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A Strategy for Evaluating Occupational Risk Factors of Musculoskeletal Disorders

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There is a large and increasing incidence of work-related muscoloskeletal disorders, both upper extremity cumulative trauma disorders and low back pain. Several occupational risk factors have been linked with the development of musculoskeletal disorders. In order to identify the known occupational risk factors associated with a specific job, an analysis procedure is described to help identify ergonomic risk factors in the workplace. Job analysis should be one part of an overall ergonomics control program. Once the ergonomic risk factors have been documented, the ergonomics committee can use that information to begin developing solutions that will decrease or eliminate the identified risk factors. When placing a worker who is returning to the workforce after recovering from an injury, health care professionals can also use the information from the job analysis to assist in matching up task demands with worker capabilities and limitations.

KEY WORDS: job analysis; ergonomic risk factors; cumulative trauma disorders.

INTRODUCTION

The incidence of work-related musculoskeletal disorders has been increasing. The Bureau of Labor and Statistics reported a sharp rise in the musculoskeletal disorders associated repetitive trauma, from approximately four new cases per 10,000 workers in 1978 to 25 new cases per 10,000 workers in 1990 (1). These disorders are a significant cause of worker impairment and a major cause of disability and compensation (2). Chronic musculoskeletal disorders commonly develop in the upper extremities, neck, or low back. Workers may present classical symptoms of

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carpal tunnel syndrome, tendinitis, or low back pain, but in many other cases, the symptoms of pain and discomfort are nonspecific.

Commonly reported occupational or ergonomic risk factors of these problems include repetitive and static exertions, forceful exertions, awkward postures, mechanical stress concentrations, vibration, and temperature extremes (3). Although ergonomic job analysis can be used to identify work-related risk factors and guide analysts in designing work stations, it is not yet possible to prevent chronic musculoskeletal disorders through worker selection or work design, therefore it is necessary to develop procedures to accommodate workers. Even if it were possible to select workers who were at a low risk of developing a chronic musculoskeletal disorder, federal laws prohibit this type of discrimination and employers are required to make reasonable accommodations for the workers (4). Therefore, we still would need to analyze jobs to identify ergonomic stresses. Job analysis can be used to identify jobs for people with known physical limitations and/or to determine appropriate accommodations.

Work-related musculoskeletal disorders are often divided into two classes: low back pain and injury, and upper extremity cumulative trauma disorders (CTDs). Low back pain can develop when the discs along the spinal column are repeatedly loaded with large amounts of mechanical stress. Inflammation of the discs can develop. The damaged and bulging discs can irritate major spinal nerve roots and cause both lower back and lower extremity pain. Upper extremity cumulative trauma disorders refer to a class of diseases that affect the soft tissues of the hand, wrist, and arms.

Because ergonomic stress can be found throughout manufacturing and service sectors (5–7) and because there has been such a large incidence of musculoskeletal disorders related to ergonomic stress, this paper will discuss a strategy for evaluating the occupational risk factors associated with musculoskeletal disorders. This framework for job analysis can be used to identify work-related risk factors of musculoskeletal disorders associated with specific jobs. This information can then be used to redesign the work stations, or to match the restricted worker's capabilities to appropriate job requirements. The occupational health nurse plays a potential front line role in job analysis and can provide valuable input in redesigning work stations and safely returning injured workers back into the workplace. Specifically, this paper will discuss an approach for implementing an ergonomics control program, the steps involved in a thorough job evaluation to identify the presence of work-related risk factors of musculoskeletal disorders, the job analysis strategy will be applied to two examples, and lastly, the placement of injured workers will be discussed.

DEVELOPMENT OF AN ERGONOMICS CONTROL PROGRAM

Ideally, analysis of jobs should be integrated into an ongoing ergonomics program. In preparation for the beginning of an ergonomics control program, it is necessary for management to understand and fully support the new initiative. A participative approach is recommended, because it is then possible to bring together all of the necessary information and resources needed to successfully address the ergonomic issues. Consequently, an ergonomics team or committee should be formed. Based on the size and diversity of each facility, it may be most effective to develop one committee for the entire facility, or several committees that work within separate departments or areas of the facility.

