

# OFFICE ERGONOMICS

Live Interactive Webinar

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## OVERVIEW OF COURSE

This course examines the risk factors for development of musculoskeletal disorders in the office environment. Injury risk assessment tools, ergonomic assessment procedures, and environmental modifications are explored.

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## COURSE RATIONALE

The purpose of this course is to enhance the clinician's ability to identify and suggest ergonomic modifications to the office/computer workstation to minimize risk of injury. Determining the best method of patient education to encourage implementation of environmental modifications will facilitate improved outcomes.

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## GOALS AND OBJECTIVES

1. Summarize the potential impact of ergonomic injuries on absenteeism and productivity.
2. Compare methods of screening for occupational injury risk.
3. Describe the domains of ergonomic intervention programs including organizational, cognitive, and physical environments.
4. Identify the types and prevalence of musculoskeletal disorders in the office environment.
5. Identify the biomechanics and physiology of musculoskeletal disorder development.
6. Describe the components of a workplace assessment.
7. Determine the specific components of an ergonomically designed office/computer worker work station.
8. Identify modifications to alleviate cumulative trauma in the office/computer station environment.
9. Discuss the benefits of postural variability and reception of occupational sedentary behavior.
10. Compare the effectiveness of various ergonomic education strategies on reducing musculoskeletal disorders.

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## COURSE OUTLINE/SCHEDULE 3 HOUR LIVE INTERACTIVE WEBINAR

Topic	Time
Impact of Ergonomics	0:00-0:15
Work Related Musculoskeletal Disorders	0:16-0:25
Ergonomic Analysis Tools	0:26-0:40
Injury Prevention Programs	0:41-0:50
<b>Interactive Discussion of Clinical Applications</b>	<b>0:51-0:60</b>
<b>Workspace Assessment</b>	<b>1:01-1:05</b>
Seating	1:06-1:15
Monitor	1:16-1:25
Keyboard/Mouse	1:26-1:35
Work Accessories	1:36-1:45
Desk	1:46-1:50
<b>Interactive Discussion of Clinical Applications</b>	<b>1:51-2:00</b>
<b>Ergonomic Modifications</b>	<b>2:01-2:05</b>
Neck/Shoulder Discomfort	2:06-2:15
Back Discomfort	2:16-2:20
Wrist/Hand Discomfort	2:21-2:25
Eye Strain	2:26-2:30
Postural Variability	2:31-2:40
Education Strategies	2:41-2:50
<b>Interactive Discussion of Clinical Applications</b>	<b>2:51-3:00</b>

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## ERGONOMICS

- Ergonomics is the practice of designing equipment and work tasks to conform to the capability of the worker, it provides a means for **adjusting the work environment and work practices to prevent injuries** before they occur.

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## IMPACT OF EROGONMICS

- Poor ergonomic design of office/computer workstations can contribute to the development of musculoskeletal disorders resulting in reduced productivity, absenteeism, and diminished work performance.

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## WORK RELATED MUSCULOSKELETAL DISORDERS (MSDs)

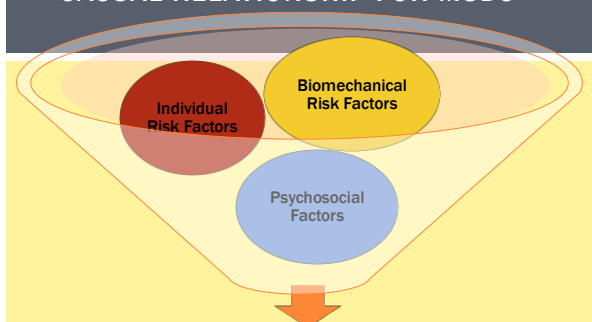
- According to the US Department of Labor “*Work-related musculoskeletal disorders are a leading cause of pain, suffering, and disability in American workplaces.*” \*
- Nearly half of work related musculoskeletal disorders occur in the manufacturing or service industry, but office worker injuries have a significant economic impact.

