Subject: Ergonomics Program
Responsible Office: Safety & Mission Assurance Office

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PREFACE

P.1 PURPOSE

a. This Langley Research Center (LaRC) Procedural Requirements (LPR) sets forth the responsibilities and procedures for the LaRC Ergonomics Program and is part of the Center’s Safety Manual. The Safety and Mission Assurance Office (SMAO) is the LaRC contact for the Ergonomics Program.

b. The Ergonomics Program is designed to provide the framework for implementing a successful program for preventing and managing Musculoskeletal Disorders (MSDs).

P.2 APPLICABILITY

a. These procedural requirements are applicable to all LaRC facilities and employees. The requirements of this LPR are to be incorporated into any contract under which contractor employees will be assigned to on-site LaRC activities that may lead to the development of MSDs.

b. It is the responsibility of Contractors to provide and implement their own ergonomics programs. As a minimum, these contractor programs shall be in accordance with the LaRC Ergonomics program as described herein.

c. In this directive, all mandatory actions (i.e., requirements) are denoted by statements containing the term “shall.” The terms: “may” or “can” denote discretionary privilege or permission, “should” denotes a good practice and is recommended, but not required, “will” denotes expected outcome, and “are/is” denotes descriptive material.

d. In this directive, all document citations are assumed to be the latest version unless otherwise noted.

P.3 AUTHORITY


P.4 APPLICABLE DOCUMENTS AND FORMS

a. NASA Procedural Requirements (NPR) 1800.1, NASA Occupational Health Program Procedure

b. NPR 8715.1, NASA Occupational Safety and Health Programs

c. NPR 8715.3, NASA General Safety Program Requirements
d. Langley Procedural Document (LaPD) 1700.2, Safety Assignments and Responsibilities

e. Langley Management System Center Procedure (LMS-CP) 4760, Reporting Injuries, Illnesses, and Compensation Claims

f. National Institutes of Occupational Safety and Health, “Elements of Ergonomics Programs”

g. Langley Form (LF) 19, Office Ergonomics Evaluation Checklist

**P.5 MEASUREMENT/VERIFICATION**

LF 19 is used to gather data for determining compliance in assessing worksites and in coordinating with clinic personnel.

**P.6 CANCELLATION**


_/s/ Clayton P. Turner       June 20, 2017_  
Center Deputy Director   Date

**DISTRIBUTION**

Approved for public release via the Langley Management System; distribution is unlimited.
CHAPTER 1 - INTRODUCTION

1.1 Background

1.1.1 Every effort shall be made to ensure that the work environment affords the necessary protection against musculoskeletal disorders (MSDs). MSDs may develop in workers whose jobs involve repetitive motions, force, awkward postures, contact stress, cold temperatures, excessive duration, and vibration.

1.1.2 The principle behind ergonomics is that by fitting the job to the worker through adjusting the workstation, rotating between jobs, taking frequent breaks, or using mechanical assistive devices, MSDs can be reduced and ultimately eliminated.

1.1.3 The aim of this procedural requirement is to:

a. Identify work practices and operations that may lead to MSDs.

b. Prevent MSDs among employees.

c. Provide a work environment free from ergonomic hazards.

d. Give priority to engineering and administrative controls to the greatest extent practicable to eliminate, or control work operations that may lead to the development of MSDs.

1.1.4 Ergonomic-related injuries are usually associated with prolonged exposure to inappropriate work conditions or practices rather than acute exposure injuries such as sprains and strains.

1.2 Issuance and Control

1.2.1 The Safety and Facility Assurance Branch (SFAB) is responsible for the issuance, distribution, and control of these procedural requirements. Revisions shall be reviewed with affected organizations and documented on a Transmittal Notice.

