causation is based on the specific major incident that produced the injury. Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

Job analysis may be revealing particularly when there is a high exposure situation (i.e., high force or combinations of high force and other ergonomic risk factors).

c. Specific Physical Exam Findings:

The physician performing an initial evaluation of a patient with elbow pain should seek a discrete explanatory diagnosis. A careful, thorough history is required. Review of systems that also involves the hand, shoulder, spine, and chest is necessary.

Cervical radiculopathy and stenosis are two common disorders that may present as elbow pain. Thus, they constitute prominent disorders in the differential diagnosis of elbow pain

d. Diagnostic Testing Procedures:

i. X-rays are recommended for evaluation of acute, subacute, or chronic elbow pain.

<u>ii. Antibody levels</u> are recommended to evaluate and diagnose patients with elbow pain who have reasonable suspicion of rheumatological disorder.

<u>iii. Bone scanning</u> is recommended for select use in acute, subacute or chronic elbow pain to assist in the diagnosis of osteonecrosis, neoplasms and other conditions with increased polyosthotic bone metabolism, particularly where there is more than one joint to be evaluated.

<u>iv. Helical CT</u> for select patients with acute, subacute or chronic elbow pain in whom advanced imaging of bony structures is thought to be potentially helpful.

<u>v. Erythrocyte sedimentation rate</u> and other inflammatory markers are recommended for screening for inflammatory disorders, or prosthetic sepsis with reasonable suspicion of inflammatory disorder, in patients with subacute or chronic elbow pain.

e. Non-operative Treatment Procedures:

i. Initial Treatment:

Comfort is often a patient's primary concern. Nonprescription analgesics will provide sufficient pain relief for most patients with acute or subacute elbow symptoms. If the patient's response to treatment is inadequate (i.e., symptoms and activity limitations continue), pharmaceuticals, orthotics, or physical methods can be prescribed.

<u>ii. Medications</u> such as analgesics and anti-inflammatories may be helpful. Refer to medication discussions in Section I. 5, Medications and Medical Management.

<u>iii. Patient education should include instruction in self-management techniques, ergonomics, body mechanics, home exercise, joint protection, and weight management.</u>

<u>iv. Return to work with appropriate restrictions should be considered early in the course of</u> treatment. Patient should be released to return to work with specific physical activity limitations clearly spelled out per the specific job requirements. However, in cases where symptoms persist and/or in settings with combined high force and high repetition, workplace limitations may be tried to assess if there is a significant impact of job physical factors. Refer to Section I.9, Return to Work.

<u>v. Other therapies</u> in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations:

Arthroscopy is recommended to evaluate and diagnose patients with elbow pain that have suspicion of intraarticular body, and other subacute or chronic mechanical symptoms.

H.11 Elbow Sprain

a. Description/Definition: An isolated elbow sprain is relatively uncommon and is caused by a significant high-force trauma, resulting in a disruption of ligament(s) about the elbow. The most common mechanism is a fall. Generally, a sprain is accompanied by other problems such as fracture, dislocation, or contusion. These potential complications need to be evaluated including the motor, sensory, and vascular systems.

b. Occupational Relationship:

Causation is based on the specific major incident that produced the injury. Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

Sprains are diagnosed based on a combination of typical inciting event (usually fall or high-force trauma) combined with characteristic elbow pain and focal tenderness over ligament(s). In contrast with dislocations and fractures, sprains generally have normal, though painful range of motion.

d. Diagnostic Testing Procedures:

X-rays that include at least two to three views are recommended to rule-out fractures. Repeat x-rays are also recommended if there is failure to improve as clinically expected over approximately a week.

e. Non-operative Treatment Procedures:

i. Initial Treatment:

A) An evaluation of the motor, sensory, and vascular system is required to rule-out accompanying injury(ies). Other than mild sprains, medical management of the sprained elbow should generally include an x-ray to assure that there is no fracture.

B) Patients are usually instructed to perform gentle range-of-motion exercises a few times a day in order to maintain normal range of motion. In addition, interventions are provided to address modifications to performance of ADLs and IADLs.

C) Slings are recommended for the treatment of elbow sprains. Slings generally should be used for less than 7 to 10 days with gradual reduction in use. Range of motion exercises of the elbow and shoulder are recommended several times daily while using a sling to prevent after complications from reduced ranges of motion.

ii. Medications such as analgesics and anti-inflammatories may be helpful.

Opioids are recommended for the treatment of select patients with severe pain with insufficient control from other means, including acetaminophen and NSAIDs or with contraindications for NSAIDs.

Refer to medication discussions in Section I. 5, Medications and Medical Management.

<u>iii. Patient education should include instruction in self-management techniques, ergonomics, body mechanics, home exercise, joint protection, and weight management.</u>

iv. Return to work with appropriate restrictions should be considered early in the course of

treatment. Avoid activities that cause significant symptoms or apply excessive force of the elbow. Functional restrictions of the affected extremity are limited by immobilization technique. Activities should be modified to allow for splinting and immobilization of the forearm. Return to work will likely be influenced by the patient and provider's subjective assessment of disability and perception of job difficulty. It may be helpful to refer the patient to an occupational therapist to address the appropriate activity modification, compensatory strategies, adaptive equipment, and environmental modification throughout the period of the patient's recovery and rehabilitation. Moderate to severe sprains and dislocations likely necessitate splinting and limitations. Refer to Section I.9, Return to Work.

<u>v. Other therapies</u> in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations:

Surgery is not indicated.

H.12 Ganglion Cyst

a. Description/Definition: Wrist ganglia are generally classified as either dorsal or palmar, with dorsal ganglia comprising up to 80% and volar ganglia making up approximately 20% of clinically detected ganglia. Approximately 10% of all hand and wrist ganglia are found on a flexor tendon sheath of the fingers.

A ganglion is a cystic structure, although is not technically a cyst as it has no synovial lining. Electron microscopy shows the walls to be composed of randomly oriented collagen fibers. The gelatinous cystic fluid is likened to synovial fluid, although the composition of hyaluronic acid, glucosamine, globulins, and albumin is not the same.

b. Occupational Relationship:

No quality epidemiological studies have shown work relatedness. However, ganglia may be accepted as work related in some legal jurisdictions. Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

Most wrist ganglia are asymptomatic. Many patient visits are primarily for aesthetic reasons.

Most ganglia present as a bump or mass. Occasionally patients with noticeable ganglia will complain of mild nuisance pain, and less often of severe pain. In the assessment of wrist pain in the absence of palpable ganglia, the unexplained wrist pain may be a result of occult ganglia and should be included in the differential diagnosis. The pain from an occult dorsal lesion has been linked to the compression of the posterior interosseous nerve. Ganglia have also resulted in compression of the median and ulnar nerves as they pass through the carpal tunnel and condylar groove respectively (see section on Ulnar Nerve Entrapment).

Wrist ganglia are usually well demarcated, firmly tethered, and have a consistency similar to a rubber ball, and are translucent. Lack of translucency should raise suspicion of other tumor type. The mass and surrounding skin should be inspected and palpated for erythema and infection.

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Examination should also include close inspection for mass effect, including neurovascular involvement, impairment of wrist or finger joint range of motion, impairment of tendon function, and triggering. Small occult dorsal wrist ganglia may result in tenderness over the scapholunate ligament and pain with hyperextension of the wrist.

d. Diagnostic Testing Procedures:

Generally, diagnosis is based on physical examination findings. Diagnosis is usually confirmed upon aspiration of mucinous fluid from the mass.

X-rays to diagnose dorsal or volar wrist ganglia in select patients is recommended: patients with ganglia, especially occurring in the context of trauma where fracture may be present.

e. Non-operative Treatment Procedures:

i. Initial Treatment:

The use of non-operative management (no treatment) for acute asymptomatic wrist and hand ganglia is recommended as first-line management as the natural history for spontaneous resolution is more than 50%, and in recognition of the high recurrence rate of most other treatment strategies.

<u>ii. Medications</u> such as analgesics and anti-inflammatories may be helpful. Refer to medication discussions in Section I. 5, Medications and Medical Management.

<u>iii. Patient education should include instruction in self-management techniques, ergonomics, body mechanics, home exercise, joint protection, and weight management.</u>

iv. Aspiration (without other intervention) of the cystic fluid is recommended as it may result in immediate relief of acute cosmetic and ganglia related pain.

<u>v. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. There is no indication for limiting work activity except for ganglia that are causing significant pain, as there is no reported strong association between activity and exacerbation or causation of ganglia. Those with considerable pain may require limitations to avoid activities provoking increased symptoms, most typically involving forceful use. Refer to Section I.9, Return to Work.

<u>vi. Other therapies in Section I. Therapeutic Procedures, Non-operative may be employed in</u> individual cases.

f. Surgical Indications/Considerations:

Surgical intervention is recommended for treatment of subacute or chronic upper extremity ganglia after a trial of non-operative management.

Because smokers have a higher risk of delayed bone healing and post-operative costs, it is recommended that insurers cover a smoking cessation program peri-operatively. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as

cotinine levels The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures:

There is no general indication for one surgical technique (arthroscopic or open excision) over another for all cases and both are recommended. There may be advantages of arthroscopic procedures for ganglia originating in the radiocarpal joints, whereas open excision may have advantages in ganglia originating in midcarpal joints, although both have the same success rate.

h. Post-operative Treatment:

i. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progression. Treatment may include the following: splinting and other active therapy with or without passive therapy.

ii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

H.13 Hand/Wrist/Forearm Pain - Non-specific

a. Description/Definition: Non-specific pain is thought to be common in initial presentations in primary occupational health clinical settings. This is a "diagnostic" category to be utilized when symptoms are present, but in the absence of an identified, specific disorder.

b. Occupational Relationship:

Non-specific hand/wrist/forearm pain typically occurs in the absence of discrete trauma; rather it frequently occurs in settings of high physical job demands or ill-defined exposures.

Work-relatedness is unclear as there are no quality studies of this condition. However, it is generally recommended that the condition be treated and it will generally resolve. Thus, in the absence of costly testing and/or treatment protocols or prolonged duration, the condition is generally non-controversial. Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

Patients most commonly give a history of gradual onset of pain or other symptoms in the absence of discrete trauma. Symptoms are most often in the forearm, and frequently are not well localized. The examination is generally without any unequivocally objective evidence. Instead, tenderness is most often the only physical examination finding. Qualitative muscle strength testing may be weak compared with the unaffected side. Precise documentation of the location of the pain should be made with consideration for photographing the location for future reference. In cases where the pain does not migrate, the probability of specifically defined pathology is believed to increase.

d. Diagnostic Testing Procedures:

Rheumatological studies are recommended for evaluation of patients with persistent unexplained arthralgias or tenosynovitis.

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Arthrocentesis (joint aspiration) of inexplicable joint effusions, particularly for evaluation of infections and crystalline arthropathies is recommended.

X-rays are recommended for evaluation of cases in which non-specific hand, wrist, or forearm pain persists.

Electrodiagnostic studies are recommended to evaluate non-specific hand, wrist, or forearm pain for patients with paresthesias or other neurological symptoms.

e. Non-operative Treatment Procedures:

i. Initial Treatment:

Relative rest is a recommended treatment in select cases of acute non-specific hand, wrist, or forearm pain particularly where there are high ergonomic exposures (high force or high force combined with other risk factors).

Most cases will resolve without significant difficulty. If there is no improvement after several weeks of treatment, focused diagnostic testing should be considered. Among patients without an identified specific disorder and in whom the condition is present for a few months, the threshold for psychological evaluation and testing is recommended to be low. Non-specific pain lasting more than 2 months is fairly rare. The search for a specific diagnosis should include proximal pathology including spine-related (e.g., radiculopathy, spinal tumor, infection) as well as psychological disorders particularly when widespread symptoms are elicited or a pattern or recurrent unexplained illnesses is present (see Chronic Pain chapter).

