Risk Control Bulletin
Carpal Tunnel Syndrome

RISK CONTROL

CNA

Introduction

Carpal tunnel syndrome is a cumulative trauma disorder that results in losses of millions of dollars in lost wages, increased workers' compensation costs and decreased production. Simply defined, carpal tunnel syndrome (CTS) is a compression and damage of the median nerve where it passes through the carpal tunnel (Figure 1). It requires only a small amount of pressure or deviation (bending) in the wrist to cause harmful compression of the median nerve. Think of it as a garden hose. Any pressure or bending will restrict the flow. The compression of the nerve is usually caused by swelling in the surrounding tissue resulting in pain, reduced hand strength, and other symptoms. Through early and proper diagnosis, timely treatment, and proper job design, this condition can be controlled.

There are many diagnoses for cumulative trauma disorders (CTD). Many are referred to as carpal tunnel syndrome (CTS). The terms that are associated with CTD fall into three categories; those afflicting the nerve, those afflicting the tendons and those afflicting the muscles. They are as follows:

Muscle Problems

- Myalgia - a general term for muscle pain.
- Myofacial pain syndrome — irritation of the membrane around muscles.

Tendon Problems

- Tendonitis - irritation of a tendon.
- Tenosynovitis - irritation of the sheath around a tendon.
- DeQuervain's disease -tenosynovitis at the base of the thumb.
- Epicondylitis - irritation of the tendon attachments at the elbow, also known as tennis elbow.
- Trigger finger - a type of extreme tenosynovitis that locks the finger.

Nerve Problems

- Carpal tunnel syndrome - damage to the median nerve in the wrist.
- Guyon's canal syndrome - damage to another of the nerves in the wrist.
- Cubital tunnel syndrome - damage to the nerve passing through the elbow.
- Thoracic outlet syndrome - compression of the nerves in the neck shoulder region.
- Hypothenar hammer syndrome - nerve damage from repeated impacts at the base of the palm.

The National Institute of Occupational Safety and Health (NIOSH) reports that the average cost for non-surgical treatment of CTS is $3,500 and for a surgically treated case the cost can go as high as $30,000. The average number of lost workdays is 30. If the worker is unable to return to work, rehabilitation can increase the costs to over $100,000. These are insured costs (direct costs). The additional uninsured costs (indirect costs) of losing a trained employee (training a replacement, loss of production/quality, overtime, etc.) can be 4 to 5 times the insured costs. Additional expenses could come from citations issued by the Occupational Safety and Health Administration (OSHA).

Causes Of CTS

Forceful Tasks

As a cumulative trauma disorder, CTS can result not only from occupational risk factors, but also from outside activities and predisposing factors.

There are several occupational risk factors, which have been identified as being contributing factors in the devel-

opment of carpal tunnel syndrome. For example:
Repetitive Tasks

Work, which involves prolonged periods of repetitive movements of the hand and arm using the same muscle groups, such as continuous hand trimming of plastic parts/keyboard use.

Wrist Deviation

Tasks which require or result in extreme wrist postures, especially when force is applied. These include excessive wrist flexion, extension, radial, or ulnar deviation, (Figure 2) such as when using pistol grip drill on a chest high horizontal surface on a continuous basis, or poor set-up

