



Cumulative Trauma Disorders

Rising Incidence, Rising Awareness

They may have little in common otherwise, but a potpourri of workers—telephone operators, musicians, meatpackers, dental hygienists, carpenters, writers, barbers, drillers, data processors, truck drivers, and grocery checkout clerks—are increasingly getting to know each other in doctors' waiting rooms. What unites them is their suffering from carpal tunnel syndrome.

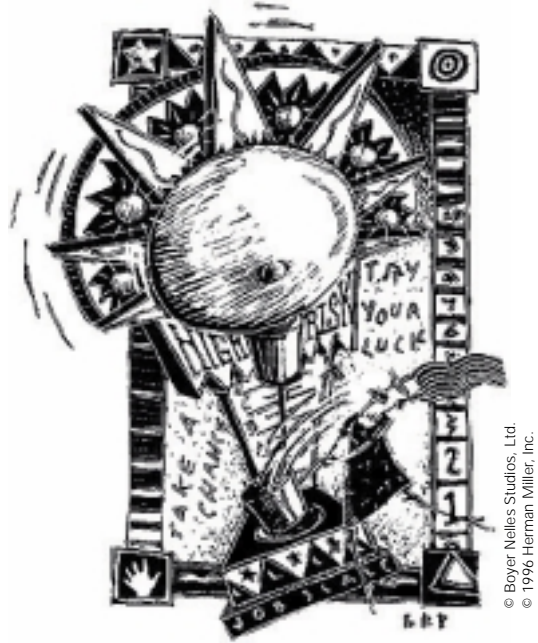
Carpal tunnel syndrome (sometimes referred to as CTS) is one of a group of musculoskeletal disorders believed to be caused by repeated trauma to the body. This group of disorders (officially labeled illnesses by the U.S. Occupational Safety and Health Administration—OSHA) is referred to by the umbrella term cumulative trauma disorders, or CTDs.

CTDs are not new. They include such familiar maladies as tendinitis, golfer's elbow, and bursitis. In fact, a malady common in the 1800s, gamekeeper's thumb, caused by the repeated twisting of the necks of rabbits, was surely a CTD.

Many of these disorders are associated with leisure-time activities; however, more and more, the term CTD is being used specifically to refer to those musculoskeletal disorders considered to be work related.

The rise in CTD cases.

CTD cases in general are considered to be grossly underreported; for example, a 1988 California study showed that health-care workers treated 7,214 cases of carpal tunnel syndrome, though only 71 cases had been officially reported to the authorities.¹ Despite that fact, the Bureau of Labor Statistics reported 332,000 cases logged by private industry in 1994, up from 302,400 in 1993, and more than double the number reported in 1989. It is clear that the incidence of reported cases has risen sharply. Not only has the number of CTDs increased, but so has their percentage of the overall job-related injuries and illnesses reported by U.S. businesses to the Occupational Safety and Health Administration (OSHA). In 1994, CTDs accounted for about 5 percent of the 6.8 million nonfatal injuries and illnesses, up from 4.5 percent in 1993.² Moreover, the Bureau of Labor notes that the average job absence for those suffering from a CTD is 20 days.³ According to a recent risk manager's survey, CTD-related costs—from productivity losses to medical costs to litigation—are the fourth-highest concern (up from the 16th concern in the 1994 survey) among U.S. executives responsible for protecting corporate assets.



CTDNews estimates that American employers spend more than \$7.4 billion a year in workers' compensation costs alone, without counting medical and other hidden costs.⁴

It is impossible, however, to know how much of the current increase is due to a higher incidence of reporting. Prior to the present level of documentation, workers may have suffered in silence due to lack of awareness that their symptoms could be occupation related or due to fear of losing their jobs if they complained.

Carpal tunnel syndrome has received a tremendous amount of attention in the news media recently because of a concurrent dramatic increase in reported cases, particularly in certain fields such as media organizations themselves.

The recent attention to carpal tunnel syndrome has spawned much speculation regarding its causes and possible remedies. Data continue to be gathered and interpreted daily by medical personnel, ergonomists, and industrial experts, resulting in a diversity of opinion regarding causes and possible methods of prevention. There are some basic questions, however, that can be answered: What exactly is carpal tunnel syndrome? What are its known causes? What is currently being done about curbing its rise?