<u>ii. Medications</u> such as analgesics and anti-inflammatories may be helpful. Refer to medication discussions in Section I. 5, Medications and Medical Management.

<u>iii. Patient education should include instruction in self-management techniques, ergonomics,</u> body mechanics, home exercise, joint protection, and weight management.

<u>iv. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. Non-specific pain may or may not require work limitations depending on task demands. For patients with high exposures, work limitations are more likely to be helpful. However, in the absence of high force or high force combined with other ergonomic factors, work limitations are at times counterproductive because they enforce debility and do not produce meaningful improvements. In those settings, work limitations may be trialed; however, in the absence of improvement, resumption of regular work activities may be helpful for long-term functional gain. Refer to Section I.9, Return to Work.

<u>v. Other therapies</u> in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations:

Surgery is not indicated.

H.14 Human and Animal Bite Lacerations

a. Description/Definition: Other than deep destruction of tissue requiring reconstruction, risk of infection is the primary concern for animal bites. There also are other zoonotic diseases such as rabies, cat scratch fever, and human blood borne pathogens exposures that should also be considered.

For purposes of this chapter, discussion and recommendations are made based on bites to the extremities or trunk as well. Facial injuries are not considered in this chapter and there may be somewhat different indications as the significance of complications is generally more severe.

b. Occupational Relationship:

Although most bites occur from animals known to the victim, occupations that may be considered at risk for animal bites include veterinarians, animal handlers, police officers, utility services personnel that access private property, mail carriers, and other similar professions. Human bites are common in care givers, educators, law enforcement officers, and in instances of accident or workplace violence that may involve the fist or hand being cut by contact with teeth.

Causation is based on the specific major incident that produced the injury. Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

A careful history for time and location of the bite should be obtained as it will help guide clinical decisions regarding prophylaxis. If possible, information about the type of animal and its health status as well as the circumstances related to why the bite occurred should be obtained.

A detailed medical history pertaining to tetanus and in the case of animal bites, rabies immunization status, and underlying medical conditions such as diabetes mellitus or other immune-compromising conditions is important. Most wounds are puncture wounds, but some wounds may be considered for suturing.

d. Diagnostic Testing Procedures:

Routine culture and sensitivity of animal and human bite wounds is moderately not recommended as it has not been shown to be an effective predictor for infection or subsequent treatment of infected wounds.

e. Non-operative Treatment Procedures:

i. Initial Treatment:

The wound should be carefully cleaned and inspected for depth of injury, potential associated crush injury or fracture, tendon or tendon sheath involvement, foreign body (e.g., teeth, fur, soil), and joint space involvement.

For human bites, it is recommended that exposures that could be considered high risk for viral blood borne pathogen transmission be evaluated and treated according to blood borne pathogen protocols.

Suturing of non-complicated dog bite wounds after adequate wound care is recommended as it may lead to a better cosmetic result and is not likely to result in increased wound infections over wounds allowed to heal by secondary intent.

<u>ii. Medications</u> such as analgesics and anti-inflammatories may be helpful. Prophylactic antibiotics are recommended for treatment of uncomplicated human bite wounds; and for treatment of complicated dog bite wounds, particularly those with delayed irrigation, delayed treatment, involvement of tendon, tendon sheath, crush injuries, and moderate- to large-size tears.

Prophylaxis for treatment of uncomplicated dog bite wounds that receive adequate wound care including irrigation, debridement, and cleansing is moderately not recommended.

Prophylactic antibiotics are recommended for treatment of uncomplicated cat bite wounds.

Refer to medication discussions in Section I. 5, Medications and Medical Management.

<u>iii. Patient education should include instruction in self-management techniques, ergonomics, body mechanics, home exercise, joint protection, and weight management.</u>

<u>iv. Return to work with appropriate restrictions should be considered early in the course of</u> treatment. Work activities are expected to be minimally impacted except for limitations related to treatment of laceration or infection. Refer to Section I.9, Return to Work.

<u>v. Other therapies</u> in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations:

Refer to section H. "Laceration Management"

Because smokers have a higher risk of delayed bone healing and post-operative costs, it is recommended that insurers cover a smoking cessation program peri-operatively. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

H.15 Kienböck Disease

a. Description/Definition: Kienböck disease involves changes in the lunate that eventually lead to collapse of the lunate bone which results in progressive pain and disability.

b. Occupational Relationship:

It is a controversial condition from the standpoint of work-relatedness, as it is a disease and there are no quality studies on cause. It may be reasonable to hypothesize work-relatedness in those cases where the onset is promptly after a discrete, significant traumatic event. However, in most cases, a physical cause is speculative. Refer to Section D. 3, Medical Causation Assessment. To

perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

Patient complains of increasing wrist pain, pain with movement, pain with use, and limited range of motion.

The physical examination may be normal early, but generally the patient has mild to moderate dorsal wrist tenderness while also having asymmetric, limited range of motion. Tenderness and limited range of motion tend to progress.

d. Diagnostic Testing Procedures:

X-rays and MRI are recommended to diagnose Kienböck disease.

Screening for systemic disorders is recommended for patients with Kienböck disease.

e. Non-operative Treatment Procedures:

i. Initial Treatment:

Initial care of patients with Kienböck disease involves identification and elimination or control of potential systemic contributing factors.

<u>ii. Medications</u> such as analgesics and anti-inflammatories may be helpful. Refer to medication discussions in Section I. 5, Medications and Medical Management.

<u>iii. Patient education should include instruction in self-management techniques, ergonomics, body mechanics, home exercise, joint protection, and weight management.</u>

iv. Splints are recommended for treatment of select patients with acute, subacute, or chronic Kienböck disease.

v. Return to work with appropriate restrictions should be considered early in the course of treatment. There is no evidence that work restrictions are helpful, yet as the condition often progresses, patients typically incur increasing degrees of disability with a progressive need for work limitations. Advanced cases generally require temporary removal from work and surgery, with return to work post-operatively. Post-operative limitations are generally based on a combination of the clinical results (i.e., severity of pain and symptoms) and work demands. Patients with light to medium work may require no limitations, while those with medium to heavy work, particularly with post-operative pain may require significant limitations. Refer to Section I.9, Return to Work.

vi. Other therapies in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations:

Surgical treatment is recommended as an option for patients with moderate to marked impairment if not improved 8 weeks post-injury or after 6 weeks of non-operative treatment due to Kienböck disease.

Because smokers have a higher risk of delayed bone healing and post-operative costs, it is recommended that insurers cover a smoking cessation program peri-operatively. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures:

There are no quality studies evaluating surgical repair for Kienböck disease. There are many different surgical procedures and no quality comparative studies that have been reported. Surgical procedures utilized have included: lunate excision with silicone implants (no longer recommended), excision with autogenous soft tissue implants including coiled palmaris longus tendon, external fixation, arthrodesis, radial shortening, scaphoid-trapezium-trapezoid fusion, in advanced cases, proximal row carpectomy, and vascularized bone transfers. A comparative clinical trial found superior clinical results and better preservation of carpal height ratio using palmaris longus tendon ball with a bone core compared with no bone core. In the absence of quality studies, the main determinant of surgical technique is the experience and comfort of the surgeon with specific treatment approaches.

h. Post-operative Treatment:

i. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progression. Treatment may include the following: splinting and other active therapy with or without passive therapy.

ii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

H.16 Laceration Management

a. Description/Definition: Lacerations result from blunt or crush injuries that produce shear forces, or more commonly from sharp objects which are abundant in the workplace.

b. Occupational Relationship:

Causation is based on the specific major incident that produced the injury. Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

Close inspection of the wound should be performed under proper lighting. Control of bleeding may be required, generally by applying appropriate pressure and elevation to the wound. The wound should be evaluated for damage to underlying structures including joint involvement, vessels, tendons, bone and nerves. Sensory examination should be accomplished prior to anesthetic administration. Examination of involved muscles should be conducted if nerve injury is suspected. Close inspection should be made for foreign bodies.

d. Diagnostic Testing Procedures:

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X-rays are recommended for the evaluation of traumatic injury resulting in skin lacerations to rule out fracture or if a radiopaque foreign body is suspected.

Ultrasound is recommended for evaluating suspected radiolucent materials or as an alternative test when radiopaque foreign body is suspected but not detected on x-ray images.

If nerve injury is detected or suspected, then electrodiagnostic studies (EDS) may be indicated 2 to 3 weeks post-injury. An immediate EDS is not recommended as Wallerian degeneration will not have been completed until at least 2 weeks post-injury, making earlier studies falsely normal.

e. Non-operative Treatment Procedures:

i. Initial Treatment:

The primary purpose of wound and laceration management is to avoid infection, detect if a nerve injury has occurred, and achieve a cosmetically acceptable result with the highest degree of function and patient satisfaction. The most optimal results are accomplished by preventing infection through thorough wound cleansing, approximating wound edges with appropriate closure techniques, and providing a proper dressing with a clean moist environment to accelerate wound healing.

It is recommended that non-complicated linear lacerations of the hand less than 2cm be managed without suturing by healing via secondary intention for some workers. Wounds should be carefully selected, not have tension, including not overlying or near joints and not have tension applied due to manual labor.

A thorough history of the injury, with particular attention to mechanism, potential degree of wound contamination, potential for foreign bodies, and presence of other trauma should be obtained. Crush wounds may be more susceptible to infection, and contamination. Additionally, inquiry of personal factors that may contribute to delayed healing or increased risk for infection, such as diabetes mellitus, chronic renal failure, or the use of immunosuppressive medications should be included. Tetanus immunization status should be noted and are recommended to be updated per CDC guidelines

If nerve injury is detected or suspected then appropriate surgical consultation should be considered.

ii. Wound Preparation:

Infection is one of the primary factors that interfere with wound healing. Contamination of the wound from inoculation of skin flora or environmental bacteria, foreign bodies such as gravel, vegetation, dirt, and other industrial related compounds can act as a nidus for wound infection. Adequate wound anesthesia may be required for wound preparation.

Meticulous wound preparation after appropriate anesthesia using saline irrigation or copious amounts of running tap water, scrubbing, and debridement of devitalized tissue is recommended.

The use of either sterile saline or tap water is recommended for an irrigating solution.

The use of either sterile or clean gloves during wound cleaning is recommended.

iii. Wound Anesthesia:

Adequate anesthesia by either topical anesthetic plus local infiltration or digital block is moderately recommended for finger laceration repair. There is no recommendation of one technique over the other. For distal finger lacerations, digital block may be substantially less painful than local infiltration performed without topical anesthetic. If the operator and patient preference is digital block, the various techniques are described and evaluated in the management of phalangeal fracture section in this chapter.

Instillation of local anesthetic for extremity wounds after sensory testing is recommended as the first-line technique for most laceration repairs unless the size or complexity would require potentially toxic doses of local anesthetic.

Local anesthetic with epinephrine (except digits) is recommended.

The use of topical anesthetics, Tetracaine-Adrenaline-Cocaine (TAC) and EMLA, are recommended as an alternative to local infiltration for lacerations of the extremities (excluding digits) or as pre-treatment to reduce pain related to needle infiltration. However, these anesthetics have longer times to onset of effective anesthesia.

<u>iv. Medications</u> such as analgesics and anti-inflammatories may be helpful. Routine antibiotic prophylaxis is not recommended for uncomplicated hand and forearm lacerations. Refer to medication discussions in Section I. 5, Medications and Medical Management.

<u>v. Patient education</u> should include instruction in self-management techniques, ergonomics, body mechanics, home exercise, joint protection, and weight management.

<u>vi. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. Refer to Section I.9, Return to Work.

<u>vii. Other therapies</u> in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations:

Because smokers have a higher risk of delayed bone healing and post-operative costs, it is recommended that insurers cover a smoking cessation program peri-operatively. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures:

Immediate referral to a surgeon is recommended if the laceration shows evidence of a nerve injury.