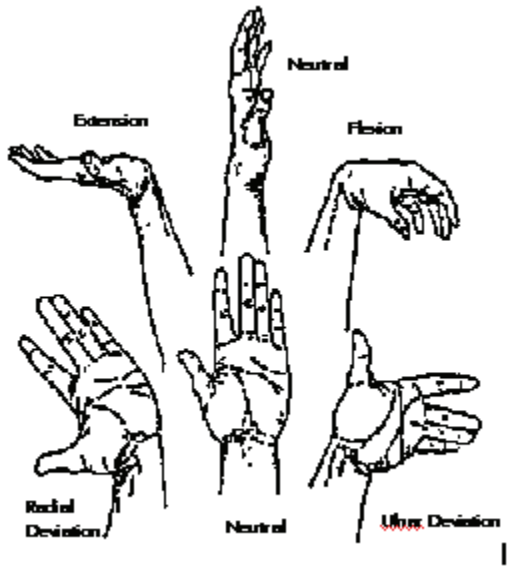


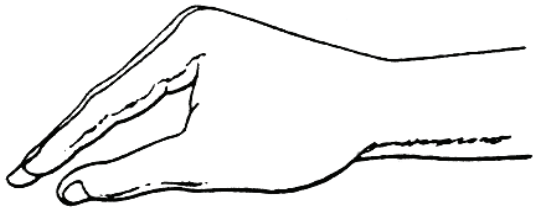
Figure 2

and posturing at a computer workstation (Figure 2a).

Figure 2a

Forceful Tasks

Work which requires or results in high levels of hand or arm force to complete. This would include high levels of torque needed to drive a screw, forceful grips and pinch positions (Figure 3) as in garment cutting and sewing.



"Pinch" Position

Figure 3

Palinar Compression

Tasks which result in mechanical stress concentrations on the palm of the hand, such as packing operations where the palm is used to compress packing materials.

Vibration

The use of vibrating tools, especially equipment that can exceed torque requirements of the task.

Many of the above occupational risk factors may also be present during outside (non-work) activities, such as sewing, racquetball, gardening, etc. In addition, there are several non-occupational predisposing factors which can cause or contribute to the development of CTS, such as:

Systemic Diseases

Rheumatoid arthritis, gout, diabetes, ganglion formation, and certain forms of cancer.

Congenital Defects

Includes bony protrusions into the carpal tunnel, anomalous muscles extending into or originating in the carpal tunnel, and the shape of the median nerve.

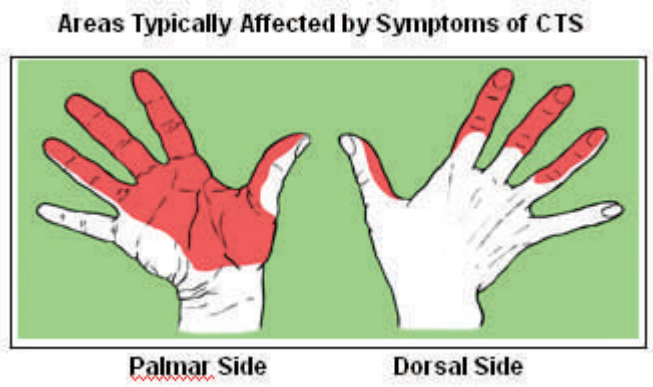
Acute Trauma

Median nerve injury inside the carpal tunnel can be produced by a blow to the wrist, laceration, burn, or other acute wrist trauma.

Symptoms

The common symptoms of CTS include:

- Numbness, especially in the area of the median nerve distribution that includes the thumb, index, middle, and medial side of the ring finger.
- Pain and/or tingling in the hand, wrist, arm, elbow, and/or shoulder.
- Nocturnal pain awakening with numbness in the forearm, wrist and hand.
- Reduced pinch or grip strength.
- A change in sensation, either an increase in sensitivity to the point that touch is uncomfortable, or a decrease so accuracy of feeling is affected.
- Atrophy or decrease in the size of the thumb muscle.
- A burning sensation in the hand or wrist.
- A loss of some of the normal sweat of the hand.



Diagnosis and Treatment

When any of these symptoms appear, it is important that a correct diagnosis be made. Because of the similarity of symptoms between several upper extremity disorders, a physician who routinely treats such diseases should be consulted. A hand surgeon who is well-versed currently on carpal tunnel syndrome is best suited to diagnose and treat CTS.

Early diagnosis and treatment of CTS are important if conservative (non-surgical) treatment is to be effective. Conservative treatment consists of:

- Rest of the effective area until inflammation subsides - job restriction may be necessary.
- Splints to decrease stress and reduce wrist deviation.
- Use of anti-inflammatory medication such as aspirin, indocin, etc.
- Use of steroids, either orally or by injection.

Identifying a qualified hand surgeon can be accomplished by working with local, state, and federal medical resources such as the American Medical Association and the American Society for Hand Surgeons.