The purpose of using a participative approach to address ergonomic issues, is that it is possible to bring together the people that have first-hand knowledge of the problems, engineering skills, health care knowledge, and the resources to make the required changes. Before the committee can begin to address the ergonomic problems present at their facility, they must be provided with general ergonomics training, information on job analysis skills, and team-building skills. In order to bring together people with the appropriate knowledge and resources necessary to effectively initiate change, the following functions are often represented on an ergonomics committee: engineering, safety, supervision, health care, workers, skilled trades, area management, labor representatives, plus other personnel as needed.

There are two primary mechanisms for controlling ergonomic stress and they include: (1) health care management of the workers, and (2) selecting appropriate work modifications. Often, both of these mechanisms are required for managing identified cases of musculoskeletal injuries.

The health care professionals are responsible for the overall health care management of the workers (see Fig. 1). Once workers with work-related musculoskeletal disorders have been identified, health care professionals should fully evaluate each case, provide health care interventions, and work with the ergonomics committee to develop and monitor work changes. The ergonomics committee is responsible for initiating and monitoring the work modifications. Work modifications may be in the form of physical changes to the work station or work environment (i.e., purchasing new equipment, changing the height or position of a fixture), or changes in the work method (i.e., reorganization of work tasks, worker rotation). Physical work station changes are often referred to as engineering controls, while changes in the work method are labeled as administrative controls.

Several key steps are identified as necessary so the ergonomics committee can develop appropriate work modifications. Priority jobs can be determined from committee members' knowledge of the facility, or worker complaints, and sometimes from medical surveillance data. Job evaluation includes a two-step process and will be discussed in greater detail in the next section. Both job documentation and an ergonomic assessment of the risk factors present are included in the job evaluation. The goal of the job evaluation is to systematically identify and describe the worker's tasks and the ergonomic stresses present. Once the job has been evaluated, the committee members can begin to develop solutions that will eliminate or reduce the identified ergonomic stresses. Solution development is often an iterative process. Usually, investigation is needed to determine the validity of proposed solutions. It may be necessary to build mock-ups that can be evaluated, or the proposed changes can be analyzed while they are still in the "paper" stage using currently available ergonomic software, such as anthropometric mannikins (8) or lifting models (9), to see if the identified stresses will actually be eliminated or reduced. The committee must then take responsibility for implementing the solutions (i.e., following up with purchase orders, scheduling installation, etc.). It is also

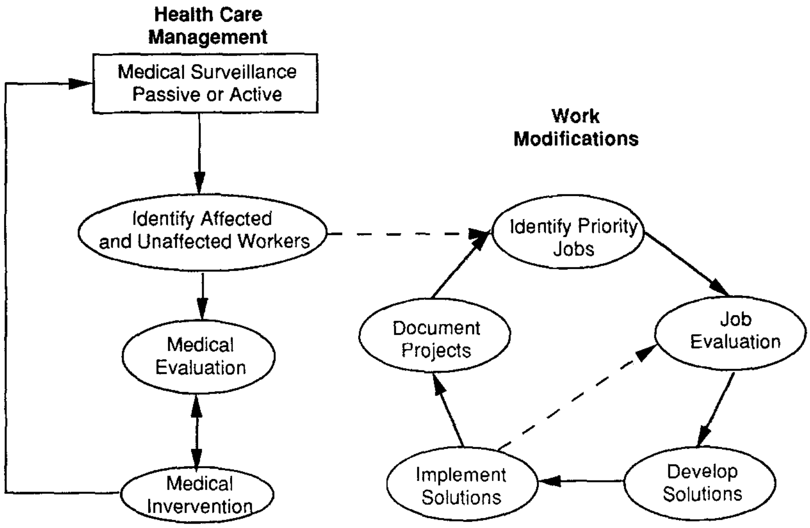

Fig. 1. Ergonomics control program.

important for the committee to document the projects they are tackling. If possible, ergonomic committees should keep both a written and a pictorial record of the workstations they have modified and the analysis that led to the changes. Modified workstations should be monitored and re-evaluated to determine if the originally identified ergonomic stresses were reduced or eliminated and that the modifications have not created any new stresses.