Suture repair is moderately recommended for lacerations of the hand or forearm as these lacerations respond well to common suture techniques and suture materials. There are no recommendations for one technique over another or for one suture material type over another.

Tissue adhesives, staples and surgical tape are moderately recommended for routine skin repair of non-complicated extremity lacerations within the limitations of repair strength equivalent to 5-0 suture material or higher.

h. Post-operative Treatment:

i. It is recommended that complicated wounds repaired with sutures or staples and heavily contaminated or infected at initial presentation be closely followed-up within 24 to 72 hours and at suture removal.

ii. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I., Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progression. Treatment may include the following: splinting and other active therapy with or without passive therapy.

iii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

H.17 Mallet Finger

a. Description/Definition: The injury involves rupture of the extensor mechanism of a digit at the distal upper extremity joint with or without fracture of the distal phalangeal segment.

b. Occupational Relationship:

Mallet finger is a common occupational and sports injury, although it may occur with minimal apparent trauma. The mechanism of injury most typically involves forcefully striking the tip of the extended digit on an object (e.g., baseballs), as well as from falls. Some occur without any trauma and are thought to mostly occur with osteoarthrosis and Heberden's nodes or other chronic joint pathology.

Work-relatedness is generally non-controversial and is based on having an acute accident at work. However, in cases without precipitating injury, work-relatedness is speculative. Causation is based on the specific major incident that produced the injury. Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

Unless there is a fracture, most cases present without significant, post-traumatic pain. The patient is unable to extend the distal phalangeal segment. Swelling often signifies a fracture fragment, while most are extensor tendon ruptures and have no significant swelling.

d. Diagnostic Testing Procedures:

X-rays are recommended in most cases of mallet finger to determine if a fracture is present and to what extent.

e. Non-operative Treatment Procedures:

i. Initial Treatment:

Care usually involves a splint and follow-up visits. Large fracture fragments are rare and necessitate surgery.

<u>ii. Medications</u> such as analgesics and anti-inflammatories may be helpful. Refer to medication discussions in Section I. 5, Medications and Medical Management.

<u>iii. Patient education should include instruction in self-management techniques, ergonomics, body mechanics, home exercise, joint protection, and weight management.</u>

<u>iv. Extension splinting</u> with the joint in a neutral or hyperextended position is moderately recommended for treatment of acute or subacute mallet finger. It is recommended that careful instructions on splint wear be provided to patients.

- Frequency/Duration Splinting for 6 to 8 weeks, possible nocturnal use for an additional 2 to 4 weeks
- Indications for Discontinuation Skin complications, non-compliance.

<u>v. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. This injury requires splinting; however, whether there is any need for work limitations involving the digit other than a requirement to wear the splint continuously is unclear. Provided there is no difficulty with wearing the splint, no work limitations are generally needed. Refer to Section I.9, Return to Work.

<u>vi. Other therapies in Section I. Therapeutic Procedures, Non-operative may be employed in</u> individual cases.

f. Surgical Indications/Considerations:

Surgery is recommended for select patients.

Because smokers have a higher risk of delayed bone healing and post-operative costs, it is recommended that insurers cover a smoking cessation program peri-operatively. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures:

Surgical treatment with a fixation wire is recommended for patients with displaced fractures involving more than one third to one half of the articular surface of the DIP joint.

Surgery is recommended for those cases that fail splinting yet have sufficient symptoms or concerns that an attempt at fixation is desired.

h. Post-operative Treatment:

i. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progression. Treatment may include the following: splinting and other active therapy with or without passive therapy.

ii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

H.18 Middle and Proximal Phalangeal and Metacarpal Fractures

a. Description/Definition: Metacarpal fractures comprise roughly 1/3 of hand fractures, with fifth metacarpal neck fractures (sometimes called "Boxer's fracture") accounting for 1/3 to 1/2 of these injuries, and fractures of the thumb constituting another 25%. Isolated fractures of the third and fourth metacarpals are uncommon and usually involve one or more the neighboring metacarpals.

Fracture type and displacement can be partially predicted by the underlying anatomic structures of the affected digit. Fractures of the proximal phalanx, which has no tendinous attachments, typically result in volar angulation. In contrast, the middle phalanx has insertions of the flexor digitorum superficialis along the volar surface, such that fractures at the base and shaft usually have a dorsal angulation because of the action of the flexor tendons, whereas fractures of the distal neck will usually have a volar angulation as the flexors act to pull the distal fragment. Fifth metacarpal fractures usually displace at a volar angle because of the action of the interosseous muscles. Other metacarpal fractures tend to angulate dorsally owing to the unbalanced pull of the interosseous muscles and extrinsic finger flexors on the distal fragment.

b. Occupational Relationship:

These fractures occur most commonly from a direct blow to the bone causing transverse shaft fracture or through an axial loading blow such as striking an object with a closed fist. Causation is based on the specific major incident that produced the injury. Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

The initial assessment involves a search for confirmation of fracture. Limited or guarded range of motion with pain, local tenderness, swelling, deformity and possibly ecchymosis over the affected area are common.

Careful history regarding the mechanism of injury including and direct axial blow or angular or rotational trauma will reflect substantially on the nature of the fracture and its inherent stability.

Prior to fracture manipulation, physical examination includes evaluation of digital nerves using two point discrimination or pin prick, tendon and ligament integrity with active and passive range of motion at each joint, vascular status with capillary refill, and surrounding soft tissue structures of affected areas. Finger shortening or knuckle depression may be present. Bone alignment should be checked for rotational deformity by finger flexion of hand, with the nails pointing toward the scaphoid tubercle. The natural alignment will be disrupted if a rotational

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fracture is present, such that one finger will overlap another.

d. Diagnostic Testing Procedures:

X-rays are recommended for diagnosing phalangeal or metacarpal fractures and should include three projections, including a posteroanterior, lateral, and oblique view. A true lateral projection isolating the involved digit is required.

e. Non-operative Treatment Procedures:

i. Initial Treatment:

Initial management should include treatment of soft tissue injuries and pain control following completion of physical examination. Regional anesthesia should be administered to complete diagnostic assessment (passive range of motion, rotational alignment) and to perform closed reduction of the fracture, although not until neurovascular examination is documented.

Regional anesthesia is typically performed through injection of local anesthetic as a digital block through one of many described techniques including digital ring block, palmar subcutaneous block, metacarpal block, and volar thecal block. The traditional digital block technique, also known as dorsal subcutaneous block, and occasionally referred to as metacarpal block, includes instilling local anesthetic from a dorsal approach into the webspace lateral to each side of the injured finger. A true metacarpal block is similar to ring block, but at the metacarpal head.A volar thecal block, also referred to as transthecal block, is the instillation of local anesthetic into the potential space of the tendon sheath at the distal palmar crease (A-1 pulley) proximal to the injured digit. The palmar subcutaneous block is performed at the same location as the thecal block, but subcutaneously. Other block techniques include ulnar or radial block injuries that are proximal to the phalanx, such as for metacarpal injuries, and hematoma block which is the direct injection of local anesthetic into the fracture hematoma.

The ring block technique, followed by volar subcutaneous block, is moderately recommended for digital anesthesia, as it provides more effective coverage of dorsal phalangeal injuries than the other techniques.

ii. Medications such as analgesics and anti-inflammatories may be helpful.

For open fractures, it is recommended that tetanus immunization status to be updated as necessary.

Refer to medication discussions in Section I. 5, Medications and Medical Management.

<u>iii. Patient education should include instruction in self-management techniques, ergonomics, body mechanics, home exercise, joint protection, and weight management.</u>

iv. Immobilization:

A) Early mobilization of acute metacarpal fracture (before 21 days) is recommended.

B) Non-operative management (immobilization) of non-displaced and stable transverse diaphyseal fractures of the middle and proximal phalanges is recommended as these fractures do not require fixation and can be managed without surgery.

• Frequency/Duration – Immobilization of the affected digit with neighboring digit in 70 to 90° of MCP flexion for 1 to 3 weeks.

C) Non-operative management of non-displaced oblique fractures of the middle and proximal phalanges is recommended as these fractures are usually stable and require rigid immobilization alone.

• Frequency/Duration – Examinations weekly for the first 3 weeks.

D) Closed reduction with splinting is recommended for base phalanx fractures, when there is involvement of less than 40% of the middle phalanx base.

E) Non-operative treatment of distal metacarpal head fractures using closed reduction and protective immobilization with radial or ulnar gutter splint is recommended for fractures with less than 20% of joint involvement.

F) Non-operative treatment of distal metacarpal head fracture using angulation is recommended: Degree of angulation 15° in the ring finger and 10° in the index and long fingers.

• Frequency/Duration – These fractures heal quickly in 3 to 4 weeks with a gutter or radial splint maintaining MCP joint flexion. Operative fixation is usually with percutaneous pinning.

G) Non-operative treatment is recommended before surgical treatment for most 5th metacarpal neck fractures as the outcomes are similar both functionally and anatomically.

H) The use of functional therapies including taping, functional bracing, and strapping is moderately recommended over casting or ulnar splinting for 5th metacarpal neck fractures.

I) There is no recommendation for or against non-operative management of metacarpal shaft fractures.

<u>v. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. Activities restrictions should provide for immobilization of affected finger or hand, but otherwise activities should be allowed. Refer to Section I.9, Return to Work.

<u>vi. Other therapies in Section I. Therapeutic Procedures, Non-operative may be employed in</u> individual cases.

f. Surgical Indications/Considerations:

i. Surgical management of condylar fractures is recommended as these fractures are unstable.

ii. Surgical management for malrotated phalangeal fractures is recommended as deformity and impairment may result.

iii. Surgical management of base fractures of the proximal metacarpal is recommended as these fractures are rarely stable and require percutaneous pins or screws to maintain reduction.

• Indications – Extra-articular fractures with up to 15° of deformity in the 4th and 5th metacarpals, and only 5° in the 2nd and 3rd metacarpals can be managed with immobilization using a gutter splint holding the MCP in 70° flexion, wrist in neutral position, and allowing movement of the PIP and DIP joints.

iv. Operative fixation is recommended for Bennett's and Roland's fractures as these fracture types are unstable.

v. Surgical management for malrotated phalangeal fractures is recommended as deformity and impairment may result.

Because smokers have a higher risk of delayed bone healing and post-operative costs, it is recommended that insurers cover a smoking cessation program peri-operatively. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures:

Displaced oblique fractures involving a single condyle are unstable, and are stabilized operatively with two transverse pins or screws. Bicondylar fractures are reconstructed with screws and connected to the shaft with a pin or through the use of a condylar plate.

h. Post-operative Treatment:

i. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progression. Treatment may include the following: splinting and other active therapy with or without passive therapy.

ii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

H.19 Olecranon Bursitis

a. Description/Definition: Bursae are sacks with a small amount of fluid that are usually located between structures that move and provide a cushion to reduce friction between the two moving body parts (e.g., between muscle and bone or between bone and overlying skin). Bursitis occurs when the bursae become inflamed and irritated. Olecranon bursitis is a common condition involving an irritated bursa between the olecranon process and overlying dermis. The elbow joint itself is not involved.

Septic (infected) olecranon bursitis is either a complication of aseptic olecranon bursitis or a direct consequence of trauma. Generally, to be a complication of aseptic olecranon, bursitis also requires introduction of organisms through the skin, such as abraded skin or an injection, although systemic seeding may also occur.

b. Occupational Relationship:

Olecranon bursitis is considered work-related when there is a discrete traumatic event, including falls onto or bumps against the olecranon. Development of olecranon bursitis after unaccustomed leaning on the elbow is also thought to be work-related. There are no quality studies to associate routine work activities with the development of this bursitis.

Causation is based on the specific major incident that produced the injury. Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

Olecranon bursitis occurs when the trochanteric bursa is "inflamed," although in most cases, there are not classic symptoms and signs of inflammation. It is a condition associated with a generally painless effusion of the olecranon bursa. Acute olecranon bursitis may be slightly warm, but is generally non-tender or minimally tender.