1.3 Guidance, Definitions, and Terminology

1.3.1 Appendices A, “Definitions and Terminology”; B, “Acronyms”; and C, “Ergonomic Injuries and Their Symptoms,” are included to assist with these procedural requirements.
CHAPTER 2 - RESPONSIBILITIES

2.1 Ergonomics Program Officer (ErgPO)

2.1.1 The LaRC Industrial Hygienist is the ErgPO and is responsible for:

a. Implementing and administering the Ergonomics Program (EP).

b. Evaluating levels of employee exposure to ergonomic hazards and recommending means of controlling exposures.

c. Ensuring that personnel are instructed, individually or in groups, by knowledgeable personnel concerning the health hazards associated with repetitive motions, force, awkward postures, contact stress, cold temperatures, excessive duration, and vibration and methods to mitigate them.

d. Maintaining survey data relative to MSD hazards and employee exposures.

e. Conducting an annual review of the ergonomic program and implementing changes to ensure coverage of all potential ergonomic hazards.

f. Conferring with the Supervisor, the Office of Human Capital Management (OHCM), and the LaRC Chief Medical Officer about placement or reassignment of personnel when notification concerning an employee with a significant musculoskeletal disorder (MSD) is received from the Occupational Medicine Clinic (Health Clinic). Requests for reasonable accommodations will be addressed via provisions in NPR 3713.1, Reasonable Accommodations Procedures, and LMS-CP-3713, Reasonable Accommodations for Individuals with Disabilities.

g. Ensuring ergonomics consultative services are provided to Center personnel.

h. Ensuring worksite evaluations are scheduled and conducted.

i. Ensuring the employee’s supervisor is notified if a significant change in workstation layout is recommended

j. Conducting follow-up evaluations for personnel who have reported to the clinic for MSDs and for personnel who have modifications made to their work place in response to a MSD complaint.

k. Reviewing LaRC injury information to determine trending of ergonomic injuries.

2.2 Occupational Medicine Clinic (Health Clinic)

2.2.1 The Health Clinic is responsible for:

a. Obtaining work histories in support of the EP, and evaluating test results.

b. Scheduling and conducting appropriate medical examinations, and/or referring personnel to an appropriate medical consultant.
c. Notifying the employee’s supervisor if a change in job assignment or workstation layout is recommended as a result of a MSD.

d. Notifying and coordinating with the ErgPO when an employee reports with an MSD.

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2.3 Supervisors

2.3.1 Supervisors are responsible for:

a. Referring to the LaRC Health Clinic for examination personnel who have a potential MSD.

b. Ensuring that employees report to the LaRC Health Clinic any potential MSD.

c. Enforcing the wearing of personnel protective devices (such as vibration-dampening gloves, knee pads, and computer glasses) to reduce the effects of MSDs on the employee.

d. Reviewing employee work activities and identifying tasks or locations that may pose an MSD risk.

e. Abating identified MSD hazards.

f. Ensuring the procurement (including credit card purchases) of appropriate ergonomic related protective equipment and other ergonomic devices by obtaining the approval of the ErgPO.

g. Notifying the ErgPO of new or previously un-reviewed work activities that are likely to result in MSDs so that ergonomic assessments can be made.

h. Ensuring employees are aware of ergonomic hazards in their work area that could result in a MSD or requesting assistance from the ErgPo if they are unsure if ergonomic hazards are present.

2.4 Employees

2.4.1 Employees are responsible for:

a. Notifying their supervisor or the ErgPo of activities that may present a risk for MSDs.

b. Reporting to the clinic for evaluation if they believe they may be experiencing symptoms of a MSD.

c. Performing work using good ergonomic practices or requesting assistance from the ErgPo if they are unsure of proper workstation setup or good ergonomic work practices.
Chapter 3 - GUIDANCE

The recommendations for implementing the Ergonomics Program are presented in this chapter. The recommendations include training of supervisors and employees regarding common MSDs and the signs/symptoms of exposure, evaluating employee workstations for ergonomic hazards, use of ergonomic devices to reduce the likelihood and severity of MSDs, and recordkeeping.

3.1 MSD Hazard Evaluation

MSD hazard evaluation includes identifying workstation layout and work practices, which are likely to result in MSDs.

3.1.1 Work Station Evaluations

3.1.1.1 Any employee who is experiencing discomfort or is concerned about workstation setup may request an evaluation. Evaluations may also be requested by supervisors or by the LaRC Health Clinic in response to a suspected MSD. Workstation evaluations are performed by the ErgPO or their knowledgeable designee.