JOB EVALUATION

The procedure for job analysis that will be described below will help analysts identify ergonomic stress. Once the work elements that contain ergonomic stress are identified, the ergonomics committee can begin to develop workstation changes that will reduce or eliminate the stress. If previously injured workers are returning to the workplace, these same job analysis procedures can be used to identify jobs that contain stress that could potentially aggravate the previously injured body part of the returning worker.

Several pieces of equipment can be used to gather information about a job. A video camera and recorder can be used to make a video record of the job that can be used for later analyses, and that can serve as the focus point for the committee when they are discussing the job. Force measuring equipment, such as a spring scale, can be used to measure the weight of objects handled or lifted. A measuring tape can be used to determine workstation dimensions and/or reach distances.

Job Documentation

The purpose of the job documentation is to accurately describe the operation(s) that are going to be studied. The following information should be recorded:

1. *Job title or job name.* Record not only the name or title, but also include a job number and a pillar location or room number so the job can be easily and correctly identified.
2. *Work objective.* Describe the purpose of the job.
3. *Work standard.* Determine the production information, how much work is expected per unit of time (i.e., number of units per hour).
4. *Work tasks.* The groups of activities that must be performed to accomplish the work objective. Work tasks are not necessarily performed in the same order, and can be further divided into steps that are usually performed in the same sequence.
5. *Work method.* Describe the steps, or basic work elements, used to perform the job. Steps should be listed separately for the right and left hand, but one list is sufficient if the hands are symmetric.
6. *Work objects.* The objects on which work is performed (i.e., sub-assemblies, carcasses, software, etc.).
7. *Tools and equipment.* List the tools that are held or manipulated with the hand to do something to the work objects (i.e., screwdrivers), and other equipment that is part of the workstation (i.e., chair, work, bench, personal protective equipment, etc.).
8. *Work station information.* Draw a sketch of the workstation and work equipment including dimensions, or list the information with key dimensions indicated.
9. *Environmental conditions.* Note the physical characteristics of the room in which the work is performed (i.e., temperature, lighting, etc.).
10. *Worker attributes.* In order to generalize the workstation parameters to other potential workers, it is important to document the current worker's height, weight, age, dominant hand, time on the job, previous experience, and history of musculoskeletal disorders.

The analyst should not get bogged down in the documentation. The documentation is intended as a framework for helping the analyst collect information that will support the ergonomic assessment. Additional details can be added as necessary to support the ergonomic assessment and recommendations.

Ergonomic Assessment

After the details of the operation have been documented, the next step in job evaluation is to perform the ergonomic assessment. For the ergonomic assessment, the committee or analyst can determine if the operation contains any of the identified work-related risk factors of upper extremity cumulative trauma disorders. There are considerable data (7, 10–17) that has linked the following work-related risk factors to the development of CTDs:

- Repetitive and sustained exertions.
- Forceful exertions.
- Specific postures.
- Localized mechanical stress.
- Vibration.
- Low temperatures. Suggestions for evaluating each of these risk factors will be described below. Each of these factors can be evaluated objectively, and subjectively by the analyst or the worker.

Repetitive Exertions

The frequency of exertions can usually be determined from the work standard and work method. The work standard refers to the number of completed tasks or items that must be performed per hour. Based on the methods analysis, it is possible to determine the number of steps required to perform the required work on the work objects. Then, it is possible to calculate repetitiveness as the number of exertions per hour (i.e., tasks or units per hour × number of work objects × number of exertions per object). This objective measure of repetitiveness (i.e., the number) is useful for comparing similar types of jobs or the same job before and after changes, although it is not useful for comparing two grossly different jobs (i.e., keying vs. meat processing). For example, 20,000 exertions per day may be a lot for a person working in a meat processing plant, but not very much for a data entry operator.

Subjective methods can also be used to estimate the repetitiveness of a job. Often, there is not explicit work standard data available (i.e., office workers). Therefore, subjective ratings can be used. This approach draws on procedures used by industrial engineers who have historically done performance ratings (18). One method for rating the repetitiveness of a job is to estimate the duration of time that the hands are exerting force, and then to rate the repetitiveness of the job. Repetitiveness can be rated using the following categories defined as (19):

Very high. Body parts are in constant rapid motion. It is difficult to keep up.