Septic (infected) olecranon bursitis is either a complication of aseptic olecranon bursitis or a direct consequence of trauma. Generally, to be a complication of aseptic olecranon, bursitis also requires introduction of organisms through the skin, such as abraded skin or an injection, although systemic seeding may also occur. Signs include swelling, pain, tenderness, and pain on range of motion.

Bursitis due to crystal arthropathies also tend to present with findings similar to those of septic bursitis.

d. Diagnostic Testing Procedures:

If the bursa is thought to be potentially infected, aspiration of the fluid and analyses including Gram stain and culture and sensitivity are recommended.

X-rays are recommended to rule out osteomyelitis or joint effusion in cases of significant septic olecranon bursitis.

e. Non-operative Treatment Procedures:

i. Initial Treatment:

Soft padding of the elbow, soft elbow supports, and ace wraps are recommended for olecranon bursitis.

Modifying activities to avoid direct pressure over the olecranon and allowing time to reabsorb the fluid are recommended.

Aspiration of a clinically infected or questionably infected bursa is recommended.

Most patients with olecranon bursitis require no further care other than monitoring to assure resolution.

ii. Medications such as analgesics and anti-inflammatories may be helpful. Refer to medication

discussions in Section I. 5, Medications and Medical Management.

<u>iii. Injections</u>: There is no recommendation for or against the use of glucocorticosteroid injections for the treatment of olecranon bursitis. This may be a reasonable option for patients who are failing to resolve prior to consideration of surgery.

<u>iv. Patient education should include instruction in self-management techniques, ergonomics, body mechanics, home exercise, joint protection, and weight management.</u>

<u>v. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. Refer to Section I.9, Return to Work.

vi. Other therapies in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations:

Surgery has been widely used to treat olecranon bursitis that has not responded to activity modifications and injections.

g. Operative Procedures:

A) Surgical drainage is recommended for treatment of olecranon bursitis that is either infected, clinically thought to be infected, or not infected but present for at least approximately 6 to 8 weeks without trending towards resolution.

B) Surgical resection of the bursa is recommended for chronic olecranon bursitis with recurrent drainage.

h. Post-operative Treatment:

i. An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progression. Treatment may include the following: splinting and other active therapy with or without passive therapy.

ii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

H.20 Scaphoid Fracture

a. Description/Definition: Scaphoid fractures, also known as wrist navicular fractures, are among the most common fractures of the carpal bones, occurring most commonly in young males. The scaphoid is located at the base of the thenar eminence (thumb side), just distal to the volar wrist crease, and acts to transfer the compression loads between the hand and forearm. It also maintains normal wrist motion, carpal stability and function of the wrist flexor and extensor tendons.

Scaphoid fractures are prone to non-union and avascular necrosis, particularly those involving

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the proximal third of the navicular, and especially if displaced. Healing problems in the proximal third have been attributed to limited blood supply that is disrupted by the fracture plane. A history of fracture, as well as non-union both increase risk for development of osteoarthrosis.

b. Occupational Relationship:

Historical features most commonly involve a high-energy injury such as a fall on an outstretched, extended hand with immediate, non-radiating pain in the radial carpus. Other common mechanisms include grasping a steering wheel in a frontal motor vehicle crash, or direct blow to the scaphoid such as when using the heel of the wrist as a hammer.

Causation is based on the specific major incident that produced the injury. Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

The main initial tasks are to confirm a fracture, identify those patients with fractures best treated with surgery, and treat those with a high clinical suspicion of fracture with appropriate splinting. A history of sufficient injury potential is important. Patients frequently complain of persistent swelling and tenderness near the thumb base in the area of the scaphoid. Gripping and wrist motion may be painful.

Physical examination findings include antalgic behavior with avoidance of use of the hand, and tenderness over the scaphoid tubercle. Scaphoid tubercle tenderness may be more sensitive and specific than snuffbox tenderness. The scaphoid tubercle is located at the volar wrist at the junction of the distal wrist crease under the flexor carpi radialis. The tubercle becomes prominent and readily palpable with radial deviation of the wrist. Patients may also have tenderness over the snuffbox, absence of tenderness in the distal radius, wrist joint effusion, and scaphoid pain on axial loading of the thumb ("scaphoid compression test"). However, many of these findings may also be present without scaphoid fracture. An isolated finding of snuffbox tenderness appears to be sensitive, but has poor positive predictive value for scaphoid fracture.

d. Diagnostic Testing Procedures:

X-rays are recommended for diagnostic purposes that include at least 3 to 4 views including a "scaphoid view".

Follow-up x-rays in 2 weeks are recommended for evaluation of potential scaphoid fractures particularly for patients with a high clinical suspicion of fracture, but negative initial x-rays.

MRI is recommended for diagnosis of occult scaphoid fractures when clinical suspicion remains high despite negative x-rays.

Bone scanning is recommended to diagnose occult scaphoid fractures when clinical suspicion remains high despite negative x-rays.

CT imaging is recommended to diagnose occult scaphoid fractures when clinical suspicion remains high despite negative x-rays.

e. Non-operative Treatment Procedures:

i. Initial Treatment:

Activities should be modified to allow for the splinting and immobilization of the carpal bones.

<u>ii. Medications</u> such as analgesics and anti-inflammatories may be helpful. Refer to medication discussions in Section I. 5, Medications and Medical Management.

<u>iii. Patient education should include instruction in self-management techniques, ergonomics,</u> body mechanics, home exercise, joint protection, and weight management.

iv. Splints:

A) Wrist splinting is recommended for treatment of scaphoid tubercle fractures.

B) Immobilization of the wrist with casting is moderately recommended for treatment of documented stable scaphoid fractures which are displaced less than 1mm, are non-oblique, and do not include the proximal 1/3 of the scaphoid.

- Indications Stable documented scaphoid fractures that include fractures with any of these properties:
 - Fragments displaced less than 1mm;
 - Fragments are non-oblique;
 - \circ Fragment does not include the proximal 1/3 of the scaphoid.
- Frequency/Duration Casting should be performed for 6 to 8 weeks, and then with the cast removed, imaging taken to assess healing

C) Colles' casting or supportive bandaging is recommended for patients with suspicion of scaphoid fracture, but with negative x-rays. Duration -2 weeks, followed by cast removal, clinical examination, and re-x-ray.

D) Long-arm casting at 90° of elbow flexion is recommended for high-risk scaphoid fractures that are displaced 1mm or more, or fractures of the proximal 1/3 of the scaphoid and oblique fractures. It is recommended that high-risk scaphoid fractures be evaluated and treated by a specialist experienced in the management of these fractures.

<u>v. Return to work</u> with appropriate restrictions should be considered early in the course of treatment. Refer to Section I.9, Return to Work.

<u>vi. Other therapies in Section I. Therapeutic Procedures, Non-operative may be employed in</u> individual cases.

f. Surgical Indications/Considerations:

Surgical intervention of treatment of non-displaced or minimally displaced scaphoid fractures is recommended for patients requiring earlier functional recovery.
Patients with non-displaced or minimally displaced scaphoid fractures who cannot or do not wish to be treated with an attempt at non-operative treatment. This includes athletes. It also may include patients who are unable to work until the fracture is healed, thus electing to forego attempted non-operative management and its attended lower risk of later osteoarthrosis but longer course of immobilization in exchange for earlier return to work.

Surgical intervention for treatment of non-displaced or minimally displaced scaphoid fractures is not recommended for all other patients.

Because smokers have a higher risk of delayed bone healing and post-operative costs, it is recommended that insurers cover a smoking cessation program peri-operatively. If a treating physician recommends a specific smoking cessation program peri-operatively, this should be covered by the insurer. Physicians may monitor smoking cessation with laboratory tests such as cotinine levels The surgeon will make the final determination as to whether smoking cessation is required prior to surgery.

g. Operative Procedures:

Surgical fixation of displaced scaphoid fractures is recommended.

h. Post-operative Treatment:

i. Routine referral for physical or occupational therapy after cast removal for Colles' fracture of otherwise healthy patients who are able to return to work is not recommended.

An individualized rehabilitation program based upon communication between the surgeon and the therapist using therapies as outlined in Section I, Therapeutic Procedures, Non-operative. In all cases, communication between the physician and therapist is important to the timing of exercise progression. Treatment may include the following: splinting and other active therapy with or without passive therapy.

ii. Return to work and restrictions after surgery may be made by an attending physician experienced in occupational medicine in consultation with the surgeon or by the surgeon.

H.21 Triceps Tendinosis/Tendinitis and Tears/Ruptures

a. Description/Definition: A strain consists of a partial or complete disruption of a myotendinous junction. Triceps tendinosis (or tendinitis) is a true muscle strain involving the muscle-tendon junction of the triceps. It is believed to be analogous to biceps tendinosis, including high force mechanism of injury.

There are no quality trials for treatment of this condition, thus treatment by analogy to biceps tendinoses and tears is recommended including surgical repairs.

H.22 Wrist Sprains

a. Description/Definition: Wrist sprains (which are partially or totally disrupted ligaments), are a common result of occupational slips, trips and falls. The diagnosis is sometimes applied as a diagnosis of exclusion among patients with pain in the setting of trauma with negative fractures. However, the specific entity is properly defined as a partial ligamentous disruption rather than

undefined pain generators. Sprains may also occur as an accompaniment to fracture.

b. Occupational Relationship:

Patients invariably have incurred an acute traumatic event, usually a slip, trip, or fall with forceful loading of the wrist joint usually in a fully deviated position (e.g., full extension).

Wrist sprains do not occur without an acute, precipitating significant mechanism of injury.

Causation is based on the specific major incident that produced the injury. Refer to Section D. 3, Medical Causation Assessment. To perform a proper causation assessment, the reader must comply with all sections.

c. Specific Physical Exam Findings:

Evaluation for occult fracture should be considered as a fracture may be present in a minority of cases.

Patients have pain in the wrist joint, and generally have no swelling. The exam may include wrist capsule tenderness, or it may be normal. Deformity suggests fracture. Scaphoid tubercle tenderness suggests scaphoid fracture.

d. Diagnostic Testing Procedures:

X-rays are recommended to determine whether a fracture is present, particularly for patients with scaphoid pain or scaphoid tubercle tenderness.

MR arthrography is recommended for patients without improvement in wrist sprains after approximately 6 weeks of treatment.

e. Non-operative Treatment Procedures:

i. Initial Treatment:

Relative rest, splinting, self-application of ice, and self-application of heat are recommended for initial treatment of acute wrist sprains. Splinting is also recommended for initial treatment of subacute wrist sprains.

<u>ii. Medications</u> such as analgesics and anti-inflammatories may be helpful. Refer to medication discussions in Section I. 5, Medications and Medical Management.

<u>iii. Patient education should include instruction in self-management techniques, ergonomics,</u> body mechanics, home exercise, joint protection, and weight management. Smoking may affect soft tissue healing through tissue hypoxia. Patients should be strongly encouraged to stop smoking and be provided with appropriate counseling by the physician.

<u>iv. Return to work with appropriate restrictions should be considered early in the course of treatment.</u> This injury may or may not require work limitations depending on task demands. However, moderate to severe wrist sprains likely necessitate splinting and limitations. Refer to Section I.9, Return to Work.

<u>v. Other therapies</u> in Section I. Therapeutic Procedures, Non-operative may be employed in individual cases.

f. Surgical Indications/Considerations:

There are no quality studies evaluating the use of surgery for wrist sprain. Other than among patients with other trauma necessitating surgery, wrist sprains are not believed to respond to surgery. Ongoing symptoms that do not resolve should be evaluated for other diagnoses.