[https://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=UNIFIED\\_AGENDA&p\\_id=4481](https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=UNIFIED_AGENDA&p_id=4481)

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## CAUSAL RELATIONSHIP FOR MSDs



**Musculoskeletal Disorders**  
Repetitive Trauma, Overuse, Cumulative Trauma, Repetitive Strain

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## PSYCHOSOCIAL FACTORS

- Psychological factors which can negatively impact pain symptoms and increase injury incidence:



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## BIOMECHANICAL RISK FACTORS

- Biomechanical factors identified as the “nature of injury” for musculoskeletal injuries in the office setting fall into the following categories:
  - Awkward Posture
  - Excessive Repetition
  - Forceful Exertions
  - Cold Temperatures

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## BIOMECHANICAL RISK FACTORS

- **Awkward Posture**
  - Repetitive or sustained awkward postures place excessive force on joints and overload surrounding musculature.
  - Consider localized pressure on body segments through mechanical contact stress.

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## BIOMECHANICAL FACTORS CONT.

- **Excessive Repetition**
  - High task repetition is considered a repetitive cycle time of 30 seconds or less
  - Exacerbated by increased job specialization and increased pace of work.

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## BIOMECHANICAL FACTORS CONT.

- **Forceful Exertions**
  - Increased muscle effort to produce high force induces fatigue.
  - Adjustment of equipment to support and distribute loads is important.
  - Consider grasping force contribution to tissue ischemia and decreased nerve conduction.

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## ERGONOMIC ANALYSIS TOOLS

- The goal of assessment tools is to identify and quantify the risk as well as problems and opportunities for improvement of task performance and environmental modifications.

Picture Based

- Rapid Office Strain Assessment ROSA
- Rapid Upper Limb Assessment RULA
- Rapid Entire Body Assessment REBA

Checklist or Scale Based

- Draft Ergonomic Practice Checklist
- Finnish Method
- Rodgers Muscle Fatigue Analysis
- ACGIH Hand Activity Level (HAL) TLV
- Strain Index

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## RAPID OFFICE STRAIN ASSESSMENT ROSA

- Designed specifically to assess office ergonomics the tool evaluates the user's posture in relation to the chair, monitor, keyboard/mouse, and telephone.
- Total scoring ranges from 1-10.
  - 5 or greater indicates an action level with high risk and further workstation assessment required for modification.

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## RAPID UPPER LIMB ASSESSMENT (RULA)

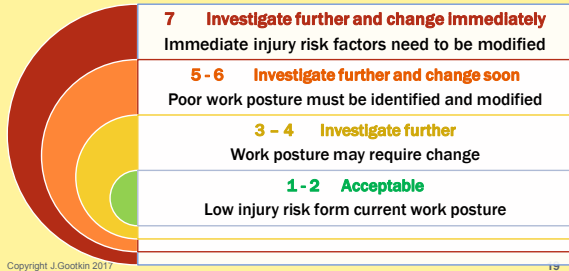
- This screening tool assesses postural loading particularly on the neck, trunk, and upper limbs to estimate the risk for developing repetitive strain injuries of the upper extremity.
- Combination of Arm/Wrist and Neck/Trunk posture, duration of task, and force utilized to determine risk score ranging from 1-7.

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## RULA SCORING

- Scoring considers urgency of intervention to reduce injury to assign hazard levels.



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## RAPID ENTIRE BODY ASSESSMENT REBA

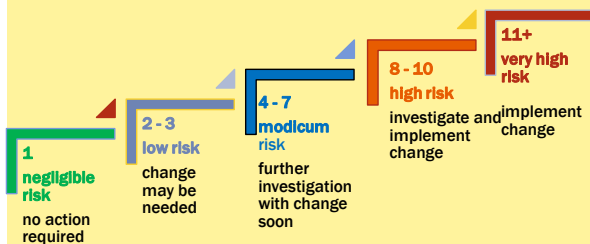
- Analyzes posture in unpredictable working environments examining individual body segments.
- Considers muscle activity in static, dynamic, changing or unstable postures to determine level of action required to address injury risk.

