

Ergonomics

| PRESENTED BY HUMAN RESOURCES



Cañada College • College of San Mateo • Skyline College

Agenda

- Ergonomics Overview
- Identifying Musculoskeletal Risk Factors
- Solving Ergonomic Problems
- Performing your own Ergonomic Assessment
- Applied Ergonomic Method
- Questions

Workplace Trends

- **17%** reduction in square footage per worker has occurred since 1994
- **90%** of computer users experience computer vision syndrome
- **64** the average number of hours spent sitting per week
- **90%** decline in the production of enzymes that burn fat after 1 hour of sitting.

Office of the Future?



This workstation looks good, but does not accommodate individual differences. What is likely to happen next?

Discomfort Indicators



Ergonomics Defined



Ergonomics is the science of **fitting the task** to the worker to maximize productivity while **reducing discomfort** fatigue and injury.



Identifying Injury Risk Factors



Common Postural Risk Factors



Wrist Extension



Radial Deviation



Ulnar Deviation

Common Postural Risk Factors cont...



Shoulder Shrugging



Shoulder Adduction

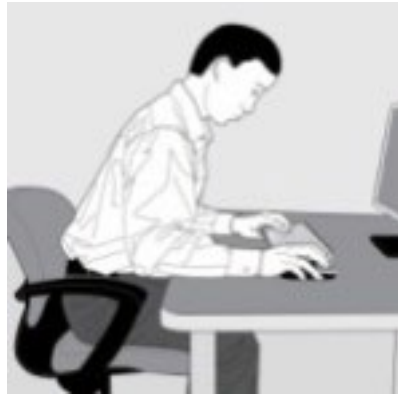


Elbow Extension

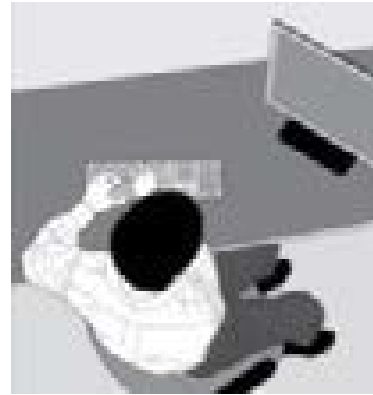


Shoulder Abduction

Common Postural Risk Factors cont...



Trunk Flexion



Trunk Rotation

Common Postural Risk Factors cont...



Neck Extension



Neck Flexion

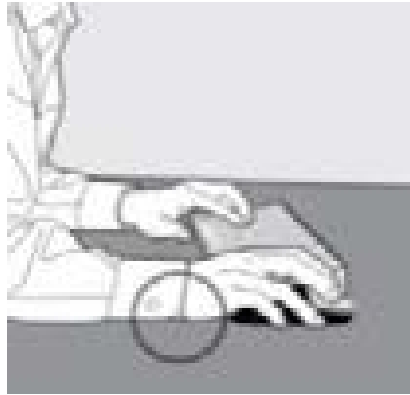


Neck Rotation

Common Postural Risk Factors cont...



Unsupported Feet



Contact Stress



Contact Stress - Knee

Common Postural Risk Factors cont...