Symptoms of carpal tunnel syndrome.

Sufferers of carpal tunnel syndrome report a range of symptoms. Numbness, burning and aching in the fingers and hand (especially at night), weakness in the wrist or hand, and a prickling sensation radiating up the inner forearm as far as the shoulder are some of the more pronounced acute symptoms. (Note that acute, as used here, refers to short-term, crisis-type symptoms; pronounced means "exaggerated" or "noticeable.")

Later, even more troubling long-term effects can develop: the sudden dropping of things held in the hand and extreme difficulty in performing simple manual tasks, such as buttoning a shirt.

What do carpal tunnel syndrome sufferers have in common?

The thread of commonality running through the lives of workers diagnosed with carpal tunnel syndrome is the frequency, speed, and

type of hand movements they are required to make in performing their jobs. These most often include:

- repetitive movements of the fingers, especially forceful action;
- extreme bending (up or down) of the wrist;
- circular twisting of the wrist; and
- pressure at the base of the palm or wrist.

Although evidence as to the exact causes of carpal tunnel syndrome and related syndromes is still considered inconclusive, experts agree that the most likely cause is the repetition of the same movements without sufficient rest.

Risk factors for CTDs.

Unfortunately, it appears that any work performed regularly can be a risk factor for CTD. "CTDs are not limited to industry or any special occupation, but to a pattern of usage," says Vern Putz-Anderson, chief of psychophysiology and biomechanics at the National Institute for Occupational Safety and Health (NIOSH).⁵ Specifically, the risks of developing a CTD increase when work involves movements of the body such as gripping, twisting, and reaching. These movements, when repeated chronically in a forceful or awkward manner without sufficient recovery time, create a very real hazard that can result in irreversible nerve damage and, in some cases, subsequent lifelong disability.

With the current rate of increase in reported cases of CTDs, the potential for the problem is obviously great. According to a 1988 report released by NIOSH, "More than half of U.S. workers have jobs with the potential for CTDs."⁶

Putz-Anderson further states, "Managers tell me it's their best workers, their most productive employees, who [are being affected by certain CTDs]."⁷

Although it cannot be substantiated that all or even most employers agree with this statement, it appears to be true within news organizations. Noel Greenwood, deputy managing editor of the Los Angeles Times: "We found that the average reporter (with a CTD) tended to work on the computer for long periods of time, concentrating very hard and rarely taking breaks. It seems that CTDs may be partly an injury of overwork."⁸



The process of determining the exact scope and causes of CTDs, and carpal tunnel syndrome in particular, is further complicated by the fact that occupation-related illnesses are traditionally underreported by physicians. While reasons for this are open to speculation, two likely causes exist: In the past, medical training has been light in the occupational health area; and since an occupational illness or injury sometimes results in complex interactions with both the patients' employers and the legal system, doctors may be both ill-equipped and reluctant to report them.⁹

NIOSH is currently urging doctors to obtain thorough histories which include specific work-related tasks from patients with carpal tunnel syndrome or other CTDs. This will help to clearly identify high-risk workplaces, occupations, and industries in the future.

Diagnosis and treatment.

The rigid carpal bones are held together by ligaments. Together they form a tunnel-like space within the wrist. Passing through this tunnel is the median nerve, along with the tendons for all four digits. Sensations in the thumb and first two fingers of the hand are transmitted by fibers of the median nerve within the carpal tunnel. Manifestations of carpal tunnel syndrome, and sometimes irreversible nerve damage (most likely caused by excessive motion within the unyielding tunnel), can result from compression or irritation of the median nerve as it passes through the carpal tunnel in the wrist.¹⁰

Once carpal tunnel syndrome is diagnosed, recommended treatments range from taking more breaks and performing hand and finger exercises to surgery. In between these extremes are such recommended methods of treatment as adding Vitamin B6 to the diet (many sufferers have been found to be deficient in pyridoxine, the largest component of Vitamin B6; but currently no definitive studies exist to show any causal relationship), wearing wrist splints at night and on the job, icing hands and wrists, and taking anti-inflammatory drugs (such as aspirin and ibuprofen) to ease pressure on the median nerve.