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## REBA SCORING

- Scoring generates hazard risk for musculoskeletal disorders.



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## DRAFT ERGONOMIC PRACTICE CHECKLIST

- This 43 item checklist was developed specifically for use with computer professionals by a panel of experts including orthopedic surgeons, physical therapists and a psychiatrist.
- The tool assesses working posture, chair and component features in addition to rest breaks.

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## FINNISH METHOD

- This checklist utilizes a three point ranking system of a dozen items including working space, equipment, lighting, thermal and acoustic environment.
- Health risks are scored as unremarkable, moderate, or intolerable to identify areas requiring modification.

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## RODGERS MUSCLE FATIGUE ANALYSIS

- The tool assesses level of muscle fatigue accumulates during various work activities within 5 minutes.
- It is designed to analyze tasks performed for more than an hour in an awkward posture or when repetitive motion is required.
- Calculating effort level, duration, and frequency total scoring prioritizes task to change.

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## ACGIH HAND ACTIVITY LEVEL (HAL) TLV

- This tool was developed to assess the risk of hand, wrist, or forearm injury of job tasks repeating the same set of motions or exertions for longer than 4 hours per day.
- Scoring incorporates frequency of exertion on VAS and peak force on Borg to generate an action level for activity modification.

Below Action Limit	Maintain
Above Action Limit & Below TLV	Slightly elevated risk of MSDs. Control measures, including surveillance, are recommended.
Above TLV	Significantly elevated risk of MSDs. Appropriate control measures should be utilized.

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## STRAIN INDEX

- Solely designed to assess the risk for developing distal upper extremity musculoskeletal disorders examining intensity, duration, frequency, speed of duration in addition to wrist posture, and duration of the task per day.
- Mathematical multipliers are utilized to generate the score with a higher score associated with increased risk of developing musculoskeletal disorders.



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## INJURY PREVENTION PROGRAMS

- A multifaceted employer program incorporates the following elements:

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## ERGONOMIC PROGRAM: ENGINEERING CONTROLS

- Modifications are made to the physical environment to reduce or eliminate the hazard from the task in a proactive manner.
- OSHA provides guidelines for many industries <https://www.osha.gov/SLTC/ergonomics/controlhazards.html>
- Changing philosophy to reduce work-related injury:

*“Designing the job to fit the worker, rather than physically forcing the worker’s body to fit the job.”*

OSHA, 3125. 2000. Ergonomics: Department of Labor, 11.The Study of Work, U.S

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## ERGONOMIC PROGRAM: ADMINISTRATIVE CONTROLS

- Alterations to workplace procedures related to work practices are aimed at minimizing exposure risks.
- Examples include:
  - Employee training on workstation assessment/modification and early reporting of musculoskeletal symptoms.
  - Alterations to work tasks and shift break policies.

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## ERGONOMIC PROGRAM: PERSONAL PROTECTIVE EQUIPMENT

- The use of equipment to reduce exposure to ergonomic-related risk factors is not typical in the office workstation environment.
- For non-traditional computer stations, consider the impact of vibration and noise exposure.

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## WORKER SELF ASSESSMENT

- Self evaluation of workspace can reduce time and cost, but the worker requires education to perform the analysis accurately.
  - Underestimating of risk factors with ROSA may occur impacting scoring.
  - Minor alterations in RULA and REBA posture assessment significantly impact hazard levels.

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## WORKER SELF ASSESSMENT

- To facilitate modifications, checklists of specific features may be most beneficial.
- OSHA provides an online or print workspace checklist and equipment purchasing guide.
  - <https://www.osha.gov/SLTC/etools/computer-workstations/checklist.html>

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## WORKSTATION BASICS

- Is this a shared space?
  - Workstation equipment must be flexible allowing adjustment for various shapes and sizes of individual workers.
- What kind of computer will be utilized?
  - Desktop computers require sufficient space for monitor and keyboard.
  - Laptops often required docking stations, and external monitors/keyboards to achieve neutral posture.