I. Therapeutic Procedures - Non-operative

Treating providers as well as employers and insurers are highly encouraged to reference the General Guidelines Principles (Section B) prior to initiation of any therapeutic procedure. All treatment plans should include frequency, duration with specific treatment milestones that are expected that would support ongoing use of the intervention for the specific duration. Before initiation of any therapeutic procedure, the authorized treating provider, employer and insurer must consider these important issues in the care of the injured worker.

First, patients undergoing therapeutic procedure(s) should be released or returned to modified- or restricted-duty during their rehabilitation at the earliest appropriate time. Refer to "Return-to-Work" in this section for detailed information.

Second, 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. If patients are not responding within the recommended duration periods, alternative treatment interventions, further diagnostic studies or consultations should be pursued.

Third, providers should provide and document education to the patient. No treatment plan is complete without addressing issues of individual and/or group patient education as a means of facilitating self-management of symptoms.

Lastly, 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 cases where a patient is unable to attend an outpatient center, home therapy may be necessary. Home therapy may include active and passive therapeutic procedures as well as other modalities to assist in alleviating pain, swelling, and abnormal muscle tone. Home therapy is usually of short duration and continues until the patient is able to tolerate coming to an outpatient center.

The following procedures are listed in alphabetical order.

I.1 Acupuncture

Acupuncture is an accepted and widely used procedure for the relief of pain and inflammation in cumulative trauma conditions. There is some evidence to support its use for lateral epicondylitis. The exact mode of action is only partially understood. Western medicine studies suggest 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.

I.1.a Acupuncture without Electrical Stimulation

Acupuncture without electrical stimulation 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 and inflammation, increase blood flow, increase range-of-motion, decrease the side effects 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, postsurgical pain relief, muscle spasm, and scar tissue pain.

I.1.b Acupuncture with Electrical Stimulation

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.

I.1.c Time Frames For Acupuncture with/without Electrical Stimulation

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.

I.1.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 sections H.11 Active Therapy

and H.12 Passive Therapy (Massage and Superficial Heat and Cold Therapy) for a description of these adjunctive acupuncture modalities and time frames.

I.2 Biofeedback

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. It is an accepted treatment. Electronic instrumentation is used to monitor the targeted physiology and then displayed or fed back to the patient visually, auditorially, 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, 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 in which 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.

I.3 Therapeutic Injections

Therapeutic injections are generally accepted, well-established procedures that may play a significant role in the treatment of patients with upper extremity pain or pathology. Therapeutic injections involve the delivery of anesthetic and/or anti-inflammatory medications to the painful structure. Therapeutic injections have many potential benefits. Ideally, a therapeutic injection will: (a) reduce inflammation in a specific target area; (b) relieve secondary muscle spasm; and (c) diminish pain and support therapy directed to functional recovery. Diagnostic and therapeutic injections should be used early and selectively to establish a diagnosis and support rehabilitation.

If injections are overused or used outside the context of a monitored rehabilitation program, they may be of significantly less value.

Indications - Diagnostic injections are procedures which may be used to identify pain generators or pathology. For additional specific clinical indications, see Sections F. and G., Specific Musculoskeletal and Specific Peripheral Nerve Diagnosis, Testing and Treatment.

Special Considerations - The use of injections has become progressively sophisticated. Each procedure considered has an inherent risk, and risk versus benefit should be evaluated when considering injection therapy. In addition, all injections must include sterile technique. **Contraindications -** General contraindications include local or systemic infection, bleeding disorders, allergy to medications used, and patient refusal. Specific contraindications may apply to individual injections.

I.3.a Autologous Whole Blood Injections/Platelet-Rich Plasma Injections

i. Autologous Whole Blood Injections: Autologous whole blood injections are an inexpensive treatment and may be used in patients who have not made sufficient functional progress with initial therapy for lateral or medial epicondylitis after 10 to 12 weeks. Refer to Sections F. 3. e. and F. 4. e.

There is some evidence in literature on lateral epicondylitis, that for patients with symptoms lasting 6 months or more, autologous blood injections result in better pain and functional outcomes after 1 year than steroid injections.

• Optimum Duration/Frequency: 2 injections may be required.

ii. Platelet-Rich Plasma Injections: There is good evidence, in literature on lateral epicondylitis, that for patients with symptoms lasting 6 months or more, platelet-rich plasma injections result in better pain and functional outcomes after 1 year than steroid injections.

• Optimum Duration/Frequency: 1 injection.

I.3.b Botulinum Toxin Injections

Rationale for botulinum toxin as a treatment for lateral and medial epicondylitis is that it reversibly paralyzes the extensor muscles and thereby prevents repetitive micro-trauma of the tendonous fibers at their origin from the osseous lateral/medial epicondyle. The unit dosage varies significantly depending on the brand used. Usage for lateral and medial epicondylitis is not FDA approved at the time of this guideline writing. There is good evidence that botulinum toxin A injection may provide short-term pain relief from pain due to chronic (3 months or longer) lateral epicondylitis. However, the long-term functional benefits are unknown. There is also good evidence that botulinum toxin A injections may include: allergic reaction to medications, increased risk of systemic effects in patients with motor neuropathy or disorders of the neuromuscular junction.

It should not be considered a first line of treatment. Other conservative measures should be tried first. Careful botulinum toxin dosing should be used to avoid complete paresis and maintain function and return to work.

Botulinum toxin injections are listed in this guideline as a treatment option for lateral and medial epicondylitis. Prior authorization is required. For more specific details, the reader must refer to Sections F. 3. e. and F. 4. e.

• Maximum: 1 injection episode

I.3.c Steroid Injections

Steroid Injections: including joint, bursa and peri-tendonous insertions are well-established procedures with varying degrees of evidence depending on the diagnosis. Peri-tendonous injections under significant pressure should be avoided as the needle may be inadvertently penetrating the tendon. Injection into the tendon can cause tendon degeneration, tendon breakdown, or rupture. Injections should be used with caution for patients under 30 years of age. When performing peri-tendonous injections, the risk of tendon rupture should be discussed with the patient and the need for temporary restricted-duty emphasized.

- Time to Produce Effect: Immediate with local anesthesia, or within 3 days if no anesthesia.
- Optimum Duration: Usually 1 to 2 injections is adequate.
- Maximum Frequency: Not more than 3 to 4 times annually.

Steroid injections should be used cautiously in diabetic patients. Diabetic patients should be reminded to check their blood-glucose level at least twice daily for 2 weeks post-injections.

There is strong evidence in literature on lateral epicondylitis that steroid injection decreases pain in the first few weeks but has a worse outcome at 52 weeks than PT or more conservative therapy including bracing, platelet-rich plasma injections, heat or cold therapy, and change in activities. The potential for negative long-term effects should be strongly considered. A program of physical rehabilitation in combination with judicious use of analgesic medications should be the core treatment for epicondylitis.

I.3.d Trigger Point Injections

Trigger Point Injections, although generally accepted, have only rare indications in the treatment of upper extremity disorders. Therefore, the Department does not recommend their routine use in the treatment of upper extremity injuries.

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 vapo-coolant spray and stretch, ischemic pressure massage (myotherapy), specific soft tissue mobilization and physical modalities. A truly blinded study comparing dry needle treatment of trigger points is not feasible.

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, 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, anaphylaxis, neurapraxia, and neuropathy. If corticosteroids are injected in addition to local anesthetic, there is a risk of developing local myopathy. 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.
- Optimum 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.

I.3.e Prolotherapy

Prolotherapy (also known as sclerotherapy) consists of peri-articular injections of hypertonic dextrose with or without phenol with the goal of inducing an inflammatory response that will recruit cytokine growth factors involved in the proliferation of connective tissue. Advocates of prolotherapy propose that these injections will alleviate complaints related to joint laxity by promoting the growth of connective tissue and stabilizing the involved joint. Laboratory studies may lend some biological plausibility to claims of connective tissue growth, but high quality published clinical studies are lacking. The dependence of the therapeutic effect

on the inflammatory response is poorly defined, raising concerns about the use of conventional anti-inflammatory drugs when proliferate injections are given. The evidence in support of prolotherapy is insufficient and therefore, its use is not recommended in upper extremity injuries.

I.3.f Viscosupplementation/Intracapsular Acid Salts

Viscosupplementation/Intracapsular Acid Salts involves the injection of hyaluronic acid and its derivatives into the joint space. Hyaluronic acid is normally secreted by the healthy synovium into the joint space and functions to lubricate the joint and protect the cartilage. These injections may only be used for osteoarthritis.

There is some evidence that intra-articular injection of high molecular weight hyaluronic acid is more effective than saline in improving function and pain at 6 months for osteoarthritis at the base of the thumb. There is no evidence that hyaluronate injections are superior to steroid injections for CTC thumb arthritis. They may be tried after 3 months of conservative therapy, including steroid injections has failed. At the time of this guidelines writing, hylan G-F 20 has been FDA approved for the treatment of pain due to osteoarthritis of the knee in patients who have failed to respond adequately to conservative non-pharmacologic therapy and simple analgesics.

- Time to Produce Effect/Frequency: 1 injection.
- Optimum Duration/Frequency: 2 injections per year.

I.4 Jobsite Alterations

Early evaluation and training of body mechanics and other ergonomic factors are essential for every injured worker and should be done by a qualified individual. Whenever a case is identified as a work-related cumulative trauma condition, job alterations are an expected treatment. These may be in the form of instructing the worker how specific duties might be performed to meet the ergonomic suggestions in the jobsite alteration section or in actual job worksite or duty changes. Studies of symptomatic workers show that those who report symptoms of pain or aching are more likely to progress to increased pain or aching or actual categories of a CTC when they have ergonomic risks at work, and are more likely to experience a decrease in work production. There is some evidence that early workplace intervention may prevent loss of work productivity, particularly when handling high physical loads. Therefore, employees presenting with pain or aching associated with ergonomic risks would benefit from having their work stations properly evaluated and adjusted as appropriate even when no workers compensation claim is accepted. In many cases, this requires a jobsite evaluation.

There is no single factor or combination of factors that is proven to prevent or ameliorate CTC, but a combination of ergonomic and psychosocial factors are generally considered to be important. Ergonomic factors that may be considered include use of force, repetition, awkward positions, upper extremity vibration, cold environment, and contact pressure on the nerve. Psychosocial factors to be considered include pacing, degree of control over job duties, perception of job stress, and supervisory support.

Job evaluation and modification should include input from a health care professional with experience in ergonomics or a certified ergonomist; the employee; and the employer. The employee must be observed performing all job functions in order for the jobsite evaluation to be a valid representation of a typical workday. Periodic follow-up is recommended to assess the effectiveness of the intervention and need for additional ergonomic changes.

Because ergonomic changes are a required medical treatment for cumulative trauma conditions and the person performing the evaluations is a health care professional, it is assumed that the insurer will be responsible for paying for the jobsite evaluation.

I.4.a Interventions

There are no conclusive studies with convincing evidence of standard ergonomic changes that will accommodate all workers. Individual characteristics, such as height or strength, affect the ideal organization of the workstation. The worksite should be adjusted to support neutral, yet natural, positions. In addition, workers should be counseled to vary tasks throughout the day whenever possible. OSHA suggests that workers who perform repetitive tasks, including keyboarding, change activities over a 5-minute interval every hour. Mini-breaks should include stretching exercises. The following should be considered: engineering controls, e.g., mechanizing the task, and changing the tool used, or adjusting the jobsite; or administrative controls, e.g., adjusting the time an individual performs the task.

I.4.b Computer Work

Mandating typing in a 90° traditional posture is not recommended for prevention or treatment of CTS and distal upper extremity tendinoses. The use of alternate or split keyboards is recommended among select patients with common distal upper extremity tendinoses. Forearm support for frequent computer keyboard users is recommended for potential prevention of neck and/or shoulder symptoms. A trackball (instead of a mouse) is recommended for treatment of select patients with symptoms of CTS.