Surgery is not always necessary, but it is recommended where other methods have failed or where nerve damage has already occurred. The operation itself is relatively simple, and when successful, relief is usually immediate and long lasting. But even this drastic cure is

effective only 80 percent of the time; and if subsequent surgeries are needed, effectiveness is reduced.¹¹

The work environment. Cumulative trauma disorders and carpal tunnel syndrome used to be associated with assembly-line workers in factories or factorylike work environments, such as the meat-packing industry.

The increasing incidence of carpal tunnel syndrome currently being reported in today's offices, however, raises difficult questions about the physical nature of office work, which some say can resemble work in a factory.

In the office, VDT users appear to be most vulnerable. In fact, carpal tunnel syndrome has been nicknamed "VDT disease." And because these workers are primarily female, carpal tunnel syndrome appears to affect women more than men. One study of carpal tunnel syndrome done in Rochester, Minnesota, and broken down according to sex and age, shows that cases among women were almost three times those among men.¹²

Another study of repetitive strain injuries (RSIs) in Ontario, Canada, found that females had a higher risk of injury than their male counterparts and received compensation benefits longer than men. The difference in injury rates between men and women was attributed to the fact that the risk of RSIs is increasing in jobs primarily filled by women.¹³ A revised VDT workstation technical standard, now in the final stages of editing and review, will provide recommendations and detailed guidelines on computer workstation equipment. The ANSI/HFES 100 American National Standard for Human Factors Engineering of Computer Workstations is a voluntary technical standard that regulatory bodies may use as a guideline to write laws. The pending standard shows how all equipment interacts in a workstation, such as chair height and angle, work surface size, and keyboard key force, and is based on accepted scientific data and practices in the field of human factors and ergonomics. The standard may help facility managers select the right equipment and configure workstations to prevent CTDs from occurring in the first place.¹⁴

The Internal Revenue Service is currently using the revised standard for guiding workstation equipment purchases for the department's 110,000 employees.¹⁵



The fact that keyboards have been around a long time suggests that the keyboard itself is an unlikely culprit. Otherwise, why weren't there such large-scale outbreaks of carpal tunnel syndrome in the days of the bullpen secretarial pools? One possible explanation may be that using a typewriter provides more natural breaks in the typing routine: changing paper, erasing, returning the carriage. Researchers suspect that even short breaks like those may delay or prevent the onset of some of these conditions.

Another reason could relate to changing cultural norms. There is speculation that women office workers today tend to work longer at these jobs than office workers of yesterday, thus increasing the cumulative years of repetitive work. There is evidence that older workers are more likely to be diagnosed with carpal tunnel syndrome, which probably reflects the cumulative nature of the disorder.

Right now, any worker performing repetitive wrist movements for eight hours a day, five days a week is in a high-risk category. And, given that there are millions of VDT users in offices around the country, hitting as many as 10,000 keystrokes an hour, office workers will continue to be extremely vulnerable.

Implications for the office. Based on the numbers for the past few years, it appears likely that the incidence of CTDs and carpal tunnel syndrome seen among office workers will continue to rise. With this type of disorder, prevention is ultimately less costly than cure, so the mandate is clear: Companies employing large numbers of office workers will need to become informed and take appropriate action in order to begin preventing carpal tunnel syndrome.

The question of course is, What is the appropriate action? Many employers are confused. And while unknowns remain and companies wait to learn more about CTDs and CTS in particular, the problem may lead to strained relations between employees and employers. For management, the need to prevent CTDs in the workplace must be balanced against production quotas and other business concerns. For employees, there may still be reluctance to report symptoms, based on fears about automation and possible job loss.

In the office, there are most likely five variables (sometimes overlapping) that may play a part in the high incidence of this problem:

- **Job design.** That is, the movements and repetition required by the job itself;

- **Equipment design.** The design and layout of the computer, keyboard, and any other equipment used in the performance of work;
- **Furniture design.** The work surface, the chair, their relative height, and the placement of the keyboard in relation to them;
- **Worker habits.** Customary ways in which an individual worker performs his or her job; and
- **Worker health.** The state of a worker's individual health, as well as outside activities related to overall lifestyle.