3.1.1.2 Copies of the results of evaluations, along with the recommended actions, shall be distributed to the employee, his or her supervisor, the Occupational Medicine Clinic (Health Clinic), and the ErgPO.

3.1.1.3 Employees are also encouraged to perform evaluations of their own workstations. (See LF 19.)

3.2 Office Environments

MSD-related injuries in the office environment are most often associated with poor workstation arrangement and excessive computer usage without taking breaks. These injuries can be prevented through proper workstation design and the use of micro-breaks.

3.2.1 Engineering Controls

3.2.1.1 Engineering controls are always the preferred method for controlling hazards. In office environments, the primary method of control is the selection of appropriate furniture and the proper position of the furniture and office equipment in relation to the worker.

3.2.1.2 The following describes the proper method for selection and use of office equipment:

a. Chairs. When purchasing chairs, the chair selected should be fitted to the individual who will be using it. In general, chairs should be highly adjustable, allowing
adjustment of the following: seat height and tilt, armrest height and width, and back rest height. Chairs being purchased to address ergonomic concerns should have good lumbar support, a five-point star base, and wheels appropriate for the floor surface. The chair height should be positioned so the occupant’s thighs are roughly parallel to the floor with the feet flat on the ground, preventing pressure on the back of the lower thigh. A footrest may be necessary to achieve proper positioning. If the seat tilt is adjustable, it should be set for a slight forward tilt. The back height and angle should be set to provide good lumbar support. The armrests should be set so the elbows are directly below the shoulders. Existing chairs will be used until unserviceable unless there are indications that their use will lead to an MSD.

b. Work Surfaces. Work surfaces should be of a height such that the worker’s forearms are roughly parallel to the floor and deep enough to accommodate all necessary equipment such as monitors and keyboards. Additionally, the working position should not require the worker’s forearms or wrists to contact any sharp corners. Articulated keyboard trays can be used to provide adjustability to workstations. An adjustable height desk can provide the worker with the flexibility to sit or stand when desired and still be able to be productive.

c. When non-standard ergonomic furniture is needed, such as an adjustable height desk, and the cost exceeds $600, additional justification is required before the furniture can be approved. The process for initiating the justification is as follows:

(1) The employee shall notify their supervisors of their concerns.

(2) The employee shall obtain medical documentation, either from the LaRC Clinic or from a private physician, to determine if the conditions warrant the purchase of the furniture. The medical documentation shall be provided to the LaRC Occupational Medicine Clinic for retention in the employee’s medical file.

(3) Request an ergonomic evaluation from the ErgPo.

d. When non-standard furniture is needed, such as an adjustable height desk, and the cost is less than $600, the process is as follows:

(1) The employee shall notify their supervisors of their concerns.

(2) The employee shall request an ergonomic evaluation from the ErgPo.

e. Computer Input Devices:

(1) Keyboards should be located directly in front of the worker at a height allowing their forearms to be roughly parallel to the floor. In addition, the angle of the keyboard should allow the wrists to maintain a neutral position. In general, this means the keyboard should not be tilted toward the worker and may in fact need to be tilted slightly away from the worker.

(2) Computer mice and trackballs should be positioned so the worker can use them without having to reach with the shoulder. Mice should be of a size that
comfortably fits in the palm of the hand. Mice should not require the user to grip them tightly in order to use them.

(3) Wrist rests may be used with both keyboards and mice/trackballs. The hands should float above the keyboard, and the wrist rests should be used during periods of inactivity.

f. Computer Monitors. Computer monitors should be positioned directly in front of the worker. The height of the monitor should be set so that the top third of the monitor is at the height of level vision. The distance of the monitor should generally be at about the end of arm’s reach when sitting in working position or what best suits the vision of the user. To avoid glare, monitors should be positioned perpendicular to windows.

g. Lighting. Room lighting should be bright enough to prevent eyestrain. Computer monitors should be positioned to eliminate glare from overhead lighting or windows. Individual bulbs may be removed from overhead lights to control lighting intensity and glare. The use of task lighting is effective for creating areas of localized lighting without increasing the overall brightness of a room.

h. Vision

(1) Vision is an often-overlooked factor in office ergonomics. Prolonged computer usage without taking frequent breaks can cause eyestrain. Frequent “micro-breaks” are recommended, in which the worker simply changes depth of focus for a short period of time.