High. Body parts are in rapid steady motion. If there are wasted motions or difficulty with equipment, the worker would immediately get behind.

Medium. Body parts are in steady motion, but the worker does not experience any difficult in keeping up with the required rate. There is some time for the worker to pause or rest briefly.

Low. Conspicuous pauses in each work cycle can be observed. For example, the worker may wait for machinery to cycle. There is no difficult keeping up with the required rate.

Very Low. The hands are idle most of the time. For example, the worker may only use the hands occasionally to remove defective parts.

Forceful Exertions

Forceful hand exertions are primarily related to the mass of work objects, tools, or body parts, to reaction forces from tools, and to friction. Forces can be increased when bulky, poor fitting, or stiff gloves are worn, and when working in specific postures. To document forceful exertions, first, it is necessary to review the work method and identify the work elements that involve hand exertions. Examples of forceful work elements include lifting or holding work objects, resisting tool reaction forces, and applying force to overcome resistance. Next, identify the work factors that affect the amount of force exerted, such as object weight, friction, hand posture, gloves, maintenance, and quality (i.e., fit of parts). Also, document the duration of the forceful exertions. Finally, estimate or rate the amount of force exerted through the use of electromyography, biomechanical analyses, or psychophysical measures (5, 7, 20-22). The NIOSH *Work Practices Guide for Manual Lifting* (13) can be used to analyze symmetric lifts.

Posture

Specific postures have been identified as stressful or awkward, but any posture can be stressful if it is maintained long enough. The identified stressful postures of the upper extremity include elevated elbows, reaching behind the torso, extreme elbow flexion, extreme forearm rotation, wrist deviation, wrist flexion, wrist hyperextension, and pinching (see Fig. 2) (3). Stressful postures for the low back are mild to severe forward flexion, extension, lateral bending, and twisting (5, 23). To assess postural stresses, first, identify the stressful postures and their corresponding work elements by observing the worker or a videotape of the worker. Next, identify the work factors that affect the stressful postures, such as tool shape, work location, or position of stock. Then, determine the frequency and duration of the stressful postures. Last, estimate or rate the severity of the identified postures by using psychophysical measures, posture analysis methods, or goniometers (5, 20, 23).

Localized Mechanical Stress

Mechanical stress is produced any time there is contact between or force exerted by an object or tool on a body tissue. Examples of mechanical stress include resting the forearms on a sharp work surface, using the palm of the hand as a hammer to position parts, or cutting stiff material with scissors. Mechanical stress is less severe when the contact is with a fleshy part of the body as opposed to an areas where nerves and tendons are near the surface. To analyze localized mechanical stress, it is necessary to first identify all contact points between the body and work objects, work surfaces, or tools for each work element. Next, determine the magnitude of mechanical stress by either quantitatively computing the contact stress (contact stress = force exerted/area over which the force is exerted), or by qualitatively describing the contact stress (i.e., the base of the tool's metal handles dig into the palm of the worker's hand) (19). Last, document the frequency and duration of the mechanical stress.

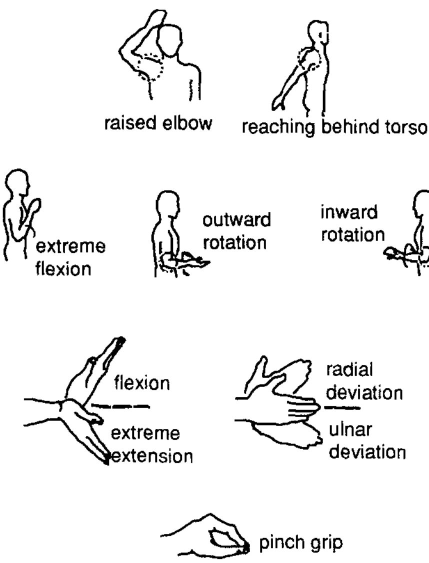

Fig. 2. Posture stresses of the upper extremity (from Ref. 3).