Job design.

The push toward high production and the trend toward specialization in jobs have left many office workers with job descriptions that are narrow, allowing little flexibility, coupled with a high demand for output. A partial solution would be to reverse this trend, redesigning jobs to make certain they are not limited to a few highly repetitive motions for eight hours a day. Allowing periodic breaks and structuring jobs to include a variety of physical activity would certainly help, although acceptable limits of repetitive movement are still not known.

In the future, more attention may be paid to designing jobs around the workers, rather than forcing workers to adapt to existing designs of jobs.

Equipment design.

Poorly designed keyboards can significantly increase the risk of carpal tunnel syndrome. The thickness and adjustability of the keyboard and the angle of the key tops themselves affect the movements a user must make. Possible solutions currently being investigated by manufacturers include the recommendation of adjustable keyboard supports; strategic layout of frequently used keys such as the "shift," "control," and "function" keys to reduce the need to twist the wrists awkwardly; and reduction of the force required to strike the keys. (An important factor in reducing force appears to be giving the keyboard user adequate feedback—the user needs to hear the "click" that indicates a key has been hit and see the resulting character appear on the screen in order to relax his or her push when striking keys.) In addition, engineers and designers are developing alternative keyboards, all designed to provoke minimal twisting of the wrist.



Furniture design.

The exact role that furniture plays is unknown at this time. However, most ergonomists believe that the design of furniture can play a role in helping to minimize CTD occurrence in the future.

Furniture should provide optimal postural conditions: The user should be comfortable and well supported, able to shift position easily and to sit or stand in a variety of positions. The keyboard should be placed in an appropriate position relative to seating. This is generally thought to be at a height and angle where the wrist does not have to bend up or down excessively to reach any keys. The wrist should always be straight or bent up very slightly when fingers are on the keyboard. This may be accomplished by the use of an adjustable keyboard support, an adjustable work surface (or a fixed work surface installed to suit the individual user), or an adjustable chair.

Most ergonomists say that, of the furniture elements, the keyboard and the chair and their relationship to each other are the most important. Ideally, the elbows should be bent at approximately a right angle (from about 70 to 90 degrees), leaving the hand slightly higher than the elbow. In addition, chairs designed with armrests can take some of the load off shoulder and upper arm muscles.

The use of adjustable keyboard trays and palm rests may also be helpful. Any palm rest should provide a broad, soft area of support for the wrists and be of approximately the same thickness as the front of the keyboard. The wrist should be nearly straight or bent up slightly to reach the keyboard, and the palm rest should not interfere with this position.

It should be noted, however, that a palm rest will not necessarily prevent a cumulative trauma disorder and, in fact, when used incorrectly, may actually do harm by forcing the wrist up at an awkward angle. Palm rests have a second inherent danger: Users can become too dependent upon them, leaving the hand resting on the palm rest and bending the wrist instead of moving the hand to reach side keys. The main benefit of a palm rest continues to be that of supporting the weight of the arm to prevent arm and hand fatigue and sometimes shoulder and neck pain.

Worker habits.

Of all the factors involved, certainly the one the worker has most control over is habit. In fact, because of the worker's intimate knowledge of his or her own comfort level, this factor may be the most flexible, and therefore the most important, of all.

Most ergonomists recommend educating employees about the risks of CTS and other cumulative trauma disorders. Employees can be taught about their individual equipment and furniture in order to use them optimally. Changing posture during the course of the day (including alternating sitting and standing positions if possible), taking breaks, and performing tasks intermittently rather than singly for hours at a time—all of these can make a difference.

Because worker habits come about partially in response to job demands, management can also play a role in changing them. Management must lead the way, not only by providing information regarding proper use of furniture and equipment, but also by building more flexibility into job descriptions.

Worker health.

Both the general health and the outside activities of the individual worker can affect his or her predisposition to develop a cumulative trauma disorder. Workers whose outside interests mimic certain occupations, such as weekend carpenters, musicians, and frequent drivers, are likely to be at increased risk. Even such seemingly harmless weekend activities as knitting, drawing, or playing squash or racquetball can influence a person's susceptibility to development of a CTD.