(2) Workers who wear corrective lenses for vision are at additional risk due to the difference in reading and computer monitor distances. The focal length for most reading eyewear is set to approximately 18 inches. Since computer monitors are usually set at farther distances, this can cause eyestrain, and in many cases causes the worker to unconsciously hunch forward in order to find their focal length. This can result in neck and shoulder strain. Eyewear can be obtained with the correct focal length for computer use. Bifocal glasses users should position the computer monitor appropriately to take advantage of the reading portion of the glasses.

3.2.2 Administrative Controls

3.2.2.1 Administrative control measures include:

a. Breaks. Taking frequent breaks is perhaps one of the easiest ways to prevent injuries associated with prolonged computer usage. A break of a few minutes should be taken frequently, i.e., 5 minutes every hour. Studies have shown that it is effective in preventing injury and that productivity and accuracy are actually improved as a result of frequent breaks.
b. Equipment. Equipment, such as braces, should not be used unless recommended by a medical professional. Do not attempt to treat symptoms yourself by buying over-the-counter braces or splints. Improper selection of protective equipment can encourage continuing poor work practices and lead to further injury. Report any symptoms of MSDs to the clinic.

3.3 Industrial Environments

3.3.1 MSD injuries in industrial environments can occur from improper lifting and material movement techniques, from performing repetitive tasks, and from using hand tools. As each industrial environment is unique, only general guidance can be provided regarding evaluation of these types of worksites.

3.3.1.1 Engineering Controls. The use of engineering controls is always the preferred method to control hazards. The primary engineering controls for an industrial setting are the use of proper material handling equipment and design of work areas to prevent awkward or stressful positions or motions. The selection of ergonomically designed hand tools is also important.

3.3.1.2 Material Handling

3.3.1.2.1 The selection of proper handling equipment can be complex and should be made in consultation with knowledgeable personnel. Situations in which material-handling aids should be considered include the movement of large, heavy or awkwardly shaped items, and work environments where employees repeatedly perform lifts. Manual lifting requirements are discussed in Section 3.3.1.5 a.

3.3.1.2.2 Common material handling equipment includes pallet jacks, pump-jack tables and mechanical lifting aids, such as vacuum lift assist devices.

3.3.1.3 Work Area Design

3.3.1.3.1 When designing industrial work areas, the types of tasks to be performed should be considered. Shelves and parts bins should be placed at heights that keep loads at the proper working height and do not require excessive reaching, and the active working area should be directly in front of the worker.

3.3.1.3.2 Work surfaces, such as benches, should also be kept at heights consistent with the working position of the employee (e.g., sitting or standing). Standing work locations should have floor mats and stools to increase worker comfort.

3.3.1.4 Tool Selection

3.3.1.4.1 Selecting appropriate hand tools can greatly increase worker comfort and prevent injuries associated with gripping small objects. Tool handles should allow workers to keep a neutral position during use and be large enough to grip comfortably.
Hand tools should be well balanced to reduce the amount of torque on the wrist. Do not use tools with finger grooves molded into them; there is no standard hand or finger size and these tools are likely to cause unnecessary pressure from the grooves.

3.3.1.4.2 Vibrating power tools have the ability to cause nerve injury. Whenever possible, tools with built-in vibration dampeners should be selected. Tool handles should be comfortable to grip and padded when possible. Tool handles should also be set at an angle consistent with their use position. As an example, consider installing screws: To install screws vertically above waist level, using an electric screwdriver with a handle that is on the same plane as the screw will allow the wrist to maintain a neutral position.

3.3.1.5 Administrative controls. Administrative controls include:

a. Lifting Techniques

(1) When lifting objects, care should be taken to use proper lifting techniques in order to avoid back injuries. More than one person should lift objects that weigh more than 40 pounds, are large, or are awkwardly shaped.