Unsupported Feet



Contact Stress

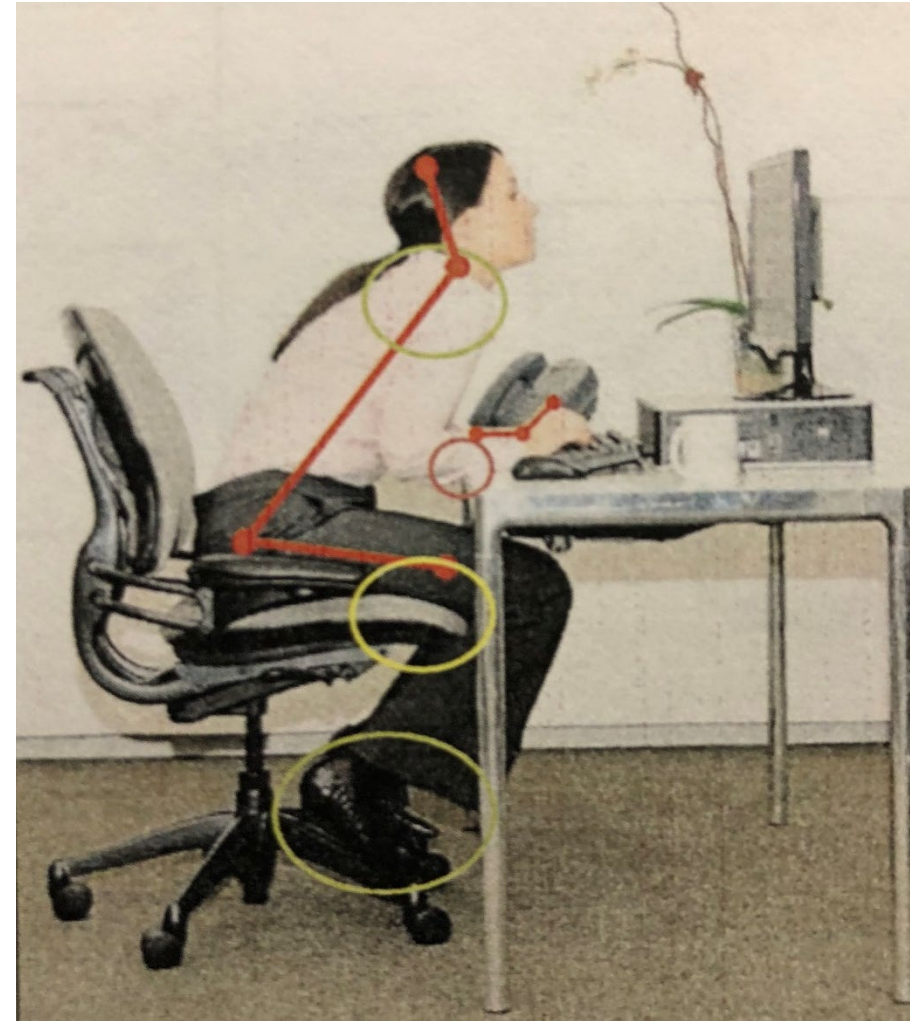


Contact Stress - Knee

Minimize Awkward Postures

Minimize postures that require **excessive muscle activity** to maintain and tax the musculoskeletal system

1. Trunk Flexion
2. Neck Extension
3. Shoulder Shrugging
4. Contact stress at forearm
5. Wrist Extension
6. Contact Stress behind Knee
7. Unsupported feet



Maximize Neutral Postures

Maximize your time spent in **neutral postures** that require minimal muscle activity to maintain

1. Chair Lowered
2. Corrected seat pan depth
3. Lowered keyboard height
4. Keyboard sloped negative
5. Keyboard closer to body
6. Arms supported at palm
7. Corrected monitor height & depth



Lack of Training

- Lack of training often yields disappointing results
- Equipment is only ONE component of the solution
- Very few will change their behavior unless they understand WHY a change is necessary