Choosing a competent surgeon is important because of the complications which can occur. These complications include:

1. Cutting of median nerve branches resulting in loss of sensitivity in the hand. This complication often results from inappropriate surgical technique.
2. Incomplete release of the carpal tunnel ligament resulting in residual compression of the median nerve and continuing symptoms.
3. Painful scar tissue.
4. Reduced grip strength. (Reports of 12% to 25% reduction in grip strength are common.)

The success rate of carpal tunnel surgery is about 81%. There are now a variety of new treatments being tried for CTS, including microsurgery and angioplasty, among others. However, information about these new treatments and their effect on costs tends to be new, prejudiced by the developers and unreliable at this time. In most cases nocturnal pain is eliminated. Recovery can be painful and lengthy. Post-surgical treatment by trained occupational and rehabilitation therapists can speed recovery and minimize lost time following surgery.

Both conservative treatment and/or surgery can relieve the symptoms of CTS in some patients; however, neither is a solution if the injured worker returns to the same job and exposures, which caused the CTS. For these treatments to continue to be effective, methods to eliminate or reduce the occupational risk factors to CTS should be implemented.

Methods of Control

Ergonomic principles should be used to control the causes previously discussed, thus, reducing the employee's risk of developing carpal tunnel syndrome. Methods of prevention include task redesign, workstation modification, hand tool selection and application, and worker placement and rotation.

Job Task Redesign and Workstation Modification

Reduce repetitive action

- Redesign the job tasks to minimize repetitive use of muscle groups. For example:
- Reduce the frequency of work by eliminating
- Redesign the job tasks to minimize repetitive use of muscle groups. For example:
  - Reduce the frequency of work by eliminating wasted motions.
- Use of anti-inflammatory medication such as aspirin, indocin, etc.
- Use of steroids, either orally or by injection.
- Provide a variety of tasks over a work shift, each task using a different set of muscle groups. For example, if one worker must repeatedly assemble hinges while a second employee installs them on cabinet doors, the tasks could be combined so each employee would do both and, therefore, have less repetition of individual tasks.
- Allow machinery to do highly repetitive tasks, when possible.
- Spread the load over as many muscle groups as possible. For instance, expand a single-handed task to allow completion using both hands.

Reduce wrist deviations and minimize stress on the wrist.

- Provide fixtures to hold parts during assembly so that awkward holding postures can be minimized.
- A vise could be used to hold a die during grinding or filing operations.
- Design work surface heights, reach length and task orientation to permit the wrist to remain as close as possible to the neutral position.
- Fixture and work table edges should be rounded or curved to reduce pressure on the arms and wrists.
- Avoid forceful exertions with the base of the palm.
- For example, a rubber mallet can be used in place of the palm for forcing hubcaps onto automobile wheels.
- Design tasks to permit gripping with the palm and fingers rather than pinching. For example, if a small part requires a pinch grip to hold it against a buffer, a hand held clamp could be used to hold the part, resulting in less hand stress.
- Reduce forces during rotation or flexion of the joint. Power assists can be used. For instance, a power nut runner could be used in place of hand held wrenches during assembly operations, or a ratchet screwdriver could be used instead of a standard one.

Tool Selection and Application

- Provide tool handles that allow use of the maximum strength capability of the hand by featuring a power or oblique grip involving the palm. The recommended diameter for a power grip handle is 1.5 inches (4 cm); an acceptable range is from 1.25 to 2.0 inches (3 to 5 cm).
- For precision work, a narrower handle is suggested. The recommended diameter is .45 inch (12 mm) with an acceptable range of .30 to .60 inch (8 to 16 mm).
- Orient the tool handle so it can be used without the wrist markedly deviated in either the ulnar or radial directions. For instance, if a task using a straight line soldering iron requires wrist deviation, changing to a soldering tip with a 90° bend can allow the task to be accomplished using a neutral wrist position (Figure 5).