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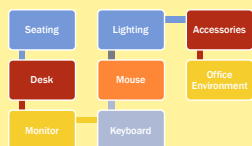
## GENERAL CONCEPT

- Holding joints in non-neutral positions particularly near end range, places additional demands on muscles leading to fatigue, imbalance, and additional stress elsewhere in the body.

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## COMPONENTS TO ASSESS



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## CHAIR SPECIFICATIONS

- The minimum features that an adjustable desk chair should have include:
  - 5 caster base
  - Easy to reach controls
  - Waterfall front edge
  - Height, tils, back, seat adjustable
  - Lumbar support
  - Padded, adjustable, removable arms

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## SEAT HEIGHT

- Neutral sitting posture is desired with thighs parallel to the floor and knees at approximately 90 degrees.
  - Buttock height can be slightly higher than knees with legs vertical.
- Feet should be flat on the floor with ankles in neutral DF/PF.

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## SEAT HEIGHT CONT.

- If the feet are not touching the floor, the seat is too high.
- If knees are higher than hips, seat is too low.

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## SEAT BACK

- Lumbar lordosis should be maintained with upper torso relaxed against the chair backrest.
- Features should include adjustable lumbar support and reclining option.

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## SEAT RECLINE

- A 15 degree recline adjustment from vertical with locking option and/or tension control supports trunk motion.
  - Avoid reclining greater than 120 - 130 degrees.

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## SEAT PAN DEPTH

- Seat depth avoids pressure in the popliteal area with a 2 - 3 inch space between the back of the knee and the front of the seat pan.
  - Especially for shorter individuals.
- A waterfall edge is preferred

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## SEAT PAN DEPTH CONT.

- Adjust the seat depth to avoid excessive pressure on the posterior thigh if too short for taller individuals.

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## SEAT PAN DEPTH CONT.

- Adjust the seat depth to avoid excessive pressure on the posterior thigh if too short for taller individuals.

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## ARMRESTS

- Improve posture reducing muscle fatigue
- Promote freedom of movement
- Stabilize position
- Reduce muscle loads on neck, shoulder, arms
- Reduce pressure on spine
- Distribute pressure on seat
- Support sit to stand
- Support task related movements

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## ARMREST HEIGHT

- Arms should be symmetrically supported allowing upright posture with elbows at 90 - 110 degrees of flexion with shoulders relaxed.

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## ARMREST WIDTH

- Pivoting the armrest allows support of arms in wider range of work postures
- Shoulder strain is reduced if arm cap can be placed directly under the arm.
  - Typically 4 inches wider than seat

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## MONITOR

- Monitor should be in front of the user.
- If not possible, not greater than 30 - 35 degrees to the right or left.

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## MONITOR DISTANCE

- Monitor should be at a centered position 18 - 40 inches from the individual to maintain neutral cervical spine.
- Monitors larger than 17 inches should be further away.

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## MONITOR HEIGHT

- The monitor should be adjusted so the top edge of the screen is at or just below eye level.
- The center of the monitor should be about 10 – 20 degrees below the horizontal line of sight.

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## MONITOR HEIGHT

Lower monitor height for bifocals, trifocal, or progressive lenses.

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## MONITOR TILT

- The top of the monitor should be tilted slightly further away from the eyes than the bottom by 10 – 20 degrees to keep the monitor perpendicular to the natural gaze.

Tilting down reduces eye fatigue from glare.

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## SCREEN COLORS

- Dark letters on a light background reduce eye fatigue and headaches.

It is easier to read this?

It is easier to read this?

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## NATURAL LIGHTING

- Glare must be minimized to avoid eye strain.
- Place monitor so that the sunlight is not projected directly into the field of view and utilize window treatments.

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## NATURAL LIGHTING CONT.

- Place monitors at right angles to windows and direct lighting sources to minimize glare.
- Curved screens do not allow full elimination of reflections because they can't avoid lights/windows.