Vibration

Both whole-body and localized vibration exposure are related to the development of musculoskeletal disorders. Exposure to whole-body vibration can occur while driving motor vehicles or standing on vibrating floors. Localized vibration exposure often occurs while working with powered hand tools, hammers, or chisels (24). The following steps can be used to assess vibration exposure: (1) identify the work elements that contain vibration exposure, (2) identify any factors that affect vibration exposure, and (3) determine the frequency or duration of vibration exposure.

Low Temperatures

The thermal work environment is the last factor to analyze. Working in a cold environment, or exposing the hands to cold air (i.e., cold exhaust air from a pneumatic tool, or cold work materials) can lead to decreased manual dexterity and exerting more force than necessary. To identify work elements that expose the hands to cold temperatures, first, identify cold objects or materials that contact the body, especially the hands. Next, examine the factors that affect the temperature of the hand or other body part (i.e., gloves, clothing, thermal conductivity of materials or tools). Finally, determine the duration of exposure.

CASE EXAMPLES

Next, the job evaluation procedure outlined above will be used to analyze two jobs, a data entry operator and a manufacturing worker.

Data Entry Worker

Job Documentation

1. *Job title.* Data Entry Operator, Room 300.
2. *Work objective.* The workers enter the data from a source document into the computer via the keyboard.
3. *Work standard.* 5000–13,000 keystrokes per hour, with an average of approximately 8000 keystrokes per hour.
4. *Work tasks.* (a) Process the required information, and (b) request the next set of jobs from supervisor (2 to 3 times per day).
5. *Work method.* (a) Read information from source documents, (b) enter the data using the keyboard, and (c) request the next set of jobs from supervisor (2 to 3 times per day).
6. *Work objects.* (a) Computer software, (b) source documents, and (c) reference manual.
7. *Tools and equipment.* (a) Computer—Four Phase Model Number 7100, (b) keyboard, (c) monitor with anti-glare screen, (d) desk, (e) chair, and (f) row marker.
8. *Work station sketch* (see Fig. 3).
9. *Environmental conditions.* The office had indirect lighting through ceiling panels. Some of the ceiling panels provided less light or light with a pinkish tinge. Noise is not a problem and the temperature is comfortable.
10. *Worker attributes.* (a) Height—165 cm, (b) weight—57 kg, (c) age—32 years, (d) hand dominance—right, (e) time on job—3 years, (f) previous work experience—worked at a factory as an inspector for 5 years, and (g) history of musculoskeletal disorders—none.

Ergonomic Assessment

Repetitive exertions are certainly part of the data entry operator's job. In the work standard, it was noted that operators perform 5000–13,000 keystrokes per hour, with an average speed of 8000 keystrokes per hour. The first two work elements, reading the information from the source documents and entering the data, are repetitive tasks. The work station layout and work organization create sustained static postures of the forearms, hand, and neck while reading and entering the data. The overall rating for repetitiveness would be medium, because the hands are in steady motion, but the operators do not have difficulty keeping up. For data entry operators, approximately 8000–12,000 keystrokes/hour is considered an average pace.

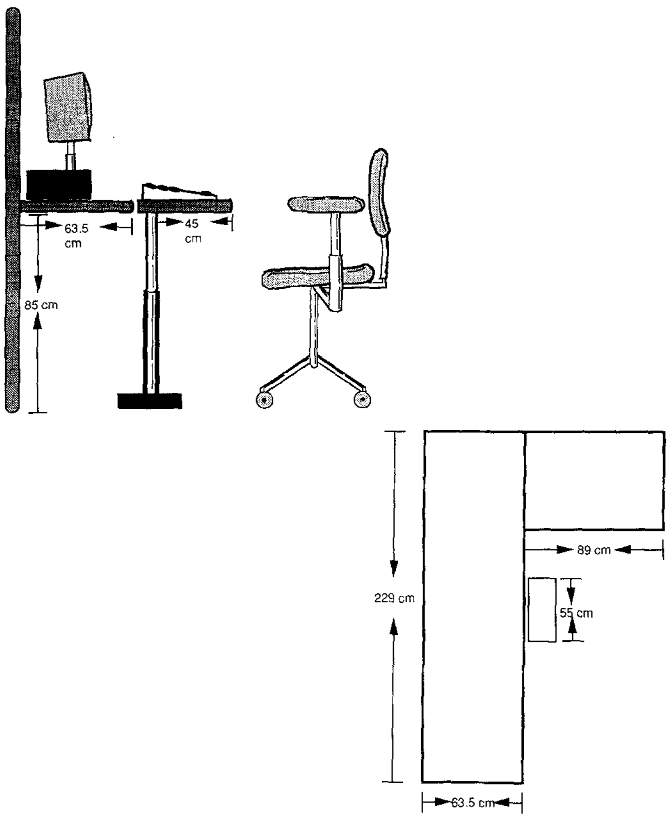

Fig. 3. Work station sketch for data entry worker.