I.4.c Seating Description

The following description may aid in evaluating seated work positions: The head should be in a neutral position, and if a monitor is used, there should be 18 to 24 inches of viewing distance with no glare. Arms should rest naturally, with the elbow at the side and flexed to 90 degrees or slightly extended. Some individuals may prefer a wrist pad to reduce wrist extension. Wrists should be straight or minimally extended. It is generally preferable to avoid dependence on arm rests. The back must be properly supported by a chair with the back upright or leaning backwards slightly, allowing change in position with backrest adjustment. There should be good knee and legroom, with the feet resting comfortably on the floor or footrest. Tools should be within easy reach, and twisting or bending should be avoided.

I.4.d Job Hazard Checklist

The following table entitled, 'Identifying Job Duties which may pose Ergonomic Hazards,' is adopted with modification from Washington State's job hazard checklist, and may be used as a

generally accepted guide for identifying job duties which may pose ergonomic hazards. The fact that an ergonomic hazard exists at a specific job, or is suggested in the table, does not establish a causal relationship between the job and the individual with a musculoskeletal injury. However, when an individual has a work-related injury and ergonomic hazards exist that affect the injury, appropriate job modifications should be made. Proper correction of hazards may prevent future injuries to others, as well as aid in the recovery of the injured worker.

I.4.e Tools

The tools should be assessed for the individual and not used universally. It is important to select the right tool for the task. In general, the person should work in the most neutral position possible and use the least force possible. For force tools, the grip should not span more than 3.5 inches, and the handle diameter should not be greater than 2 inches. Precision tools may require a smaller diameter. If possible, continual forearm tasks requiring supination/pronation should be avoided by using automatic tools.

Identifying Job Duties Which May Pose Ergonomic Hazards*		
Type of Job Duty	Hours per Day	
Pinching an unsupported object(s) weighing 2 lbs or more per hand, or pinching with a force of 4 lbs or more per hand (comparable to pinching a half-ream of paper):		
Pinching an unsupported object(s) weighing 2 lbs or more per hand, or pinching with a force of 4 lbs or more per hand (comparable to pinching a half-ream of paper):	More than 3 hours total/day	
2. Wrist palmar flexion greater than 45 degrees, wrist extension greater than 30 degrees, ulnar deviation greater than 20 degrees, or radial deviation greater than 20 degrees.		
3. Most of the work cycle performed with the elbow flexed equal to or greater than 90 degrees.	-	
4. No other risk factors.	More than 4 hours total/day	
Gripping (an) unsupported object(s) weighing 10 lbs or more/hand, or gripping with a force of 10 lbs or more/hand (comparable to clamping light duty automotive jumper cables onto a batter): *Handles should be rounded and soft, with at least 1.25''-2.0'' in diameter grips at least 5'' long. Preferably, a power grip should be used.		

1. Highly repetitive motion.	More than 3 hours total/day
2. Wrist palmar flexion greater than 45 degrees, wrist extension greater than 30 degrees, ulnar deviation greater than 20 degrees, or radial deviation greater than 20 degrees.	-
3. Most of the work cycle performed with the elbow flexed equal to or greater than 90 degrees.	-
4. No other risk factors.	More than 4 hours total/day
Repetitive Motion (using the same motion with little or no variation) with a cycle time 30 seconds or less or greater than 50% of cycle time performing the same task:	
1. High, forceful exertions with the hands, with wrist palmar flexion greater than 45 degrees, wrist extension greater than 30 degrees, ulnar deviation greater than 20 degrees, or radial deviation greater than 20 degrees.	More than 2 hours total/day
2. Most of the work cycle performed with the elbow flexed equal to or greater than 90 degrees.	-
3. No other risk factors.	More than 6 hours total/day
Intensive Keying:	
1. Wrist palmar flexion greater than 45 degrees, wrist extension greater than 30 degrees, ulnar deviation greater than 20 degrees, or radial deviation greater than 20 degrees.	More than 4 hours total/day
Intensive Keying (continued) 2. Most of the work cycle performed with the elbow flexed equal to or greater than 90 degrees.	
3. No other risk factors.	More than 7 hours total/day
Repeated Impact:	

1. Using the hand (heel/base of palm) as a hammer more than once/minute.	More than 2 hours total/day
Vibration:	
Two determinants of the tolerability of segmental vibration of the hand are the frequency and the acceleration of the motion of the vibrating tool, with lower frequencies being more poorly tolerated at a given level of imposed acceleration, expressed below in multiples of the acceleration due to gravity.	
1. Frequency range 8-15 Hz and acceleration 6 g	More than 30 minutes at a time
2. Frequency range 80 Hz and acceleration 40 g	
3. Frequency range 250 Hz and acceleration 250 g	
4. Frequency range 8-15 Hz and acceleration 1.5 g	More than 4 hours at a time
5. Frequency range 80 Hz and acceleration 6 g	
6. Frequency range 250 Hz and acceleration 20 g	

* This table may not be used to establish causation. Refer to Section D. 3. Medical Causation.. Recommendations for ergonomic changes to make the workplace more comfortable and efficient for the worker are not identical to risk factors which may cause an identified CTC.

I.5 Medications and Medical Management

Medications and medical management use in the treatment of cumulative trauma related conditions is generally accepted for controlling acute pain and inflammation. Use of medications will vary widely due to the spectrum of injuries from simple strains to post-surgical analgesia. 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. Treatment for pain control is initially accomplished with acetaminophen and/or NSAIDs. The patient should be educated regarding the interaction with prescription and over the counter medications as well as the contents of over the counter herbal products.

Oral non-steroidal anti-inflammatory drugs (NSAIDs) and acetaminophen are useful in treating conditions associated with degenerative joint disease and/or inflammation. Topical medications may also be useful in controlling pain.

I.5.a Acetaminophen

Acetaminophen is an effective analgesic with antipyretic but not anti-inflammatory activity. Acetaminophen is generally well tolerated, causes little gastrointestinal irritation but may be associated with stomach bleeding in at risk patients. Acetaminophen has been associated with liver toxicity in overdose situations or in chronic alcohol use. Patients may not realize that many

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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.

I.5.b Minor Tranquilizer/Muscle Relaxants

Minor Tranquilizer/Muscle Relaxants may be appropriate for muscle spasm, mild pain, and sleep disorders; however, are rarely necessary to treat cumulative trauma condition. When prescribing these agents, physicians must seriously consider side effects of drowsiness or dizziness and the fact that benzodiazepines and some other muscle relaxants may be habit forming.

- Optimal Duration: 1 week.
- Maximum Duration: 4 weeks.

I.5.c Narcotics

Narcotics should be primarily reserved for the treatment of severe upper extremity pain. There are circumstances where prolonged use of narcotics is justified based upon specific diagnosis, and in these cases, it should be documented and justified. In mild-to-moderate cases of upper extremity pain, narcotic medication should be used cautiously on a case-by-case basis. Adverse effects include respiratory depression, the development of physical and psychological dependence, and impaired alertness.

Narcotic medications should be prescribed with strict time, quantity, and duration guidelines, and with definitive cessation parameters. Pain is subjective in nature and should be evaluated using a pain scale and assessment of function to rate effectiveness of the narcotic prescribed. Any use beyond the maximum duration should be documented and justified based on the diagnosis and/or invasive procedures.

- Optimal Duration: 3 to 7 days.
- Maximum Duration: 2 weeks. Use beyond two weeks is acceptable in appropriate cases. Refer to the Chronic Pain Guidelines which gives a detailed discussion regarding medication use in chronic pain management.

I.5.d Nonsteroidal Anti-Inflammatory Drugs (NSAIDs)

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 advise 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. 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.

NSAIDs may be used for pain management after joint replacement. They have also been used to reduce heterotopic ossification after arthroplasty. NSAIDs do reduce the radiographically documented heterotopic ossification in this setting, but there is some evidence in lower extremity cases that they do not improve functional outcomes and they may increase the risk of bleeding events in the post-operative period. Their routine use for prevention of heterotopic bone formation is not recommended.

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 NSAIDs shortterm 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 anticoagulants, or have a longer duration of therapy. Celecoxib is contraindicated in sulfonamideallergic 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.

I.5.e Oral Steroids

Oral steroids have limited use but are accepted in cases requiring potent anti-inflammatory drug effect in carefully selected patients. A one-week regime of steroids may be considered in the treatment of patients who have arthritic flare-ups with significant inflammation of the joint.

For carpal tunnel syndrome, oral steroids have been shown to have short-term symptomatic benefit but no long-term functional benefit. There is good evidence that local steroid injection is superior to oral steroids at 3 months. Given this and the problematic systemic effects of oral steroids, they are not recommended for carpal tunnel syndrome. It may occasionally be appropriate to use them for patients with severe CTS symptoms who refuse injections and who have no risk factors for adverse effects.

The physician must be fully aware of potential contraindications for the use of all steroids such as hypertension, diabetes, glaucoma, peptic ulcer disease, etc., which should be discussed with the patient.

- Optimal Duration: 3 to 7 days.
- Maximum Duration: 7 days.

I.5.f Psychotropic/Anti-anxiety/Hypnotic Agents

Psychotropic/Anti-anxiety/Hypnotic Agents may be useful for treatment of mild and chronic pain, dysesthesias, sleep disorders, and depression. Post-operative patients may receive medication to assure normal sleep cycles. Antidepressant medications, such as tricyclics and Selective Serotonin Reuptake Inhibitors (SSRIs), are useful for affective disorder and chronic pain management. Tricyclic anti-depressant agents, in low dose, are useful for chronic pain but have more frequent side effects.

Anti-anxiety medications are best used for short-term treatment (i.e., less than 6 months). Accompanying sleep disorders are best treated with sedating antidepressants prior to bedtime. Frequently, combinations of the above agents are useful. As a general rule, physicians should access the patient's prior history of substance abuse or depression prior to prescribing any of these agents.

Due to the habit-forming potential of the benzodiazepines and other drugs found in this class, they are not routinely recommended. Refer to the Chronic Pain Guidelines which give a detailed discussion regarding medication use in chronic pain management.

- Optimal Duration: 1 to 6 months.
- Maximum Duration: 6 to 12 months, with monitoring.

I.5.g Topical Drug Delivery

Creams and patches may be an alternative treatment of localized musculoskeletal disorders. They should only be considered for patients who cannot tolerate oral NSAIDs. It is necessary that all topical agents be used with strict instructions for application as well as the maximum number of applications per day to obtain the desired benefit and avoid potential toxicity. As with all medications, patient selection must be rigorous to select those patients with the highest probability of compliance. Refer to "Iontophoresis" in Passive Therapy of this section for information regarding topical iontophoretic agents.

i. Topical Salicylates and Nonsalicylates: have been shown to be effective in relieving pain in acute and chronic musculoskeletal conditions. Topical salicylate and nonsalicylates achieve tissue levels that are potentially therapeutic, at least with regard to COX inhibition.

There is good evidence that diclofenac gel reduces pain and improves function in mild-tomoderate hand osteoarthritis. There is some evidence that topical ketoprofen patches are more effective than placebo in reducing pain of upper extremity tendonitis; however, the need for continuous skin application may limit overall use. Use of ketoprofen topical patch for the disorders described in these guidelines has not been FDA approved at the time of this guideline writing.

Other than local skin reactions, the side effects of therapy are minimal, although not non-existent and the usual contraindications to use of these compounds needs to be considered. Local skin reactions are rare and systemic effects were even less common. Their use in patients receiving warfarin therapy may result in alterations in bleeding time. Overall, the low level of systemic absorption can be advantageous; allowing the topical use of these medications when systemic administration is relatively contraindicated such as is the case in patients with hypertension, cardiac failure, or renal insufficiency. Hepatic changes have been documented with topical NSAID use and therefore monitoring of liver enzymes is recommended.

There is no evidence that topical agents are more or less effective than oral medications.