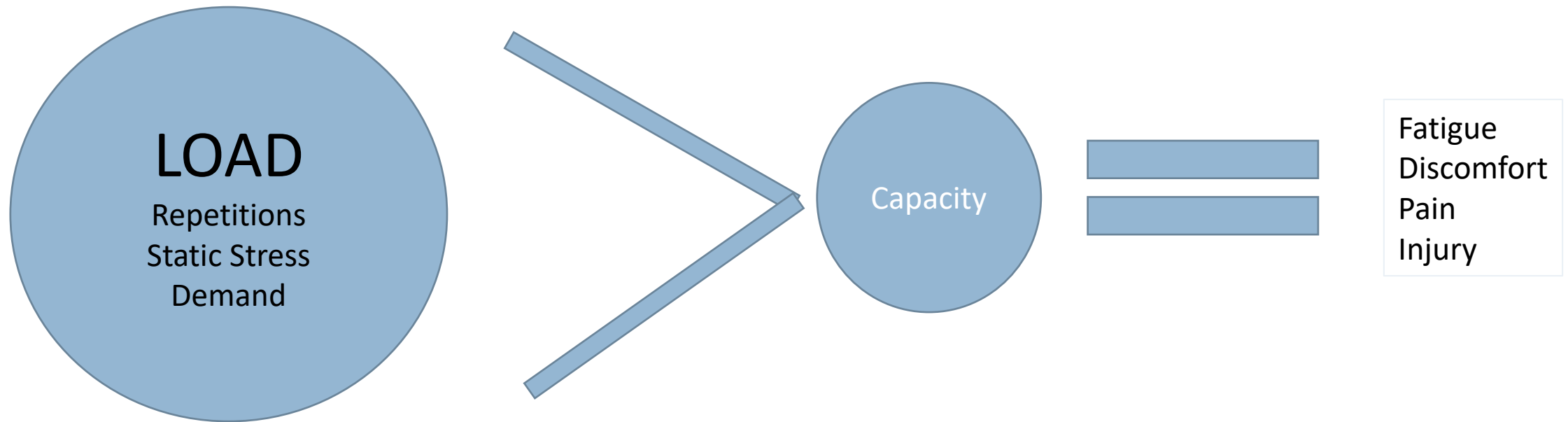


Musculoskeletal Disorders

- Musculoskeletal Disorders (MSDs) are injuries and disorders to muscles, nerves, tendons, ligaments, joints, cartilage and spinal discs
- Also referred to as:
 - Cumulative Trauma Disorder (CTD)
 - Repetitive Stress Injury (RSI)
 - Repetitive Motion Injury (RMI)



How Do Injuries Occur?