(2) If lifting from the ground, start the lift in a squatting position with the item between the knees. Use handles if provided, otherwise position the hands in locations that will provide adequate support. Pick the item up off the ground and straighten the legs, keeping the back straight. Keep the item as close to the body as possible and at about waist level while moving it.

(3) When moving items from elevated surfaces, ensure that the lift starts as close to the body as possible and do not twist the body while lifting.

b. Rotation of Duties. Rotate lifting duties among personnel who are physically capable of performing the lifts.

c. Protective Equipment. The use of protective equipment, such as back braces or lifting belts, is not recommended by NIOSH and should not be used unless recommended by a medical professional.

3.4 Laboratory Environments

3.4.1 Laboratory environments present some unique challenges that must be addressed on a case-by-case basis. In most cases they can be considered to be a combination of office and industrial environments, and the principles previously described can be applied.

3.5 Non-Workplace Environments

3.5.1 MSDs occur as a result of chronic exposure to improper working positions or techniques. Many people engage in activities outside the workplace that can pose
ergonomic risks. Examples include: computer use, painting and drawing, woodworking, working on automobiles and other mechanical equipment, and gardening. It is important to note that these exposures are additive to exposure at work. This can even lead to personnel having a MSD injury that is difficult to diagnose and correct since the exposure condition may not occur in the workplace.

3.5.2 The principles used to prevent MSD injuries at work also apply to non-work settings.

3.6 Training

3.6.1 On-line training programs and site-specific training by Safety and Facility Assurance Branch (SFAB) personnel are available. Training includes the following:

a. Common MSDs
b. Signs and symptoms of MSDs
c. Correct workplace design and proper work habits

3.7 Additional Information

3.7.1 The Internet contains many resources regarding ergonomics, some of which are high quality and some of which are not. The following sites have been evaluated and are recommended resources:

a. Occupational Safety and Health Administration (OSHA):
   http://www.osha.gov/SLTC/ergonomics/

b. National Institute for Occupational Safety and Health (NIOSH):
   www.cdc.gov/niosh/homepage.html

c. Repetitive Stress Injury Information: www.MSDnews.com/

d. University of California at Los Angeles Ergonomics Program:
   www.ergonomics.ucla.edu

e. Cornell University Ergonomics Web: http://ergo.human.cornell.edu/

f. United States Army Center for Health Promotion and Preventive Medicine (USACHPPM) Ergonomics Program:

g. Department of Defense Ergonomics Working Group:
   http://www.denix.osd.mil/ergoworkinggroup/
APPENDIX A – DEFINITIONS AND TERMINOLOGY

Cold Temperatures - reduce blood flow throughout the body and decreases tactile feedback. Reduced blood flow minimizes the nutrients that travel to the muscles. Reduced tactile feedback will cause the hands to work harder than they have to.

Compression/Contact Stress - any outside object coming into contact with the body causes compression. Items such as a hard edge, sharp surface, corner, or excessive weight can cause damage to the body’s soft tissues (nerves, tendons, blood vessels, etc.).

Duration - the length of any period of work activity which poses a MSD risk. The longer the duration of a task, the greater the exposure and risk of an MSD.

Ergonomics - the application of knowledge about human capacities and limitations to the design of workplaces, jobs, tasks, tools, equipment, and the environment.

Frequency - the rate at which specific physical motions or exertions are repeated.

Force - physical exertion by or pressure applied to any part of the body to move, direct, or operate equipment. The less force required to operate equipment the less traumatic it is to the body. Ideally we want all systems to require a minimum of force.

Musculoskeletal disorders (MSDs) - disorders caused by improper job, tool, and workstation design, by application of excessive force on the body, or by unusual postures. In general, the term MSD applies only to injuries received from chronic exposure rather than to acute injuries such as strains and sprains. Other terms commonly associated with MSD are Cumulative Trauma Disorder (CTD) and Repetitive Stress Injury (RSI).

Posture - the position of any part of the body during a work activity. Neutral postures are important because they maximize the amount of strength a worker can exert, maximize comfort, and minimize the risk of injury.

Repetition - Repetition or use of the same body parts continuously throughout the workday is damaging to the body. Micro-traumas from repetition can result in inflammation of the tendons, muscle irritation or entrapment syndromes, and nerve irritation. Prolonged exposure to repetitive motions can result in even more traumatic injuries.