General health factors and the presence of certain health conditions also affect a worker's predisposition to develop a CTD. Illnesses such as diabetes and rheumatoid arthritis have been suggested as complicating factors.¹⁶

With the exception of the increased susceptibility associated with certain sports such as racquetball and squash, regular exercise is generally believed to be a positive deterrent to susceptibility.

Legal questions.

The legal issues surrounding CTDs and carpal tunnel syndrome are extremely complicated and threaten to become more so before they are resolved.



© Boyer Nelles Studios, Ltd.
© 1996 Herman Miller, Inc.

Although OSHA released federal guidelines for the meatpacking industry, there are as yet no concrete legal standards governing cumulative trauma disorders. A proposed OSHA standard that would protect workers from repetitive-strain disorders, originally scheduled for release in September 1994, has been repeatedly shelved and may not be issued at all given the anti-regulatory climate in Congress and medical uncertainty about RSIs. Initial estimates put the cost of complying with the agency's regulations at \$21 billion for U.S. businesses.¹⁷ Some believe that regulations should be made by the states, but in November 1994 the California Standards Board unanimously rejected an ergonomics standard in that state—the only state to formally propose a standard.¹⁸ The province of British Columbia in Canada is also pursuing an ergonomics standard, in part because more than \$400 million was paid out in workers' compensation claims between 1988 and 1992 for ergonomics-related injuries.¹⁹

Without specific guidelines, OSHA must rely on the general-duty clause of the U.S. Occupational Safety and Health Act in order to determine whether to cite and fine employers for failing to address a CTD hazard. The general-duty clause requires employers to "furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or likely to cause death or serious harm to his employees."²⁰

But even this clause is open to interpretation as it relates to CTDs. The terms "recognized hazards" and "serious harm" are still subjective enough to require interpretation. And the underlying requirements to support a citation from OSHA include that the "hazard" be recognized as such by the employer and that there be a "feasible method by which the cited employer could have abated the recognized hazard."²¹

Although OSHA has the authority to determine whether or not a citation should be issued and a fine levied, the current reigning confusion leaves the organization itself vulnerable to legal challenge.

Most employee claims fall under no-fault workers' compensation laws, which protect employers from direct lawsuits. But rather than preventing lawsuits in general, this situation sometimes tends to merely divert them to third parties. Thus, a newspaper publisher may be immune from an employee's carpal tunnel syndrome lawsuit, but the paper's equipment or furniture supplier may not.

Currently, more than 3,000 repetitive-stress-injury lawsuits are pending against keyboard manufacturers.²² But while manufacturers do not believe that their products are putting users at unreasonable risk of injury, computer giants like Compaq Canada, Inc., attach warning labels to their keyboards and include a booklet on workplace ergonomics to ensure that customers are using their products correctly.²³

Since there are no existing specific guidelines on how to prevent CTDs and since it is believed that personal factors can complicate and aggravate work-related disorders of this type, about all that can be said for certain is that questions of legal responsibility regarding CTDs are extremely difficult to answer.

Several related questions remain to be answered as well: What governing body will take control of this issue and at what level—federal, state, or even local? Will lawsuits end up providing guidelines for future legislation? For employees with claims, will their state of residence affect the outcome? And for employers, what will be required to make their workplaces safer?

The future.

Cumulative trauma disorders will certainly be a leading occupational issue in the future. Even so, research has yet to reveal the exact causes of CTDs and carpal tunnel syndrome, and there remains disagreement within the medical profession about the genesis of CTDs as well.

The focus will undoubtedly be on prevention. Despite the lack of agreement as to cause, prevention will come about most likely by careful attention and adjustments to all the different factors believed to affect carpal tunnel syndrome and other CTDs.

The rising awareness of CTDs has already begun to create change within some offices. The Los Angeles Times, whose incidence of CTDs was particularly high, hired outside safety consultants to work with the paper's safety department to try to halt the spread of CTDs within the company.

Some changes taking place in other companies include instituting specific training programs aimed at raising awareness and managing presumed risk factors, redesigning high-risk jobs, and providing stress counseling programs for employees.