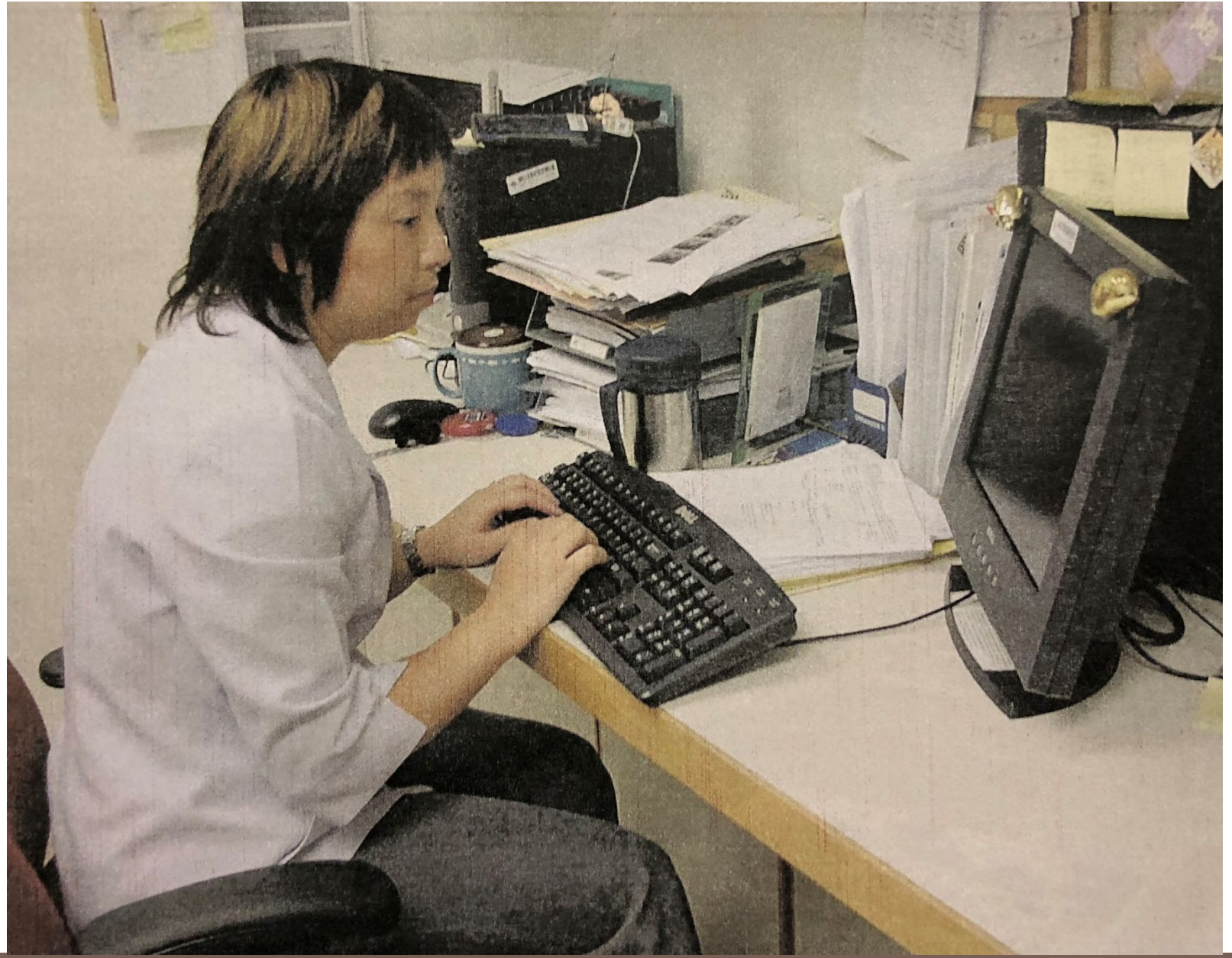
Breakout Activity

- Identifying Injury Risk Factors – Identify and list all musculoskeletal risk factors
- What specific MSDs are these individuals at risk for developing?
- What kinds of information will help you make recommendations?

Risk Factors?
Source?



Risk Factors?
Source?



Implementing Ergonomic Solutions

1. The Chair
2. The Work Surface
3. The Keyboard and Mouse
4. Monitor and Document Placement
5. Laptop Considerations
6. Proper Lighting

Essential Chair Adjustments

- Seat Height
- Seat Depth
- Backrest
- Armrest Height
- Backrest Tension

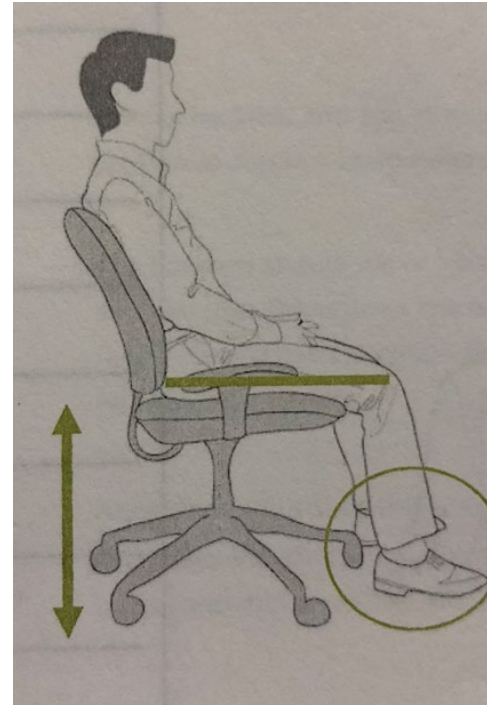


Seat Height

- Adjust height such that feet are flat on the floor and thighs are parallel to the floor



Remove unsupported feet; risk factor



Seat Pan Depth

- Allow at least 2 inches of clearance behind the knees
- Proper length will improve pressure distribution



