Cumulative Trauma of the Upper Extremities

A Guide for Management

Many traditional work injuries occur *suddenly*, as a result of a specific incident. Cumulative Trauma Disorders (CTDs), on the other hand, develop *gradually*, over a period of weeks, months, or even years. CTDs are disorders of muscles, tendons, nerves and blood vessels that are caused, precipitated or aggravated by repeated exertions or movements of the body. For this reason, CTDs are often referred to as overuse or overexertion disorders.

Because of the extensive use of the upper extremity, especially hands and wrists to perform manipulative work, CTDs frequently manifest themselves in these portions of the body. Although many symptoms are associated with CTDs, the most common are pain, restriction of joint movement, soft tissue swelling, and numbness of the extremities.

It is often difficult or impossible to distinguish between the occupational and non-occupational factors that contribute to the development of CTDs. The disorder may be related to such common activities as gripping, twisting, reaching, and bending. What seems to create the hazard is not the activity itself, but its chronic repetition in a forceful and awkward manner without rest or sufficient recovery time.

Common Cumulative Trauma Disorders

Employees reporting any of the conditions or symptoms described below should be evaluated by a qualified medical practitioner.

Carpal Tunnel Syndrome – Early symptoms include numbness or tingling and burning sensations in the fingertips. This syndrome is caused by compression of the median nerve that runs through the wrist.

Tendinitis – Characterized by pain, swelling, tenderness, and even redness of the hand or wrist, this disorder is caused by overstretching or constriction of the tendons of the hands and wrists.

Tenosynovitis – Symptoms may include pain, tenderness, and swelling, resulting from an inflammation of the sheaths surrounding the tendons.

DeQuervain's Disease – Pain and difficulty in movement are typical symptoms of this disorder, which results from a progressive constriction of the wrist tendon sheath at the base of the thumb.

Trigger Finger – Characterized by a snapping and jerking movement when attempting to move the affected finger, this condition results when a tendon sheath becomes so swollen that the tendon locks in the sheath.

Vibration Syndrome – Also known as White Finger or Raynaud's phenomenon, this syndrome is identified by recurrent episodes of finger blanching and extreme discomfort. The disorder is often associated with prolonged use of vibrating tools, especially in cold weather.

Thoracic Outlet Syndrome – A neurovascular disorder of the shoulder and upper arm. Symptoms are similar to carpal tunnel syndrome, namely numbness in the fingers and hands.

The Magnitude of the Problem

Over the past 15 to 20 years, there has been a dramatic increase in the incidence of CTDs reported through the state workers compensation systems. Recent data from the U.S. Bureau of Labor Statistics indicates that CTDs account for about 4.4% to 4.9% of the total injuries and illnesses reported to the BLS. The upward trend of the 80's and early 90's seems to have leveled off but for reasons not entirely known.

It is difficult to pinpoint the combination of factors that led to the dramatic increase. Some probable reasons include:

- **Higher Production Rates (often with fewer workers).** The pace of many job activities increased as the workplace incorporated more mechanization and automation. Computer keyboarding tasks have become very common in office environments.
- **Shift Toward Service and High-Tech Jobs.** Many tasks in these industries tend to be repetitive, prolonged, and labor-intensive. Examples include bench assembly work.
- **Increased Awareness by Medical Practitioners.** The same conditions that in past years may have been treated as just a sore hand or wrist are now diagnosed as CTDs.
- **Greater Reporting.** Public awareness and concern about CTDs also increased. Individuals suffering from these disorders are more likely to seek medical treatment.
- **Expanded Workers Compensation Laws.** Most state workers compensation laws recognize musculoskeletal disorders which develop gradually and in a cumulative fashion.
- **Knowledge of Occupational Causes.** Extensive research led to a greater understanding of the work-related factors that may contribute to the development of CTDs.

What Causes Cumulative Trauma Disorder?

Many factors can interact concurrently to bring about CTDs, so it is often impossible to identify a specific cause. The issue is further complicated by the difficulty in separating occupational from non-occupational causal factors, and the degree to which individual susceptibility plays a role.

Nevertheless, studies have identified the six most common factors which can lead to the development of CTDs:

1. Frequent repetition,
2. Forceful exertion including static forces,
3. Awkward postures (e.g., deviation of the wrist away from a straight line, using a pinch-type grip, extreme reaching, and forearm rotation),
4. Mechanical pressure (e.g., the sharp edge of a tool or work surface contacting palms or wrists),
5. Hand/arm vibration, and
6. Exposure to cold temperatures

Although the most significant single risk factor is frequent repetition, the risk of injury increases greatly when two or more risk factors are present.