Perhaps the biggest change will come from individual workers themselves and, more importantly, from supervisors who manage them. Employers may need to redesign highly specialized jobs to allow for greater flexibility and rotation of tasks, perhaps following the teamwork approach now being practiced by some automobile manufacturers.

After IBP, Inc., the nation's largest meatpacker, initiated a comprehensive ergonomics program, the incidence of RSIs among employees at the company's 23 plants was reduced by 50 percent in the first full year of the program.²⁴

For decades, voices in favor of a more humanistic workplace have disapproved of highly repetitive, specialized jobs on the basis that they were mind-numbing and resulted in worker dissatisfaction. But in the past, America's devotion to the assembly-line method of production has precluded doing much to change this. Now, with medical expenses from CTD surgery alone estimated at \$2 billion a year, costs incurred in workers' compensation cases estimated at \$7.4 billion a year, and the potential for increased insurance premiums and lawsuits,²⁵ change may be brought about by a wholly pragmatic concern—it may simply be too expensive to go on the way we have.

Notes

- 1 "CTDs' Toll on Workers' Comp Illness Rolls," CTDNews (October 1992).
- 2 "Can Voice Recognition Make Keyboards, CTDs Scarce?," CTDNews (November 1995).
- 3 "Repetitive Stress Injuries," CQ Researcher (June 23, 1995), p. 541.
- 4 "CTDs Taking Bigger Bite of Corporate Bottom Line," CTDNews (June 1995).
- 5 Putz-Anderson, Vern, *Cumulative Trauma Disorders: A Manual for Musculoskeletal Diseases of the Upper Limbs* (Taylor & Francis, London, 1988), p. 4.
- 6 *Ibid.*, p. 6.
- 7 *Ibid.*, p. 4.
- 8 Hembree, Diana, and Sarah Henry, "A Newsroom Hazard Called RSI," *Columbia Journalism Review* (School of Journalism, Columbia University, New York, January-February 1987), p. 23.
- 9 Baker, Edward, M.D., MPH, and Richard Ehrenberg, M.D., "Preventing the Work-Related Carpal Tunnel Syndrome: Physician Reporting and Diagnostic Criteria," *Annals of Internal Medicine*, 112: 5 (American College of Physicians, Philadelphia, March 1, 1990), p. 317.
- 10 Greenspan, Joseph, M.D., "Carpal Tunnel Syndrome: A Common But Treatable Cause of Wrist Pain," *Postgraduate Medicine*, 84: 7 (McGraw-Hill Health Care Group, New York, November 15, 1988), p. 34.
- 11 *Ibid.*, p. 43.
- 12 Stevens, Sun, Beard, O'Fallon, and Kurland, "Carpal Tunnel Syndrome in Rochester, Minnesota, 1961 to 1980," *Neurology*, 38 (Edgell Communications, Cleveland, January 1988), p. 136.
- 13 "Women at Higher Risk for RSIs Than Men," *Occupational Hazards* (June 1995), p. 35.
- 14 "Revised VDT Workstation Rule Due in the Fall," CTDNews (July 1995).
- 15 "IRS Accounts for Ergonomics," *Occupational Hazards* (April 1995), p. 71.
- 16 *Ibid.*, p. 134.
- 17 "A Pain for Business," *Newsweek* (June 26, 1995), p. 42.
- 18 "Technology and Health: Compaq to Put Warnings on Keyboards About Risk of Repetitive-Stress Injuries," *The Wall Street Journal* (February 14, 1995), Section B, p. 6.
- 19 "CTDs Taking Bigger Bite of Corporate Bottom Line."
- 20 Freeman, Roger L., "Going Around and Around with CTDs: A Look at the Legal Issues," *Occupational Safety & Health Reporter* (Bureau of National Affairs, Inc., June 13, 1990), p. 63.
- 21 *Ibid.*
- 22 "Delayed Disclosure Leads to Loss," *ABA Journal* (June 1995), p. 36.
- 23 "A Pain in the Wrist," *MacLean's* (November 21, 1994), p. 58.
- 24 "Repetitive Stress Injuries," *CQ Researcher* (June 23, 1995), pp. 537-560.
- 25 "CTS Surgery Costs \$2 Billion Annually," CTDNews (November 1995).