Contact stress at seat edge; risk factor



Lumbar Height

- Fit the backrest curvature to the natural curve of the lower back



Trunk Flexion; risk factor

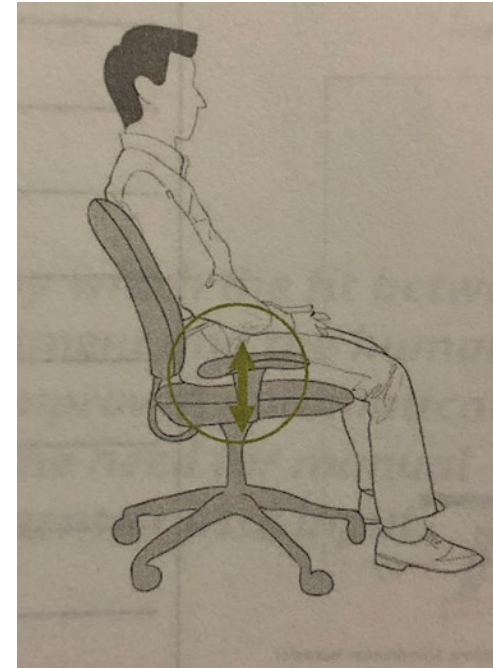


Armrest Height

- Position the armrests such that they are no higher than seated elbow height



Shoulder shrugging; risk factor

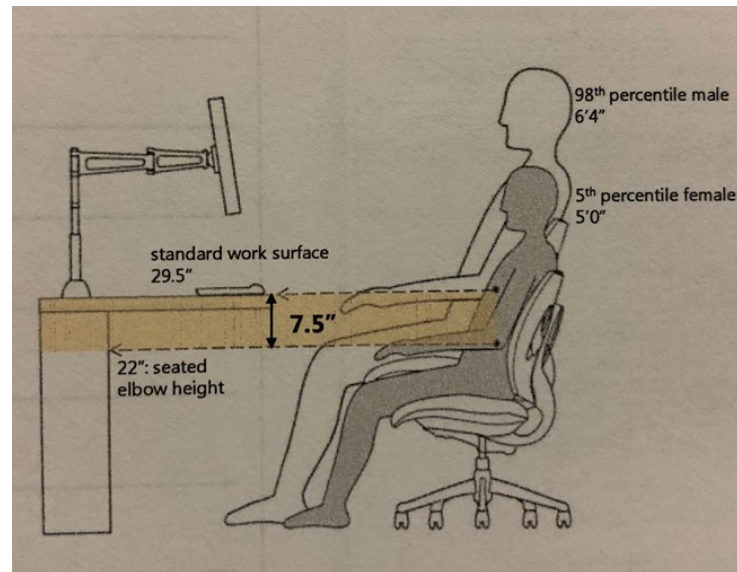


Recline Tension

- Unlock backrest and adjust the recline tension to support body weight
 - The backrest should move freely and support user through the recline range – it is a misconception that sitting up straight is healthy
 - Movement nourishes the spine, lubricates the joints, removes muscle toxins and improves circulation

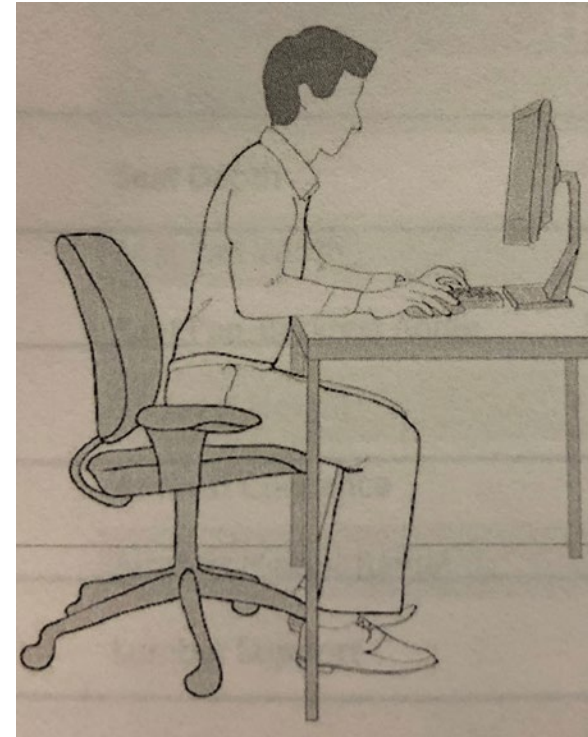
The Work Surface

- The standard 29.5" work surface correlates to the seated elbow height of a 6'4" male, less than 2% of our working population.