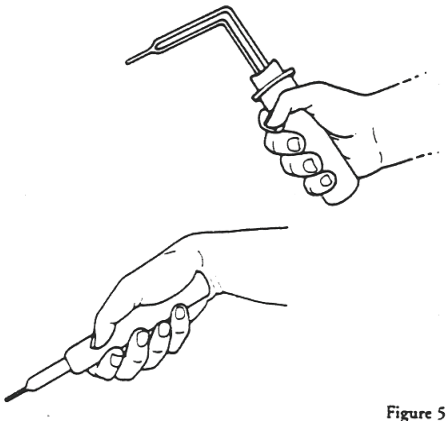


Figure 5

- Handles should be long enough to avoid applying repeated pressure to the base of the thumb palm, as when using a paint scraper (Figure 6). Ideal handle length is 5 inches (13 cm). The minimum acceptable length is 4 inches (10 cm). When gloves are used add an additional .5 inch (13 mm).

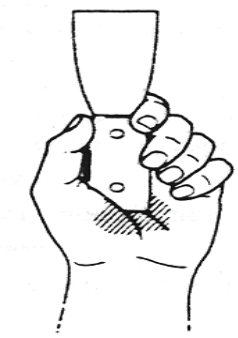


Figure 6

- For tools with two handles, such as scissors, clippers, pliers or pop riveters (Figure 7), the recommended distance between the handles at the point the greatest force is applied is 2.5 to 3.5 inches (6.25 to 8.75 cm).

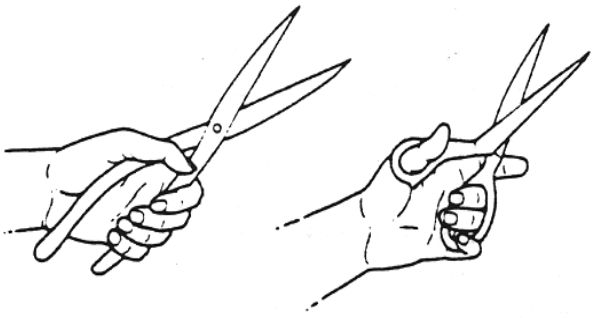


Figure 7

- Tool handle surfaces should be textured to provide control and a relaxed grip force. Fluted handles should be avoided. For a forceful grip, a compressible gripping surface is best, however the surface should be hard enough to resist embedding of particles and should be impervious to absorbing oil, solvents and other chemicals.
- Decrease the worker's exposure to vibration from powered hand tools by reducing the vibration through proper tool selection and reducing the exposure time.

Figure 8

- Suspend power tools on balancers to reduce the static muscle load, and to reduce the grip force needed to control the tool (Figure 8).
- Maintain tools in good condition, such as by keeping cutting edges sharp.

Worker Placement and Job Rotation

Neither worker placement procedures nor job rotation are substitutes for engineering controls to reduce the hazards, which contribute to CTS. Proper worker placement and job rotation are methods which can be used to reduce the employees' exposure to CTS. Other methods may include:

1. Identify the physical demands of repetitive motion jobs and place employees according to their physical ability to safely perform the task. Employees with a known predisposition to CTS should not be placed in jobs with factors that can contribute to CTS.
2. Gradually orient employees into repetitive motion jobs. Initial production demands could be reduced or additional job rotations could be implemented during the orientation period.
3. Rotate workers between tasks which have different force requirements or which use different muscle groups.
4. Train workers to accomplish tasks in the ways which minimize joint, tendon and muscle strain.

Conclusion

The incidence of carpal tunnel syndrome is a significant problem in some occupations. This coupled with high per-case costs amplifies the need to control this disorder.

Surgery is not a solution for CTS. Even those workers who have successful surgery can have a recurrence of carpal tunnel syndrome if they are returned to a task, which involves the occupational exposures previously discussed.

The solution is to use ergonomic principles to modify job tasks to reduce the exposures to CTS. This can be achieved by implementing a program, which includes:

- Task redesign
- Work station modification
- Tool selection and application
- Worker placement and rotation

Date	Company Name	
Project Number/Name	Meeting Location	Person Conducting Meeting

Items Discussed

Problem Areas or Concerns

Attendees

Comments