- Optimal Duration: 1 week.
- Maximal Duration: 2 weeks per episode.

ii. Capsaicin: is another medication option for topical drug use in upper extremity injury. Capsaicin offers a safe and effective alternative to systemic NSAID therapy. Although it is quite safe, effective use of capsaicin is limited by the local stinging or burning sensation that typically dissipates with regular use, usually after the first 7 to 10 days of treatment. Patients should be advised to apply the cream on the affected area with a plastic glove or cotton applicator and to avoid inadvertent contact with eyes and mucous membranes. At the time of these guidelines writing, neuropathic pain associated with post-herpetic neuralgia is the only FDA approved use of prescription topical capsaicin.

- Optimal Duration: 1 week.
- Maximal Duration: 2 weeks per episode.

iii. Iontophoretic Agents: Refer to "Iontophoresis," under Passive Therapy of this section.

iv. Topical Glyceryl Trinitrate: There is some evidence that topical glyceryl trinitrate is not effective for epicondylitis therefore it is not recommended.

v. Topical Lidocaine: There is no evidence that lidocaine patches have a functional benefit over other well-accepted treatment for carpal tunnel. At the time of these guidelines writing, post-herpetic neuralgia is the only medical condition for which topical lidocaine patch is FDA approved. The patches are not generally recommended, although may be used when the primary complaint of the patient is pain and the patient refuses a steroid injection.

I.5.h Tramadol

Tramadol is useful in relief of upper extremity pain and has been shown to provide pain relief equivalent to that of commonly prescribed narcotics. Although Tramadol may cause impaired alertness, it is generally well tolerated, does not cause gastrointestinal ulceration, or exacerbate hypertension or congestive heart failure. Tramadol should be used cautiously in patients who have a history of seizures or who are taking medication that may lower the seizure threshold, such as monoamine oxidase (MAO) inhibiters, SSRIs, and tricyclic antidepressants. This medication has physically addictive properties and withdrawal may follow abrupt discontinuation. It is not recommended for those with prior opioid addiction.

- Optimum duration: 3 to 7 days
- Maximum duration: 2 weeks. Use beyond 2 weeks is acceptable in appropriate cases.

I.5.i Vitamin B6

Vitamin B6: Randomized trials on non-surgical treatment for carpal tunnel syndrome have demonstrated conflicting results. Higher doses may result in development of a toxic peripheral neuropathy. In the absence of definitive literature showing a beneficial effect, use of Vitamin B6 cannot be recommended.

I6. Occupational Rehabilitation Programs

I.6.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.

i. Work conditioning: is usually initiated once re-conditioning 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 6 weeks must be documented with respect to need and the ability to facilitate positive symptomatic or functional gains.

ii. 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 (FCE) and/or Jobsite Evaluation.

- 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 6 weeks must be documented with respect to need and the ability to facilitate positive symptomatic or functional gains.

I.6.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 worker's program with the goal of the patient gaining full- or optimal-function and returning 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 Department's Chronic Pain Disorder Medical Treatment Guidelines.

i. 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, 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 6 weeks must be documented with respect to need and the ability to facilitate positive symptomatic or functional gains.

I.7 Patient Education

No treatment plan is complete without addressing issues of individual patient and/or group education as a means of prolonging the beneficial effects of treatment, as well as facilitating selfmanagement of symptoms and injury prevention. Patient education is widely used, wellestablished, and generally well-accepted. The patient should take an active role in the establishment of functional outcome goals. They should be educated on his or her specific injury, assessment findings, and plan of treatment. Education and instruction in proper body mechanics, posture, positions to avoid task/tool adaptation, self care for exacerbation of symptoms, and home exercise/task adaptation should also be addressed.

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

I.8 Personality/Psychological/Psychosocial Intervention

Personality/Psychological/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 crises intervention, hypnosis, and meditation. Any screening or diagnostic workup should clarify and distinguish

between pre-existing psychological conditions versus aggravated psychological conditions versus psychological conditions caused by occupational injury or disease. 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 Department'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. If further counseling beyond 3 months is indicated, the authorized treating provider must document every 4 to 6 weeks during treatment what treatment is for pre-existing psychological conditions versus aggravated psychological conditions versus psychological conditions caused by occupational injury or disease, as well as project a realistic functional prognosis.

I.9 Return to Work

Early return-to-work generally accepted and 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 6 months. It is imperative that the patient be educated regarding the benefits of return-to-work, work restrictions, and follow-up 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 is often necessary to assist the physician in making return-to-work recommendations. This may require a formal 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 Department recommends the following:

I.9.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 nonsurgical 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 2 weeks off work should be thoroughly documented. Refer to Specific Diagnoses in Sections F. and G., Post-operative Return to Work Subsections.

I.9.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. Refer to Section E. 6.c. Jobsite Evaluation and Section I. 4, Jobsite Alteration.

I.9.c Compliance with Activity Level Restrictions

In most CTC cases, compliance with restriction of activity levels will require a complete jobsite evaluation. A functional capacity evaluation (FCE) or other special testing may be occasionally necessary. Refer to the "Special Tests" section of these guidelines.

I.10 Sleep Disturbances

Sleep disturbances are a common secondary symptom of CTCs. Although primary insomnia may accompany pain as an independent co-morbid condition, it more commonly occurs, secondary to the pain condition itself. Exacerbations of pain often are accompanied by exacerbations of insomnia; the reverse can also occur. Sleep laboratory studies have shown disturbances of sleep architecture in pain patients. Loss of deep slow-wave sleep and increase in light sleep occur and sleep efficiency, the proportion of time in bed spent asleep, is decreased. These changes are associated with patient reports of non-restorative sleep. Many affected patients develop behavioral habits that exacerbate and maintain sleep disturbances. Excessive time in bed, irregular sleep routine, napping, low activity, and worrying in bed are all maladaptive responses that can arise in the absence of any psychopathology. Behavioral modifications are accepted interventions, easily implemented and can include:

- 1. Maintaining a regular sleep schedule, retiring and rising at approximately the same time on weekdays and weekends.
- 2. Avoiding daytime napping.
- 3. Avoiding caffeinated beverages after lunchtime.
- 4. Making the bedroom quiet and comfortable, eliminating disruptive lights, sounds, television sets, and keeping a bedroom temperature of about 65 degrees Fahrenheit.
- 5. Avoiding alcohol or nicotine within 2 hours of bedtime.

- 6. Avoiding large meals within 2 hours of bedtime.
- 7. Exercising vigorously during the day, but not within 2 hours of bedtime, since this may raise core temperature and activate the nervous system.
- 8. Associating the bed with sleep and sexual activity only, using other parts of the home for television, reading, and talking on the telephone.
- 9. Leaving the bedroom when unable to sleep for more than 20 minutes, retuning to the bedroom when ready to sleep again.

These modifications should be undertaken before sleeping medication is prescribed for long-term use.

I.11 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 alleviating discomfort. Active therapy requires an internal effort by the individual to complete a specific exercise or task, and thus assists in developing skills promoting independence to allow self care after discharge. This form of therapy requires supervision from a therapist or medical provider such as verbal, visual, and/or tactile instructions. At times a 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. Frequency times and duration of treatment apply only to diagnoses not previously covered in Sections F. and G.

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

I.11.a Activities of Daily Living (ADL)

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.

I.11.b Functional Activities

Functional Activities are generally well-accepted interventions which involve the use of therapeutic activity to enhance mobility, body mechanics, employability, coordination, 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.

I.11.c Nerve Gliding

Nerve Gliding exercises are generally accepted and consist of a series of flexion and extension movements of the hand, wrist, elbow, shoulder, and neck that produce tension and longitudinal movement along the length of the median and other 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 that tension 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.

- Time to Produce Effect: 2 to 4 weeks.
- Frequency: Up to 5 times per day by patient (patient-initiated).
- Optimum Duration: 2 provider-directed sessions.
- Maximum Duration: 3 provider-directed sessions.

I.11.d Neuromuscular Re-education

Neuromuscular Re-education is an accepted treatment that involves 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.

I.11.e Proper Work Techniques

Proper Work Techniques: Please refer to the "Jobsite Evaluation and Alteration' sections (Sections E and H.4) of these guidelines.

I.11.f Therapeutic Exercise

Therapeutic Exercise is generally well-accepted and widely used. It is done with or without mechanical assistance or resistance may include isoinertial, isotonic, isometric and isokinetic types of exercises. Indications include the need for cardiovascular fitness, reduced edema, improved muscle strength, improved connective tissue strength and integrity, increased bone density, promotion of circulation to enhance soft tissue healing, improvement of muscle recruitment, increased range of motion, and are used to promote normal movement patterns. Can also include complementary/alternative exercise such as movement therapy (with oversight of a physician or other appropriate healthcare professional).

- Time to Produce Effect: 2 to 6 treatments.
- Frequency: 3 to 5 times per week.
- Optimum Duration: 4 to 8 weeks.
- Maximum Duration: 8 weeks.

I.12 Passive Therapy

Most of the following passive therapies and modalities are generally well-accepted methods of care for a variety of work-related injuries. This 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, swelling, and to improve the rate of healing soft tissue injuries. They should be used in adjunct with active therapies to help control swelling, pain and inflammation during the rehabilitation process. They may be used intermittently as a therapist deems appropriate or regularly if there are specific goals with objectively measured functional improvements during treatment.

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

I.12.a Electrical Stimulation (Unattended)

Electrical Stimulation (Unattended) is an accepted treatment. Once applied, requires minimal on-site supervision by the physician or non-physician provider. Indications include pain, inflammation, muscle spasm, atrophy, and decreased circulation.

Electrical stimulation is rarely used in cumulative trauma conditions. It may be appropriate in rare situations when nerve damage or other work related issues have resulted in muscle atrophy and the patient is unable to engage in sufficient active therapy to increase muscle mass. TENS therapy or PENS are not indicated for diagnoses in this guidelines. Refer to Exhibit 9, Chronic Pain Medical Treatment Guidelines for usage.

- Time to Produce Effect: 2 to 4 treatments.
- Frequency: Varies, depending upon indication, between 2 to 3 times/day to 1 time/week. Provide home unit if frequent use.
- Optimum Duration: 2 to 4 weeks.
- Maximum Duration: Home unit as needed.

I.12.b Extracorporeal Shock Wave Therapy (ESWT)

Low energy ESWT is an accepted treatment for lateral and medial epicondylitis. The mechanism of action in the use of ESWT for decreasing symptoms is not well understood. ESWT uses acoustic impulses with duration in microseconds focused on the target tissue. Low energy ESWT does not require anesthetics. It is given in a series of treatments, generally 3 sessions.

Large studies on lateral epicondylitis have not provided evidence that this intervention provides long-term benefit. The natural history of epicondylitis supports an expectation of improvement within 3 months of using patient education and modified activities.

Other studies on lateral epicondylitis have indicated the following: There is some evidence that highly motivated patients may show up to a 35% additional improvement over no other treatment, when administering low energy shock wave treatment without local anesthesia. There is some evidence that using the same treatment with local anesthetic is not effective and therefore no use of local anesthetic is recommended. There is some evidence that radial shock wave therapy may also be effective for lateral epicondylitis. There is some evidence that ESWT results in better long-term functional and pain outcomes than steroid injections, for patients who have failed 6 months of other treatment.

ESWT treatments are generally reserved for patients who have experienced some positive response to other therapy but continue to have functional deficits after 10 to 12 weeks.

It is not considered a first line of treatment. It may be considered after other treatments such as NSAIDs, ice, braces, jobsite changes and steroid injections have been tried. These patients should meet the indications for surgery found in specific diagnosis, epicondylitis. Peripheral vascular disease, upper extremity neuropathy and diabetes are all relative contraindications. Diagnostic testing may be needed to rule out these conditions. Some devices used in ESWT may not be FDA approved for the above-mentioned indications.