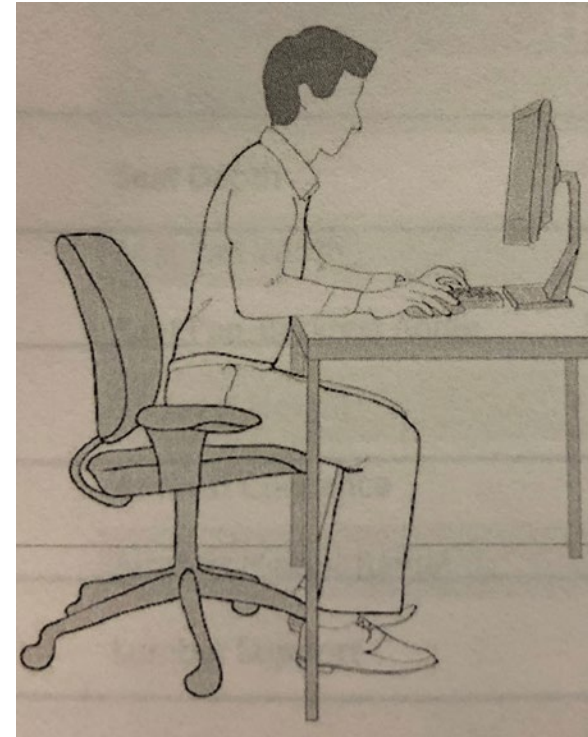
Fixed Work Surfaces

- Fixed work surface heights result in keyboard positions that are too high and too far away from the body
- What risk factors could occur?



Postural Implications

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- What risk factors could occur?



Postural Implications cont..

- Wrist extension angles are as high as 41.8° when the keyboard is positioned on a standard height work surface.
- The keyboard tabs compound the issue, particularly for proficient typists who anchor their wrists in front of the keyboard

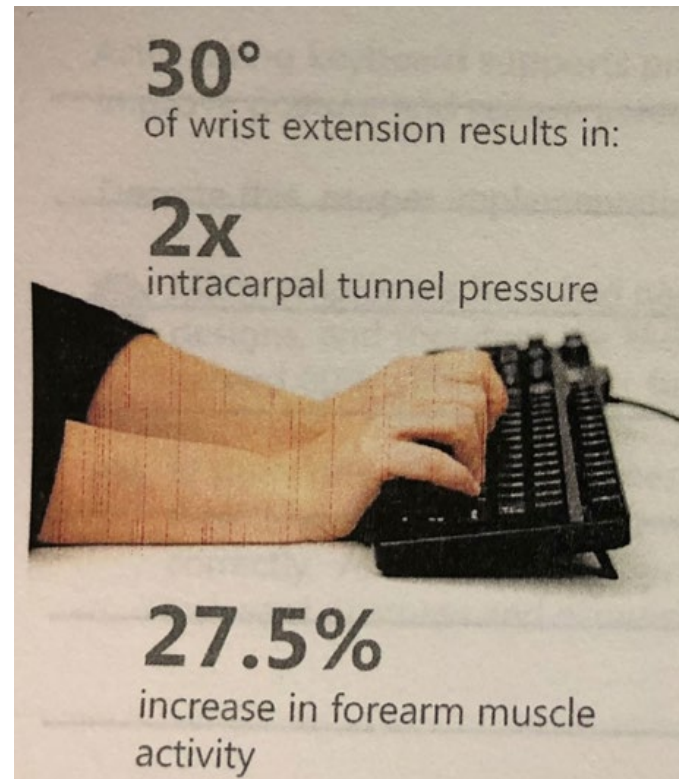


Postural Implications cont..