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## AMBIENT LIGHTING

- Ceiling lights should be positioned parallel to the individual's line of sight.
- Decrease fluorescent ceiling lighting with egg crates or louvers to limit luminance.



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## GLARE

- If other modifications are not effective, an antiglare screen on the monitor may assist.
- Wall paint color of a medium tone matte finish reduces glare.

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## KEYBOARD POSITIONING

- QWERTY portion of keyboard should be centered in front of user and monitor.
- It should not require excessive forward flexion of trunk or shoulder, or elbow extension to reach the keyboard.
- Visibility of keys may be necessary for hunting and pecking.

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## KEYBOARD HEIGHT

- Ensure clearance between keyboard tray and thighs.
- Keyboard height should allow:
  - Shoulders relaxed at side with 90 degrees of elbow flexion
  - Wrists in neutral flexion/extension
  - No radial or ulnar deviation.

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## KEYBOARD SLOPE

- Conventional slope increases wrist extension that reduces diameter of carpal tunnel increasing tendon nerve pressure and shortens wrist extensors increasing fatigue.
- Negative slope limit wrist extension by lowering front edge of keyboard.

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## WRIST OR PALM REST

- Must be closely examined as this feature can increase or alleviate symptoms.



- Increased contact pressure on the wrist
- Interfere with typing
- Excessive wrist flexion

- Alleviate soft tissue contact pressure
- Minimize wrist extension
- Provide hand support for rest breaks



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## KEYBOARD TYPE

- Split keyboard straightens the wrist by increasing the distance between the right and left hands and rotating the keyboard to allow neutral radial/ulnar deviation.

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## KEYBOARD TYPE CONT.

- Tented keyboard reduces the amount of pronation of the forearm but needs to be placed lower because they are higher than traditional keyboards

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## MOUSE LOCATION

- Position the mouse close enough to the body to avoid full elbow extension and excessive abduction.

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## MOUSE SIZE

- Wrists should be in neutral position when utilizing mouse.
- Ensure the mouse size and shape permits proper grip avoiding pinching.

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## MOUSE CONT.

- Use keyboard short cuts to rest fingers.
- Increase sensitivity of mouse to minimize forceful exertions from clicking and dragging.

Short cut	Action
Ctrl + Ctrl -	Zoom in/out
Ctrl C Ctrl V	Copy/Paste
Esc	Stop/Exit current task
F3	Search for file/folder
Ctrl A	Select all items in document

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## DESK

- Reach or work zones assist in placing objects to minimize upper extremity motions.
- In general, minimize reaching above and below shoulder height.

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## PRIMARY REACH ZONE

- The area reached by moving hands and forearms only with elbows at the sides.
- Approximately 16 inches in front of or to the side.
  - For items requiring dexterity and hand force.



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## SECONDARY REACH ZONE

- The area reached just by moving the arm forward at the shoulder.
  - Less frequently utilized items.

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## TERTIARY REACH ZONE

- The reach distance when the trunk is flexed forward at the waist and the arms are stretched out.
  - Place infrequently used items here.

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## FOOT REST

- A foot rest is utilized to support lower extremities when seat height does not allow foot contact with floor.

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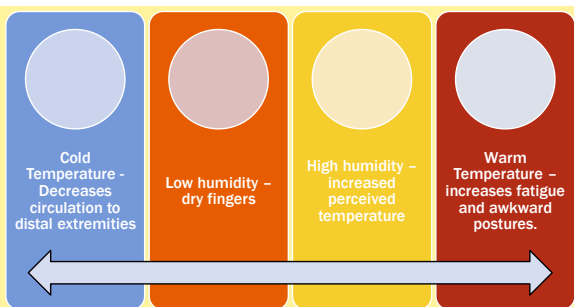
## DOCUMENT HOLDER

- Place source documents at the same height and distance from the eyes as the monitor.

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## OFFICE ENVIRONMENT



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## WORK TASK MODIFICATION

- To minimize symptoms from continuous work:
  - Alternate between tasks every hour.
  - If repeating the same task, take micro breaks every 30 minutes to 2 hours for a few minutes.