- Time to Produce Effect: 2 sessions.
- Optimum Duration: 3 sessions, 1 week or more apart.
- Maximum Duration: Treatment may be continued for up to 5 total sessions if functional improvement has been demonstrated after 3 treatment sessions. Functional improvement is preferably demonstrated using functional scales validated in clinical research settings or direct testing.

I.12.c Iontophoresis

Iontophoresis is an accepted treatment. It is 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 (mecholyl, hyaluronidase, and salicylate), ischemia (magnesium, mecholyl, and iodine), muscle spasm (magnesium, calcium) calcific deposits (acetate), scars and keloids (chlorine, iodine, acetate). Refer to the specific diagnosis for use with cumulative trauma.

- Time to Produce Effect: 1 to 4 treatments.
- Frequency: 2 to 3 times per week with at least 48 hours between treatments.
- Optimum Duration: 6 to 9 treatments.
- Maximum Duration: 9 treatments.

I.12.d Low Level Laser Therapy

There is no evidence that low level laser therapy alone is beneficial for changing the outcome of patients with carpal tunnel syndrome. Additionally, there is good evidence that low level laser is not more effective than placebo for lateral epicondylitis. Therefore, it is not recommended for lateral and medial epicondylitis or for carpal tunnel syndrome.

I.12.e Manipulation

Manipulation is a generally accepted, well-established and widely used therapeutic intervention for upper extremity injuries. 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

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restrictive/pathologic barrier, c) the patient actively assists 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. Refer to the specific diagnosis for use with cumulative trauma conditions.

- 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 reinjury, interrupted continuity of care, exacerbation of symptoms, and in those patients with co-morbidities. Functional gains including increased ROM must be demonstrated to justify continuing treatment.

I.12.f Manual Therapy Techniques

Manual Therapy Techniques are passive interventions in which the provider uses his/her hands to administer skilled movements designed to modulate pain; increase joint range of motion; reduce/eliminate soft tissue swelling, inflammation or restriction; induce relaxation; and improve contractile and non-contractile tissue extensibility. These generally accepted techniques are applied only after a thorough examination is performed to identify those for whom manual therapy would be contraindicated or for whom manual therapy must be applied with caution.

i. Mobilization (Joint)/Manipulation. Mobilization is passive movement involving oscillatory motions to the involved joints. The passive mobility is performed in a graded manner (I, II, III, IV, or V), which depicts the speed of the maneuver. 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. Contraindications include joint instability, fractures, severe osteoporosis, infection, metastatic cancer, active inflammatory arthridites, and signs of progressive neurologic deficits.

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

ii. Mobilization (Soft Tissue). Mobilization of soft tissue is the skilled application of manual techniques designed to normalize movement patterns through the reduction of soft tissue pain and restrictions. Indications include muscle spasm around a joint, trigger points, adhesions, and

neural compression. Time to Produce Effect: 4 to 6 treatments.

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

I.12.g Massage Manual or Mechanical

Massage is manipulation of soft tissue with broad ranging relaxation and circulatory benefits. It is an accepted treatment. 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 practitioners' hands. Indications include edema, muscle spasm, adhesions, the need to improve peripheral circulation and range of motion, or to increase muscle relaxation and flexibility prior to exercise.

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

I.12.h Orthotics/Immobilization with Splinting and Bracing

Orthotics/Immobilization with Splinting and Bracing is a generally accepted, well-established and widely used therapeutic procedure. Depending on the specifics of the condition, the treatment plan, and the daily activities, splints may be effective when worn at night or during portions of the day. Splints should be loose and soft enough to maintain comfort while supporting the involved joint in a relatively neutral position. Splint comfort is critical and may affect compliance. Although off-the-shelf splints are usually sufficient, custom thermoplastic splints may provide better fit for certain patients.

Splint use is rarely mandatory. Providers should be aware that over usage is counterproductive, and counsel patients to minimize daytime splint use in order avoid detrimental effects, such as, stiffness and dependency over time.

- Time to Produce Effect: 1 to 4 weeks.
- Frequency: Daytime intermittent or night use, depending on symptoms and activities.
- Optimum Duration: 4 to 8 weeks.
- Maximum Duration: 2 to 4 months. If symptoms persist, consideration should be given to further diagnostic studies or to other treatment options.

I.12.i Paraffin Bath

Paraffin Bath is a superficial heating modality that uses melted paraffin (candle wax) to treat irregular surfaces such as the hand. Accepted indications include the need to enhance collagen extensibility before stretching, reduce muscle guarding, or reduce inflammatory response.

- Time to Produce Effect: 1 to 4 treatments.
- Frequency: 1 to 3 times per week.
- Optimum Duration: 4 weeks.
- Maximum Duration: 1 month. If beneficial, provide with home unit or purchase if effective.

I.12.j Superficial Heat and Cold Therapy

Superficial Heat and Cold Therapy is an accepted intervention. Thermal agents are applied in various manners that lowers or raises the body tissue temperature for the reduction of pain, inflammation, and/or effusion resulting from injury or induced by exercise. Includes application of heat just above the surface of the skin at acupuncture points. Indications include acute pain, edema and hemorrhage, need to increase pain threshold, reduce muscle spasm and promote stretching/flexibility. Cold and heat packs can be used at home as an extension of therapy in the clinic setting.

- Time to Produce Effect: Immediate.
- Frequency: 2 to 5 times per week (clinic). Home treatment as needed.
- Optimum Duration: 3 weeks as primary or intermittently as an adjunct to other therapeutic procedures up to 2 months.
- Maximum Duration: 2 months. If symptoms persist, consideration should be given to further diagnostic studies or other treatment options.

I.12.k Ultrasound (Including phonophoresis)

Ultrasound (Including phonophoresis) is an accepted treatment. It uses sonic generators to deliver acoustic energy for therapeutic thermal and/or non-thermal soft tissue effects. Refer to Specific Diagnosis sections for use. Indications include scar tissue, adhesions, collagen fiber and muscle spasm, and to improve muscle tissue extensibility and soft tissue healing. Ultrasound with electrical stimulation is concurrent delivery of electrical energy that involves 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: 4 to 8 treatments.
- Frequency: 2 to 3 times per week.
- Optimum Duration: 4 to 6 weeks.
- Maximum Duration: 2 months.

I.13 Restriction of Activities

Continuation of normal daily activities is an accepted and well-established recommendation for CTCs with or without neurologic symptoms. Complete work cessation should be avoided if possible, since it often further aggravates the pain presentation. Modified return-to-work is almost always more efficacious and rarely contraindicated in the vast majority of injured workers with CTCs.

I.14 Vocational Rehabilitation

Vocational Rehabilitation is a generally accepted intervention. Initiation of vocational rehabilitation requires adequate evaluation of patients for quantification of highest functional level, motivation, and achievement of maximum medical improvement (MMI). Vocational rehabilitation may be as simple as returning to the original job or as complicated as being retrained for a new occupation. The effectiveness of vocational rehabilitation may be enhanced when performed in combination with work hardening and work conditioning.

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.

Appendix: Dupuytren's Disease

A. DEFINITION/DESCRIPTION: Dupuytren's disease is a disorder of the hand involving the formation of fibrosis (scar tissue) in the palm and digits with subsequent contractures.

B. OCCUPATIONAL RELATIONSHIP: It has strong age and inheritance patterns; thus, it is generally thought to be non-occupationally related. Purported risks include the use of alcohol, smoking, diabetes mellitus, and epilepsy. However, although there are no quality studies involving occupational factors, there are some reported associations with both heavy and manual work. Therefore, to help provide improved care for patients, this disorder is included as an appendix to the Upper Extremity Disorders chapter.

C. TREATMENT: Many treatments have been used for patients with Dupuytren's disease, including radiotherapy, dimethylsulfoxide injections, topical applications of vitamins A and E, physical therapy, ultrasound, corticosteroid injections, 5- Fluorouracil, and gamma interferon injections. Almost all of these treatments have been found ineffective. While surgery is currently the most effective treatment for Dupuytren's disease, the contracture often reoccurs with time.

1. COLLAGENASE INJECTIONS

Collagenase injections have been utilized for treatment of Dupuytren's disease to lyse and rupture the finger cords that are causing the joint contracture. Collagenase injections are moderately recommended for treatment of Dupuytren's disease.

- Indications Dupuytren's contractures sufficient to result in impairment, nearing impairment, or sufficient to result in significant cosmetic deformity.
- Frequency/Dose Clostridial collagenase 10,000 U injection; repeat injection(s) at 4 to 6 week intervals.
- Discontinuation Resolution of contracture, sufficient reduction for patient to decline additional injection, adverse effects, or failure to respond to 3 injections.

2. INTRA-OPERATIVE 5-FLUOROURACIL

5-Fluorouracil is not recommended to prevent the recurrence of Dupuytren's disease in surgical patients

5-Flourouracil (5-FU) is a chemotherapy drug that has been used for many years to treat cancer, principally as a thymidylate synthase inhibitor. It is administered intravenously or as a topical cream. 5-FU is also used in ophthalmic surgery as an anti-scarring agent, and topically to treat actinic (solar) keratoses and some types of basal cell skin carcinomas. 5-FU has also been used topically to attempt to slow or prevent recurrence of Dupuytren's disease after surgery by reducing proliferation rates of fibroblasts.

3. POST-OPERATIVE USE OF NSAIDS AND ACETAMINOPHEN

NSAIDs have been used to treat post-operative swelling from surgery for Dupuytren's disease

and appear to be superior to acetaminophen (paracetamol). Naproxen may also be useful as an analgesic during the immediate post-operative phase.

<u>a. NSAIDs</u> are moderately recommended to treat post-operative swelling from surgery for Dupuytren's disease.

- Indications Dupuytren's disease surgical patients.
- Frequency/Dose Naproxen 500mg BID.
- Duration Trial utilized 3 days of treatment.

b. Acetaminophen is recommended for Dupuytren's surgery.

• Frequency/Dose – Paracetamol 1g QID trialed for 3 days. (Note: an FDA advisory committee recommended a maximum dose of 650mg and there is a suggestion of toxicity at 1g QID especially over a few days and particularly in patients consuming excess alcohol or who have liver disease.)1039

4. SURGERY

Surgical procedures have long been used to attempt to improve range of motion in patients with contracture from Dupuytren's disease. The goal of surgical care is to excise or incise the diseased fascia. This treatment does not cure the disease, but is meant to improve severe debilitating joint contractures.

As some patients with functional limitations appear to improve at least in the short to intermediate term lasting many months to years, regional or selective fasciectomy is recommended. Surgery is invasive, has known adverse consequences including recurrences, and is costly. However, it also appears effective for at least a limited period of time and for some patients it may be the only treatment option available; thus, surgery is recommended particularly for patients with functional limitations.

Several types of surgery have been used to treat Dupuytren's disease, depending on the contracture.

<u>g. Extensive fasciectomy</u> involves removing as much fascia as possible, including that which is grossly normal. Today, this procedure is not commonly performed because of increased morbidity which often included hematoma, edema, and prolonged post-operative stiffness.

<u>h. Dermofasciectomy</u> removes the diseased fascia and the overlying skin. This requires resurfacing (covering) the wound with a full-thickness skin graft. Recurrence rates are quite low with this approach. Because of the radical nature of this procedure, it is usually reserved for patients with recurrent or severe disease.

<u>i. Regional or selective fasciectomy</u> involves excising only grossly involved fascia. Although the disease process clearly extends into clinically normal palmar fascia, this approach has proven successful in correcting MCP joint contractures and some PIP joint contractures; this procedure

carries an acceptably low morbidity rate. Some surgeons prefer to leave the skin wound open to heal by secondary intention as a means of decreasing hematoma risk. This approach is commonly used today.

Surgery using the technique of regional or selective fasciectomy is recommended for contracture due to Dupuytren's disease.

"Firebreak" full-thickness skin graft, extensive fasciectomy, or dermofasciectomy for Dupuytren's contracture is not recommended for routine Dupuytren's contracture surgery.