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Effect of Wrist Extension Angle on intracarpal tunnel pressure



Articulating Keyboard Supports

- Used to improve hand, wrist and seated posture
- Appropriate for both seated or standing applications
- With proper use, postural risks are virtually eliminated



Adjust your Keyboard Platform

1. Lower the keyboard to allow the front edge of the tray to touch the thighs
2. Angle the keyboard away from the body until the wrists are straight
3. Lower the keyboard such that it is 1-1.5 inches above the lap
4. Tuck the keyboard tray under the work surface and bring the body closer to the work

Sit to Stand Workstation

- Allows for the greatest amount of postural variation



Health Implications - Sitting

- Elevates spinal disc pressure and can contribute to premature spinal disc degeneration
- Causes enzymes responsible for burning fat to shut down, resulting in weight gain, lower metabolism and lower levels of good cholesterol (HDL)
- Lowers demands of the circulatory system and results in a slow down of heart activity and blood flow, which accelerates fatigue

Health Implications - Standing

- Is much more tiring and requires 20% more energy
- Causes pooling of the lower extremities and vein inflammation
- Is linked to foot pain, varicose veins, and static muscle fatigue
- Causes the joints in the spine, hips, knees and feet to become temporarily immobilized. This can result in degenerative damage to the tendons and ligaments

Keyboard and Mousing

- The finger travels **16 miles** over an 8 hour work day
- > **500,000** finger movements per week
- **13,000** key strokes per hour
- Total finger force is in excess of **46 tons**
- We scroll **over half a mile** a day

Keyboarding Challenges

- Risk Factors?
 - Wrist Anchoring (Lack of palm support)
 - Wrist Extension (Keyboard tabs)
 - Ulnar Deviation

Keyboard width places the mouse at a significant reach



Keyboard Use

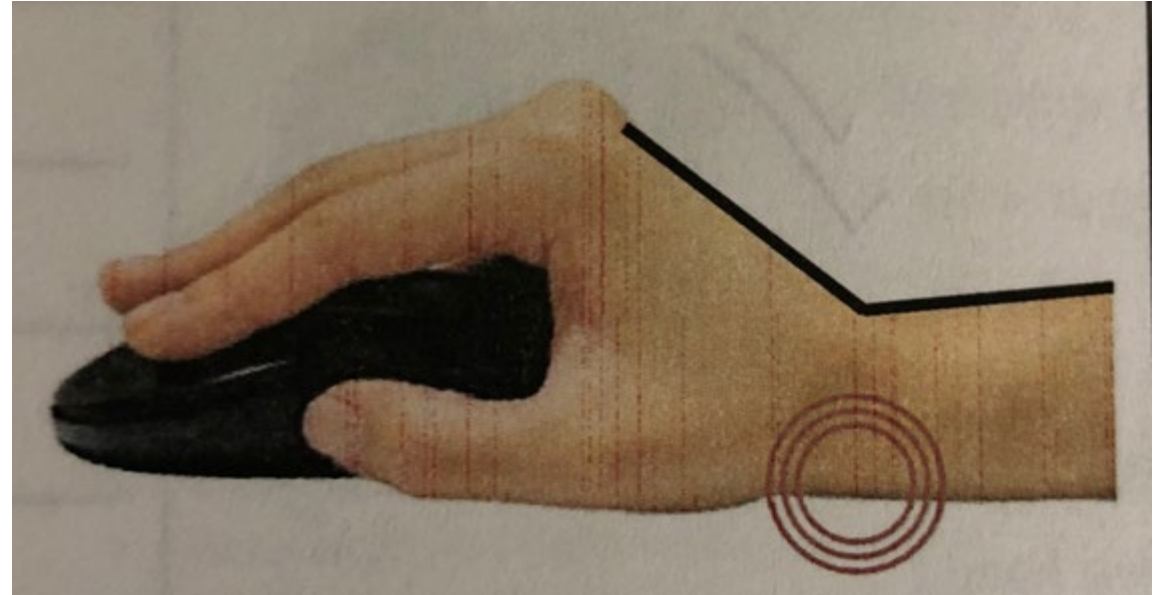
- Remove keyboard tabs
- Use an external palm support
- If you have a keyboard platform, tilt the tray at a negative slope
- Support the PALM, NOT the wrist or forearm