Forceful exertions occur as the workers enter the data via the keyboard. Although, the forces necessary to press keys are very low, users generally exert more than the minimum required force. Stressful work postures can increase the force exerted. The duration of the forceful exertions is related to the number keystrokes. For this type of job, electromyography can be used to document the amount of force used to enter the data (25). However, in most cases it would be difficult to use electromyography, so alternatively, psychophysical measures can be used to document the amount of force the data entry operator exerts (26). The Borg rating of perceived exertion (22, 27) or visual analogue scales can be used to estimate the amount of force exerted (21). Visual analogue scales are generally 10 cm lines with verbal endpoints indicating two extremes (i.e., hardest imaginable work and easiest imaginable work). The user indicates his rating by simply drawing a line at that point on the 10-cm continuum which corresponds to his physical exertion. The analyst can then read off the rating (based on a 10-point scale) by placing a ruler over the line.

Specific *stressful postures* can be identified, but the data entry operator tends to sit in the same static postures for long periods of time, and those static postures can also cause problems. The stressful postures for each work element include: flexed and rotated neck to read the source documents that lay on the desk top, wrist extension while typing on the keyboard, and wrist extension while moving the row marker on the source documents. Next, the work factors that affect the stressful postures include: placement of the source documents on the desk top instead of on a document holder, the chair and desk height, and the keyboard height. The stressful postures occur for most of the workday, except when the operators have a break or are requesting new jobs from their supervisor (2 to 3 times per day). Either goniometers or psychophysical measures can be used to estimate the severity of postural stresses.

Localized mechanical stress can be found between the forearm and the desk edge, and between the wrist and the edge of the keyboard. The factors that affect mechanical stress for the data entry operator include: weight of the forearm and wrist, and the curvature of the desk top and keyboard. The duration of the mechanical stress can also be estimated. Of the 8-hour work day, 90 minutes is allotted for lunch and breaks, and 15 minutes is set aside to clean up at the end of the day. For approximately 78% of the day, the forearm and wrist is resting on the sharp desk edge and keyboard edge.

No significant exposure to vibration or low temperatures was observed for the data entry operator. Lighting can be improved by scheduling periodic cleaning of the light fixtures. Table I contains a summary of the ergonomic risk factors identified for this job.

Table I. Summary of the Ergonomic Risk Factors for the Data Entry Worker and the Auto Manufacturing Worker

Risk factor	Data entry worker	Auto manufacturing worker
Repetitive or sustained exertions	Average 8000 keystrokes per hour Rating: High	900 exertions per hour Rating: medium
Forceful exertions	Entering data via keyboard	Picking up and attaching door hinges
Specific postures	Right wrist extension Left wrist extension Neck flexion Neck rotation	Wrist flexion Elbow extension
Localized mechanical stress	Between forearm and desk Between wrist and keyboard	Between the fingers and hinges
Vibration	No exposure	Low torque tool used 50% of work cycle
Low temperatures	No exposure	Cold air from tool

