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Cumulative Trauma Disorders: An Emerging Occupational Health Problem*

Vern Putz-Anderson

Chief, Psychophysiology and Biomechanics Section
National Institute for Occupational Safety and Health
Cincinnati, Ohio

In recent years, there has been a dramatic increase in reports of work-related musculoskeletal disorders associated with ergonomic or chronic trauma hazards in the workplace. Since these musculoskeletal conditions have only recently gained public attention, no uniform label or term for them has been adopted. Descriptive labels that have been used include wear and tear disorders, overuse injuries, osteoarthritis, and degenerative joint diseases.⁽¹⁾ More recently, the terms "repetitive motion injury," "repetitive strain injury," and "myofascial or regional pain syndrome" have been used as nonmedical labels for worker symptoms of physical discomfort and the accompanying limitation of activity.

In the United States, the label of "cumulative trauma disorder" (CTD) is most frequently applied to work-related conditions that affect structures of the musculoskeletal system. Labels using the term "injury" should be avoided because the majority of musculoskeletal conditions included in this category are not injuries, as normally defined. Employers, moreover, are required to record these conditions as illnesses in their annual Log and Summary of Occupational Injuries and Illnesses (OSHA Form No. 200).

Until the mid-1980s, musculoskeletal disorders attributed to overuse

commanded comparatively little medical attention. Yet, there is ample evidence from early medical reports that over the years craftsmen experienced a variety of musculoskeletal disorders associated with their trades. Names such as bricklayer's shoulder, carpenter's elbow, stitcher's wrist, game keeper's thumb, telegraphist's cramp, and cotton-twister's hand represent a sampling of the names used to label such syndromes.⁽²⁾ A common feature was the element of overuse superimposed on the progressive changes that accompany the normal aging of the body.

Definition of Cumulative Trauma Disorders

A useful definition of CTDs can be constructed by combining the separate meanings for each word. Cumulative indicates that these conditions develop gradually over periods of weeks, months, or even years as a result of repeated stresses on a particular body part. The cumulative concept is based on the theory that each repetition of an activity produces some trauma or wear and tear on the tissues and joints of the body.⁽³⁻⁵⁾ The word trauma signifies bodily damage from mechanical stresses. And the term disorders refers to physical ailments or abnormal conditions. In 1983, the Institute of Indus-

trial Engineering defined CTD as

"Physical symptoms which result from trauma or work strain from repeated or continuous application of work stress, which for short periods of time or a single application would not be harmful."

CTDs belong to a collection of musculoskeletal problems that are considered to be work-related; that is, the disorders are more prevalent among working people than among the general population. As such, work, or excessive usage, is a risk factor for CTDs.

Work may also serve as a contributor or exacerbator of an existing health problem or physical limitation. For example, work may be a factor in a disease with multiple etiologies, such as degenerative joint disease or rheumatoid arthritis. Work may also lead to an aggravation of an existing condition of nonoccupational origin, such as joint pain in the elbow stemming from a previous sports-related injury. Such overuse symptoms may be experienced by weekend golfers, racket ball players, and other sports participants.⁽⁶⁾

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Risk Factors for Developing CTDs

Contrary to popular belief, the majority of work-related musculoskeletal problems do not result from accidents or sudden mishaps that break bones or strain ligaments. Rather, the disorder referred to here usually develops gradually as a result of repeated microtrauma. Because of the slow onset and often innocuous character of the microtrauma, the condition is often ignored until the symptoms become chronic and permanent injury occurs.

A worker fatigued from lack of sufficient rest, or a worker who is recovering from an illness, may be more at risk of developing a CTD than a rested or healthy worker. The risk of an overexertion injury may be further increased if the worker returns to a job requiring a level of physical exertion that exceeds his or her capacity. In general, if a sequence of events including episodes of repeated overexertion followed by insufficient recovery is repeated over successive days or weeks, a more permanent CTD may develop.

Activities associated with the onset of CTDs arise from ordinary movements that may include repetitive gripping, twisting, reaching, moving, etc. These activities, by themselves, are no more hazardous at work than at home. What makes them hazardous is chronic repetition in a forceful and awkward manner without rest or sufficient recovery time. Such conditions more often characterize work activities than leisure pursuits.

The difficulty in identifying the roles played by occupational and non-occupational factors in causing CTDs is further complicated by the role of personal factors or individual susceptibility. A worker's physical size, strength, prior injuries, and joint alignment may contribute to injury or exacerbate the adverse effects of repeated microtrauma.