Segmental Vibration - Segmental vibration affects a part of the body. The most common type of segmental vibration is hand-arm; it is usually caused by a worker holding a vibrating hand tool for a long period of time. This action causes reduced blood flow to the fingers and can lead to blanching of the fingers.

Whole Body Vibration - Whole body vibration often occurs while standing or seated in vibrating environments, such as trucks or heavy machinery. It contributes to low back pain and is a major source of lost time in occupational environments.
# Appendix B – ACRONYMS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>EP</td>
<td>Ergonomics Program</td>
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<tr>
<td>ErgPO</td>
<td>Ergonomics Program Officer</td>
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<tr>
<td>LaRC</td>
<td>NASA Langley Research Center</td>
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<tr>
<td>MSD</td>
<td>Musculoskeletal disorder</td>
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<tr>
<td>OHCM</td>
<td>Office of Human Capital Management</td>
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<tr>
<td>OMC</td>
<td>Occupational Medicine Clinic</td>
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<tr>
<td>PPE</td>
<td>Personal Protective Equipment</td>
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<tr>
<td>SFAB</td>
<td>Safety and Facility Assurance Branch</td>
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</table>
Appendix C – Ergonomics Injuries and Their Symptoms

The following are common ergonomic injuries and their common symptoms. This list is not exhaustive and **should not** be used for self-diagnosis of an injury. It is merely a guide to understanding the warning signs of MSDs. Individuals experiencing symptoms should seek professional medical advice.

<table>
<thead>
<tr>
<th>Injury</th>
<th>Symptoms</th>
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<tbody>
<tr>
<td>Carpal tunnel syndrome</td>
<td>Symptoms include tingling, numbness, and burning sensation in the thumb, index and/or middle finger. Aching sensation and wrist pain (often at night) are common. Caused by compression of the median nerve, which runs through the middle of the wrist.</td>
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<tr>
<td>Tendonitis</td>
<td>Symptoms include pain, tenderness, swelling and/or weakness of the hand, arm or shoulder. Redness of the hand or wrist may also occur. Caused by the tendons of the wrists, hands, or shoulder becoming inflamed from overstretching or constriction.</td>
</tr>
<tr>
<td>Tenosynovitis</td>
<td>Symptoms include swelling, pain and/or tenderness of the hand. Caused by inflammation of the tendon and the sheath that it passes through.</td>
</tr>
<tr>
<td>De Quervain’s disease</td>
<td>A progressive constriction of the tendon sheath, affecting the tendons on the side of the wrist and base of the thumb. Symptoms include pain and difficulty in moving the thumb.</td>
</tr>
<tr>
<td>Rotator cuff injury</td>
<td>Symptoms include pain and limited mobility of the shoulder. Caused by inflammation of one or more of the rotator cuff tendons in the shoulder.</td>
</tr>
<tr>
<td>Raynaud’s syndrome (White finger)</td>
<td>Symptoms include paleness, tingling or burning sensation in the fingers. Caused by damage to blood vessels in the finger from use of vibrating tools, especially in cold climates.</td>
</tr>
<tr>
<td>Epicondylitis (Tennis elbow)</td>
<td>Tendonitis of the elbow. Symptoms include pain, swelling and/reduced mobility of the elbow.</td>
</tr>
<tr>
<td>Trigger finger</td>
<td>Swelling in the tendon sheaths of the finger causes the tendon to lock in the sheath, which results in a snapping or jerking movement when attempting to move the finger.</td>
</tr>
<tr>
<td>Synovitis</td>
<td>Swelling of the bursae (fluid filled sacs used to cushion movement) in the knee, elbow, or shoulder.</td>
</tr>
<tr>
<td>Back Injuries</td>
<td>Static postures can add a tremendous amount of pressure to the back muscles and spinal discs. Sitting in a slouched position can overstretch the spinal ligaments and strain the spinal discs. A load that slips or shifts as it is being lifted or a slip and fall can jolt the back, with resulting muscle strain or tearing of soft tissue.</td>
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</tbody>
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