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## GENERAL GUIDELINES

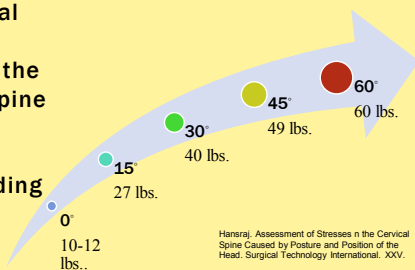
- It sounds simple, but remember to:
  - Avoid clutter on the desk surface
  - Remove items stored under the desk

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## NECK DISCOMFORT

- Loss of the normal cervical lordosis with translation of the head on the spine into a forward head position increases loading and muscle strain.



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## NECK AND UPPER BACK PAIN

- The monitor may be set too low, too high, too far or too close.
  - For bifocals lower monitor height.
- Seat may be reclined too far back.
- Ensure keyboard is at elbow level with obstacles that prevent sitting close to the keyboard removed.

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## NECK PAIN

- Shift keyboard and monitor for both to be centered in front of user.
- Corner units provide additional depth for monitor, keyboard, and mouse placement.

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## SHOULDER DISCOMFORT

- Armrest width adjustments can decrease shoulder discomfort by altering degree of shoulder abduction.
- If shoulders are elevated, lower or remove arm rests.
- As forearms drop with fatigue, awkward posturing may result of the wrists.
- Reaching for the mouse or keyboard can contribute.

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## CUBITAL TUNNEL

- Compressive forces from leaning against sharp edges impairs circulation around nerves creating tissue trauma.
  - Armrest should be broad and padded with 4 inches between arm rest and seat back.

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## BACK DISCOMFORT

- Forward head, rounded shoulder, decreased lordosis in sitting postures increase spinal loading and contributes to viscoelastic laxity of posterior stabilizing structures.
  - Assess entire chair including arm rest height and lumbar support.
- Consider reclined sitting controlled by seat tension adjustment.

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Aphis.usda.gov

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## BACK CONT.

- If there is no lumbar support built into the seat, add an external lumbar pad.
- For individuals with obesity, an alternative keyboard may allow better positioning alleviating back discomfort.

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## BACK AND LEG DISCOMFORT

- If the seat is too deep not allowing proper trunk and lower extremity positioning, add a lumbar cushion or move seat pan back.

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## WRIST AND HAND DISCOMFORT

- Assess keyboard location to ensure it is not too close or far from user.
- Clean mouse ball and ensure cables moves freely.
- Alternate use of the mouse between each hand.
- Tented keyboard requires less pronation optimizing hand placement while typing.

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## WRIST AND HAND CONT.

- Utilize voice recognition software to reduce keyboard use.
  - Investigate computer accessibility features.
- Substitute keystrokes for mouse strokes.

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## WRIST AND HAND CONT.

- For individuals with restricted wrist motion it is important to avoid compensation with excessive shoulder motion.
- Select a mouse with a high counts per inch (CPI) which requires less mouse motion to move the cursor across the screen.
- Adjust the mouse to be highly sensitive requiring less muscle force to operate.

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## CARPAL TUNNEL

- Reduce the amount of force required when utilizing the mouse.
- Closely examine wrist position with keyboard.
  - Arm rest height may need to be adjusted.
  - Avoid mechanical contact stress
- Pad sharp edges on keyboard trays ensuring thickness does not affect wrist posture.
- Ensure hands are warm by assessing room temperature and ventilation that may be contacting wrist/hand region.

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## EYE STRAIN SYMPTOMS

- Symptoms of eye fatigue vary and may be more severe for individuals who wear contacts:
  - Dry or itchy eyes
  - Tired eyes
  - Sore eyes
  - Blurred or double vision
  - Headaches
- Low room humidity levels and decreased blinking are contributors.
  - Lowering the monitor height promotes blinking.