Auto Manufacturing Worker

Job Documentation

1. *Job title.* Door Hinge Assembly, Pillar H-18.
2. *Work objective.* Attach door hinges to car body.
3. *Work standard.* 75 cars per hour, with four door hinges per car.
4. *Work tasks.* (a) Attach four hinges to each car body, and (b) arrange stock.
5. *Work method.* (a) Pick up four door hinges, (b) pick up bolts, (c) from outside the car, attach two front door hinges using bolts, (d) from inside the car, attach two front door hinges using bolts, (e) from outside the car, attach two rear door hinges using bolts, and (f) from outside the car, attach two rear door hinges using bolts.
6. *Work objects.* (a) Car body, (b) boxes of stock, (c) door hinges, and (d) bolts.
7. *Tools and equipment.* (a) Pistol shaped air-powered tool, (b) table for boxes of bolts, and (c) platform for door hinge stock.
8. *Work station sketch* (see Fig. 4).
9. *Environmental conditions.* Temperature ranged from approximately 20–29°C.
10. *Worker attributes.* (a) Height—175 cm, (b) weight—82 kg, (c) age—47 years, (d) hand dominance—right, (e) time on job—22 years, (f) previous work experience—worked as a hospital orderly for 6 years, and (g) history of musculoskeletal disorders—periodic episodes (1–2 times per year, for 1–2 weeks in duration) of low back pain.

Ergonomic Assessment

The *repetitiveness* of this operation can be determined from the work standard and method. For this job, each step in the work method requires two exertions, so there are 12 exertions to attach four door hinges (one work cycle). Consequently, there are 900 exertions per hour (12 exertions/car × 75 cars/hour). The operator carries the tool all day, so the duration of exertions is 99% for the tool hand and 85% for the non-tool hand. Overall, this job would be given a medium repetitiveness rating, because the operator is working steadily, and there is time to leisurely walk back to the next car.

Forceful exertions can be identified from the work method, and these include picking up and attaching the door hinges. The factors that affect the amount of force that is exerted include the weight of the metal door hinges (less than 1 kg), thin cotton gloves that the workers wore, and flexed wrist posture to attach the door hinges inside the car. Quality, maintenance, and low friction did not seem to be a problem. Forceful exertions occurred during approximately 50% of the work cycle.

It is possible to identify the *stressful postures* and their corresponding work elements by observing a few cycles of the operation. There is severe wrist flexion