Hence, CTDs are "not limited to industry or to specific occupations but to a pattern of usage."⁽⁷⁾ Although the dynamics of repetitive and stereotypical usage still apply when nonoccupational causes are suspected, the impairment occurring in a nonoccupa-

tional setting is more likely to be described as an overuse injury than a CTD. If chronic, it may be regarded as the beginning stages of degenerative joint disease.⁽⁸⁾ Regardless of the label and the origin, life activities, whether occurring in the home during leisure or at work, should be regarded as a continuum. With matters of health, there are seldom any firm boundaries that separate the work environment from the nonwork environment.

The human body has great recuperative powers given the opportunity to repair itself. All that is generally needed for recovery is a sufficient interval of rest-time between episodes of high usage. When the recovery time is insufficient, however, and when high repetition is combined with forceful and awkward (constrained) postures, the worker is at risk for developing a CTD.^(9,10) Since almost every job has elements of repetition, requires the use of force, and occasional assumption of awkward or constrained postures, nearly every manual worker is at some risk for developing CTDs. Major occupational categories that have been identified as posing a risk for developing CTDs include, but are not limited to, construction, services, manufacturing, and clerical.⁽¹¹⁾

Reports and Estimates of CTDs

The overall prevalence of CTDs is not known, but data collected at individual worksites suggest that CTDs are responsible for a significant amount of lost work time and high labor turnover. One of the earliest reports documented more than 60 cases during 960 worker-years of electronics assembly (6.4 per 200,000 man-hours worked).⁽¹²⁾ The reported disorders included ganglionic cysts, tenosynovitis, and carpal tunnel syndrome. The severity of the CTD problem can also be expressed in terms of the amount of lost work and the need for medical treatments. For example, in a 5-year period, 104-reportable cases of CTD were distributed among 85 employees at a plant where workers packed small parts for shipping. Nearly all of the cases required restricted duty that averaged 22.6 days. In addition, 11 of the most

severe cases required home rest accounting for an average of 12.6 lost workdays. Nineteen of the affected people who failed to recover were eventually transferred to other jobs, and three people suffered permanent partial disabilities.⁽¹³⁾

The OSHA Form 200 (Log and Summary of Occupational Injuries and Illnesses) provides another source of data supporting the growing concern over the expanding incidence of CTDs. Recently, the Bureau of Labor Statistics (BLS) reported that nearly 50 percent of all occupational illnesses recorded by employers on the OSHA Form 200 in 1988 were for "disorders associated with repeated trauma" (Section 7f, OSHA Form 200). This latest figure from the BLS represents a 9 percent increase over the 1987 data in reported illnesses for the category of repeated trauma. This continues the trend first noted in 1981 of increasing reports for this category of illness (Figure 1).

Two precautions should be noted in interpreting the data in Figure 1. First, the OSHA Form 200 requires that an employer classify all disorders associated with repeated trauma as occupational illnesses, not injuries. Strains and sprains of the musculoskeletal system, however, are usually classified as injuries and therefore would not be included in the data shown in Figure 1. Second, Section 7f is not limited to disorders that affect only the musculoskeletal system; it also includes the disorder of "noise-induced hearing loss." Although the BLS data confound these two disorders, supporting data are available from the Supplementary Record (OSHA Form 101) and workers' compensations systems suggesting that the increase in CTDs is not a reporting artifact. Moreover, data collected from the worker's compensation system revealed that the occupations of meat-cutters and butchers, miscellaneous laborers, and bottlers and canners had the largest number of claims for upper-extremity CTDs.⁽¹⁴⁾

One reason that it is difficult to determine the true incidence of CTDs is that the person's pain and movement limitation often develops slowly over months or even years.⁽¹⁵⁾ As a result,