Simultaneous exposure to **frequent repetition** and **forceful exertion** is particularly risky – the odds of sustaining a CTD are more than 30 times greater than they would be in the absence of those risk factors.

Keep in mind, hand/arm vibration and cold temperature are considered risk factors for carpal tunnel syndrome as they contribute to increased force required to do the job.

What Can Be Done About It?

There is no simple way to prevent all CTDs in your facility. It is a complex issue that requires a coordinated program involving multiple control approaches.

The first step in your control effort will be to systematically examine your operations to identify specific tasks that expose workers to CTD risk factors.

Once specific jobs or tasks have been identified, a combination of administrative and engineering approaches can be directed toward their control. Be sure to involve the worker when developing an appropriate control plan!

Some relevant principles are listed here which you should include in your control program wherever possible:

Administrative Controls

- ❑ Reduce task frequency, if this is compatible with production demands.
- ❑ Rotate workers between different types of jobs, so that individuals do not perform the same repetitive task all day.
- ❑ Instruct workers to alternate hands so that the job is not performed primarily with only one hand.
- ❑ Have gradual break-in periods, especially for new workers, and during the early part of a shift.
- ❑ Educate workers about the nature of the CTD risk factors that they are exposed to, and train them in correct work methods.
- ❑ Train management and supervisors about CTD risk factors and symptoms, and how to respond appropriately to affected employees.
- ❑ Avoid machine pacing.
- ❑ Avoid incentive pay scales that encourage workers to push themselves beyond their physical limits.
- ❑ Vary the work content of the job or a technique commonly called “job enlargement”.
- ❑ Seek medical opinions about the advisability of job placement exams, worksite exercise and stretching programs, the use of wrist splints, and the efficacy of vitamin regimens.
- ❑ Well designed job rotation and job enlargement programs proactively build in sufficient rest and recovery time into work tasks while productive work is being performed.

Engineering Controls

- ❑ Position the work and worker to eliminate awkward postures.
  - If wrist extension is the problem, either lower the work or raise the worker.
  - If wrist flexion is the problem, either raise the work or lower the worker.
- ❑ Make workstations and seating adjustable to allow for changes in posture.
- ❑ Angle or tilt the work toward the worker, if necessary, to eliminate wrist deviations.
- ❑ Use adjustable fixtures or jigs to support the work, so that the fixture (not the wrist) can be angled to reposition the part.
- ❑ Keep tools and parts within easy reach of the worker.
- ❑ Smooth all surface edges to eliminate sharp protrusions.
- ❑ Locate parts bins below elbow height to avoid bent wrists.
- ❑ Design jobs to minimize hand force and frequency of repetition.
- ❑ Reduce the forces needed to turn knobs and valves; those requiring power to turn should be designed for a palmar grip.
- ❑ Mechanize or automate the job to eliminate hand movements, particularly for frequent manual tasks.
- ❑ Mount heavy tools on automatic retractors or overhead balancers.
- ❑ Design jobs so that the worker can use both hands relatively equally.
- ❑ Reduce hand movements by eliminating rehandling, and/or by combining multiple operations at a single location.

Where Can I Go for Additional Help?

Our Loss Prevention consultants are trained in the principles of CTD loss control. Your consultant can help you evaluate jobs and tasks for the presence of CTD risk factors, and assist

you in developing an appropriate control program utilizing administrative and engineering techniques.

Your state or federal OSHA consulting service, or the National Institute of Occupational Safety and Health (NIOSH), can provide additional assistance.

Many books and references are available on the subject. Two of the best overall presentations prepared by NIOSH are:

Cumulative Trauma Disorders: A Manual for Musculoskeletal Diseases of the Upper Limbs, edited by Vern Putz-Anderson, Taylor & Francis, Philadelphia.

DHHS (NIOSH) Publication No. 97-117, *Elements of Ergonomic Programs: A Primer based on Workplace Evaluations of Musculoskeletal Disorders*, NIOSH Publications Dissemination, Cincinnati, OH, 1-800-35-NIOSH.

The federal government published guidelines, available from your local OSHA office, on how to establish an effective ergonomics program aimed at controlling CTDs:

OSHA Publication #3123 - *Ergonomics Program Management Guidelines For Meatpacking Plants*

For general industry see OSHA *1989 Voluntary Safety and Health Program Management Guidelines*

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