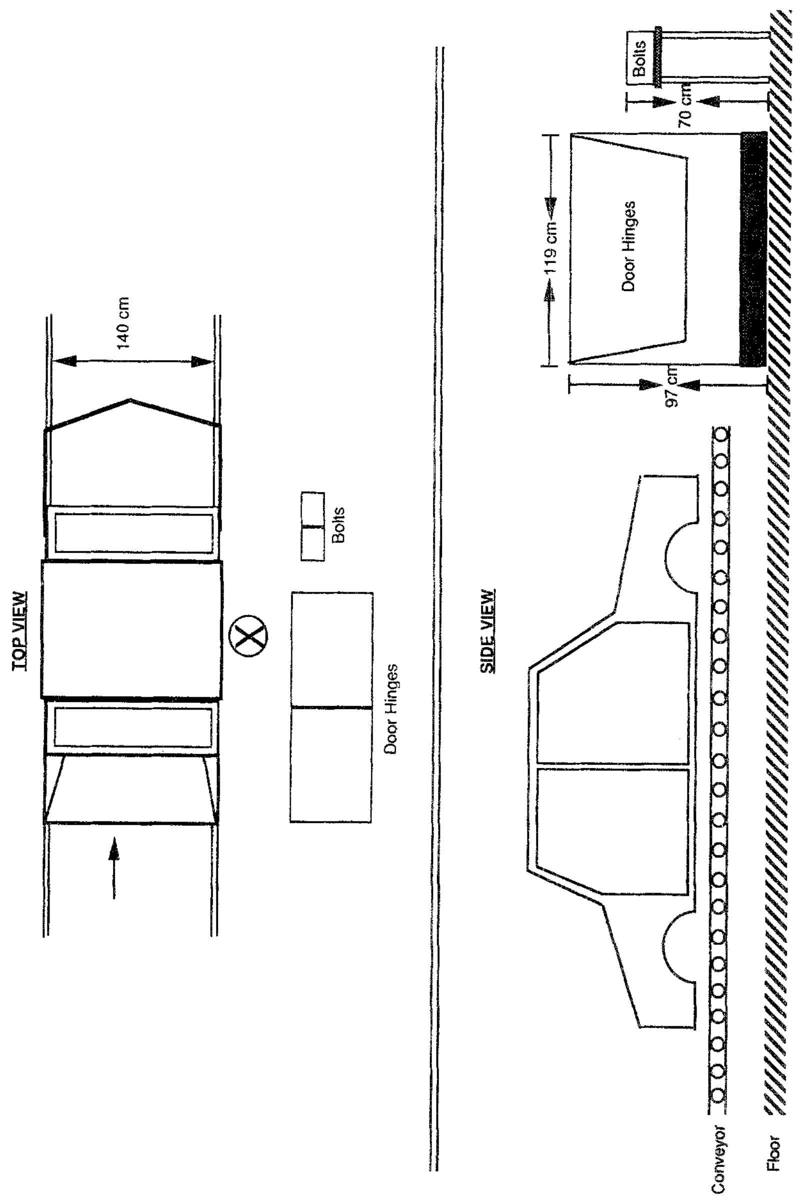

Fig 4. Work station sketch door hinge assembly.

and elbow extension when securing the door hinges inside of the car body while standing outside. The work factors that affect the stressful postures are the shape of the tool (pistol shaped) and the work location (inside the car body). Since four bolts are secured inside the car body per work cycle and there are 75 cars/hour, there are 300 stressful wrist postures per hour. The stressful postures occur during approximately 25% of the work cycle. Either goniometers or psychophysical measures can be used to estimate the severity of postural stresses.

Localized mechanical stress occurs between the fingers and the edges of the door hinges when the worker picks them up. But since the door hinges are less than 1 kg, this is probably not a problem.

Localized vibration exposure occurs when the worker is using the air-powered tool to drive the bolts and attach the door hinges. The torque of the tool is approximately 3.0 Nm. The tool is used for approximately 50% of the work cycle, and drives 600 bolts per hour (8 bolts/car × 75 cars/hour.).

No significant exposure to *low temperature* was observed for the production worker. Table I contains a summary of the ergonomic risk factors identified for this job.

PLACING RETURNING WORKERS: GUIDELINES FOR THE OCCUPATIONAL HEALTH NURSE

The information that is gathered during job evaluation can be used by the occupational health nurse to determine appropriate work assignments for workers who are returning to work after recovering from a musculoskeletal injury. Ideally, the occupational health nurse has received ergonomics training, understands and can perform a job evaluation, and is an active participant of the ergonomics committee. Then, the occupational health nurse has the knowledge or access to the resources so that operations within the facility can be evaluated. First, the occupational health nurse must review the returning worker's medical case, assess his/her condition, and determine the worker's capabilities and limitations. For example, wrist flexion and deviation have been linked to the development of carpal tunnel syndrome (15, 28). Although the returning worker can flex and bend his/her wrist, the returning worker should not be repeatedly exposed to the same stresses that caused the injury, and this would be considered a limitation. The occupational health nurse can develop a list of specific work conditions linked to musculoskeletal stress that should be avoided or reduced through accommodation of employees returning to work.

Next, potential jobs must be evaluated to document the presence and severity of ergonomic risk factors. Third, the occupational health nurse can compare the task demands and ergonomic risk factors that correspond to a job with the capabilities and limitations of the returning worker. Through this, the occupational health nurse can determine an appropriate work assignment for the returning worker. Last, the occupational health nurse must monitor the health of the returning worker by providing periodic physical exams and visiting the worksite to monitor any work methods or work station changes to confirm that there is still a match between the task demands and the worker's capabilities. The occupational health nurse is involved in the entire process of worker health assessment, job evaluation, job design, worker placement, work accommodation, and continual monitoring of worker health.

SUMMARY

Because work-related musculoskeletal disorders affect a large number of workers throughout a variety work settings, a framework for job evaluation was described. This framework should be used as part of an ergonomics control program. Job evaluation can be used to identify the ergonomic risk factors associated with an operation. The ergonomic risk factors of work-related musculoskeletal disorders which are identified during job evaluation include: repetitive exertions, forceful exertions, posture stresses, localized mechanical stress, exposure to low temperatures, and exposure to vibration. Once the risk factors of an operation have been identified, the ergonomics committee can use that information to develop solutions that will decrease the stress. In addition, health care professionals can use that information when matching up tasks demands with worker capabilities for workers who are returning to the workforce after an injury.

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