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## EYE STRAIN

- Incorporate visual rest every 20 minutes.
- Positioning individual away from equipment exhaust fans and ventilation systems.
- Polished surfaces reflect light so consider accessories and type/color of wall paint.
- Check location of source document compared to monitor screen to limit refocusing.

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## EYE STRAIN CONT.

- Ensure glare has been minimized from direct lighting sources.
  - Clean the screen!
- Eliminate or reduce bright, high contrast reflections by using bright background displays with dark letters light background.

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## POSTURE VARIABILITY

- Fully adjustable workstations permit seated and standing postures to utilize different muscle groups.
- Declined and Reclined sitting are options in addition to neutral sitting.

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## RECLINED SITTING

- Tilting chair back allows for slight reclining of trunk with seat pan remaining horizontal to floor.
- Trunk is reclined back approximately 10-20 degrees.

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## DECLINED SITTING

- Trunk remains erect with knees lower than hip accomplished by raising seat height.
- Hip flexion is less than 90 degrees.

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## EDUCATION STRATEGIES

- Ergonomic education workshops and workstation modification “how to” sessions encouraging problem solving, have proven effective in decreasing symptoms.
  - Symptom surveys clarify problems.
  - Self Assessment Checklists for Modifications can be utilized.
    - Government agencies provide resources
    - [www.osha.gov](http://www.osha.gov)
    - [www.lni.wa.gov/](http://www.lni.wa.gov/)
    - <http://www.ors.od.nih.gov/sr/dohs/Pages/default.aspx>

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## EDUCATION CONT.

- Somatization tendency and negative pain beliefs have been shown to exacerbate musculoskeletal pain particularly in the neck and shoulder region.
- Cognitive techniques such as visualization and positive self talk may be beneficial at alleviating discomfort for some individuals.

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## EDUCATION CONT.

- Exercise and stretching programs should focus on postural strengthening and stretching overused muscles.
- Take advantage of employer healthy lifestyle promotion programs to reduce psychological and individual health contributors to the development of MSDs.

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## CONCLUSION

- Multiple ways the clinician can apply knowledge of workplace injuries for prevention programs in addition to return to work.

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## Office Ergonomics Resource Links

### Analysis Tools

ROSA

<http://ergo.human.cornell.edu/CUErgoTools/ROSA/ROSA%20forms.pdf>

RULA

<http://ergo.human.cornell.edu/ahrula.html>

REBA

[http://www.osha.oregon.gov/grants/resident\\_handling/docs/AppendixH/REBA.pdf](http://www.osha.oregon.gov/grants/resident_handling/docs/AppendixH/REBA.pdf)

Draft Ergonomic Checklist

[http://www.researchgate.net/publication/244483086\\_Content\\_validity\\_and\\_inter-rater\\_reliability\\_of\\_a\\_checklist\\_to\\_assess\\_the\\_ergonomic\\_practice\\_of\\_computer\\_professionals](http://www.researchgate.net/publication/244483086_Content_validity_and_inter-rater_reliability_of_a_checklist_to_assess_the_ergonomic_practice_of_computer_professionals)

Finnish Method

<http://www.ttl.fi/en/ergonomics/methods/ewm/pages/default.aspx>

Rodgers Muscle Fatigue Analysis

[http://personal.health.usf.edu/tbernard/HollowHills/Rodgers\\_MFA\\_M20.pdf](http://personal.health.usf.edu/tbernard/HollowHills/Rodgers_MFA_M20.pdf)

ACGIH Hand Activity Level

<http://www.theergonomicscenter.com/graphics/ErgoAnalysis%20Software/HAL.pdf>

Strain Index

<http://www.theergonomicscenter.com/graphics/ErgoAnalysis%20Software/Strain%20Index.pdf>

### Ergonomics

OSHA Ergonomics Guidelines

<https://www.osha.gov/SLTC/ergonomics/controlhazards.html>

OSHA Computer Workstation e-Tool Assessment

<https://www.osha.gov/SLTC/etools/computerworkstations/checklist.html>