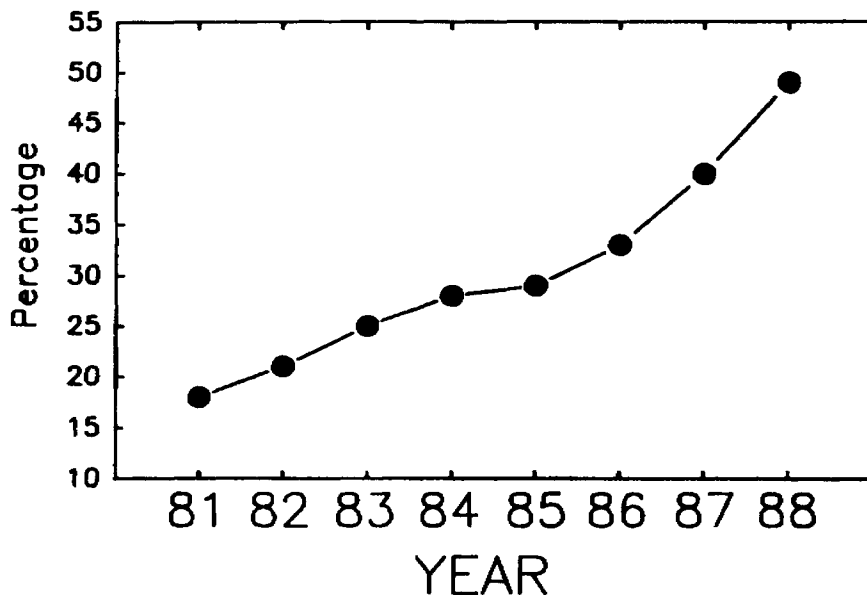


FIGURE 1. Data for recent years from the *Annual Survey of Occupational Injuries and Illnesses in the United States by Industry, 1988*, U.S. Department of Labor, Bureau of Labor Statistics. Data are plotted for Category 7f, "Disorders associated with repeated trauma," from the OSHA Form 200, "Log and Summary of Occupational Injuries and Illnesses."

a single event or mishap cannot be identified as a cause. The chronic nature of the disorders also contributes to the widespread belief that aches and pains are the inevitable price for working hard and growing old.

Although many symptoms are associated with CTDs, the most notable are pain, restriction of joint movement, and soft tissue swelling. In the early stages, there may be little or no visible signs of bruises or swollen joints. If nerves are affected, the sense of touch and manual dexterity may be reduced. Left untreated, CTDs can produce significant and lasting disability.⁽¹⁶⁻¹⁸⁾

Reasons for the Increase in CTDs

A main reason for the evident increase in CTDs is the pace of work. Modern work is geared to production standards. The emphasis on production symbolized by the assembly line has its modern counterpart in the computerized office machine, the electronic checkout station in food stores, and the mass food processing services, to name a few examples where high-volume output is required. Most of these jobs involve performing a simple, repetitive task such as gripping, pushing, and reaching. The movement may be

performed as many as 25,000 times in the course of the workday, despite physical fatigue.⁽¹⁹⁾ Furthermore, during high-volume periods, minimal time exists for rest and recovery. In general, mechanization and automation have served to lighten the workload; but on the negative side, they have increased the pace and stress of work and concentrated the forces on smaller elements of the anatomy, such as the hands and wrists.^(20,21)

Today, with the proliferation of assembly-line techniques, the ever-increasing tempo of production, and the widespread use of vibrating and air-powered tools, CTDs have become a fact of modern industrial life.⁽²²⁾ Recent reports describe new evidence of CTDs among such diverse groups as retail clerks, computer keyboard operators, and assembly-line workers.⁽²³⁾ Several changes in the U.S. workforce have also contributed to an increase in CTDs:

1. An increase in service and high-tech jobs.⁽²⁴⁾
2. An aging workforce.^(25,26)

The shift away from heavy industry and toward more service and high-technology jobs is exemplified by the fact that McDonald's, the restaurant chain, employs more workers than U.S.

Steel.⁽²⁷⁾ Though the work in these new industries may not be as physically strenuous as in the older heavy industries, it does tend to be more repetitive, prolonged, and labor intensive. The advent of robotics and increased automation has also simplified many jobs, reducing them to single repeated acts akin to the cyclic actions of machine-driven processes.

The aging workforce contributes to CTDs because as a person ages, the body's resilience to chronic wear and tear is reduced.^(28,29) Hence, a worker pays an increasingly higher health price for performing the same task as he or she grows older.

In summary, as information spreads on the causes and nature of CTDs, workers and employers are beginning to recognize that certain types of work activity can cause or contribute to these disorders. Moreover, these disorders do not have to be accepted as part of the job. Many of these disorders can be prevented.⁽³⁰⁾ Prevention is not always simple, however, since the hazard is often in the way a job is performed or how a particular tool is used.⁽³¹⁾

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