Mouse Challenges

- Risk Factors?
 - Wrist Anchoring
 - Wrist Extension
 - Ulnar/Radial Deviation

Design Challenges?

- One size does not fit all
- Most designs do not accommodate left hand users



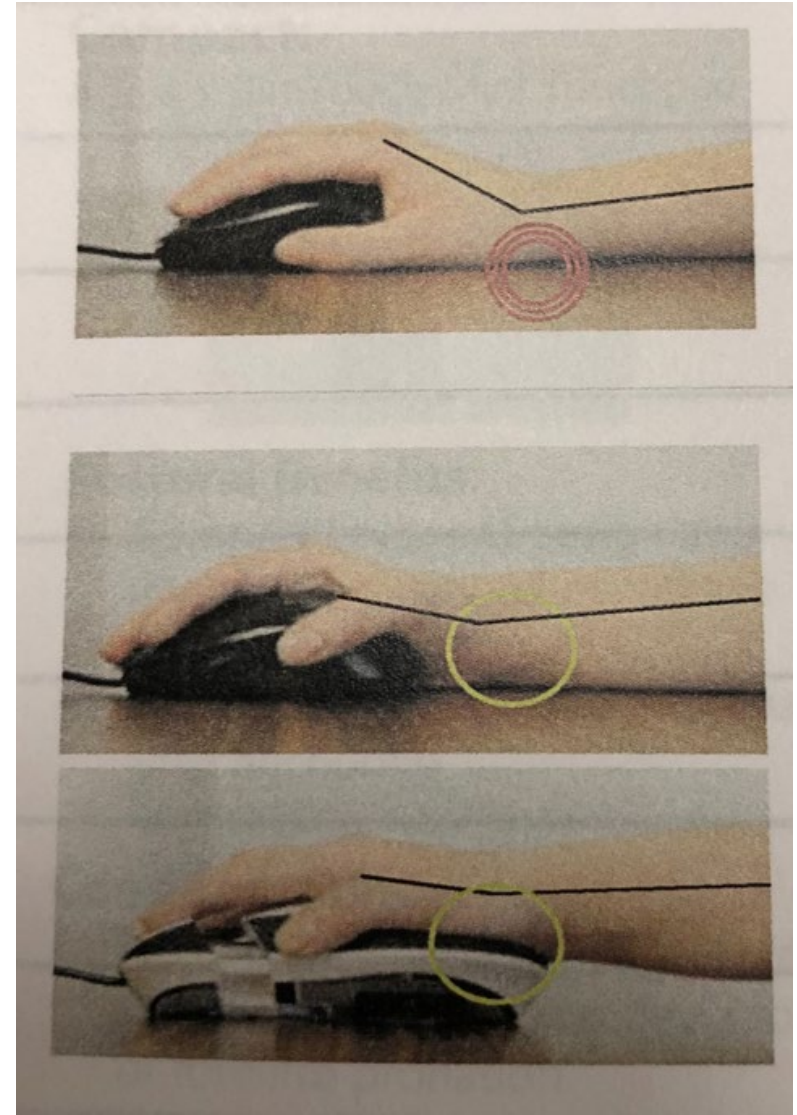
Mouse Considerations

Avoid

- Anchoring wrist on work surface
- Using a wrist rest
- Pivoting at wrist

Consider

- Switching hands
- Moving your entire arm

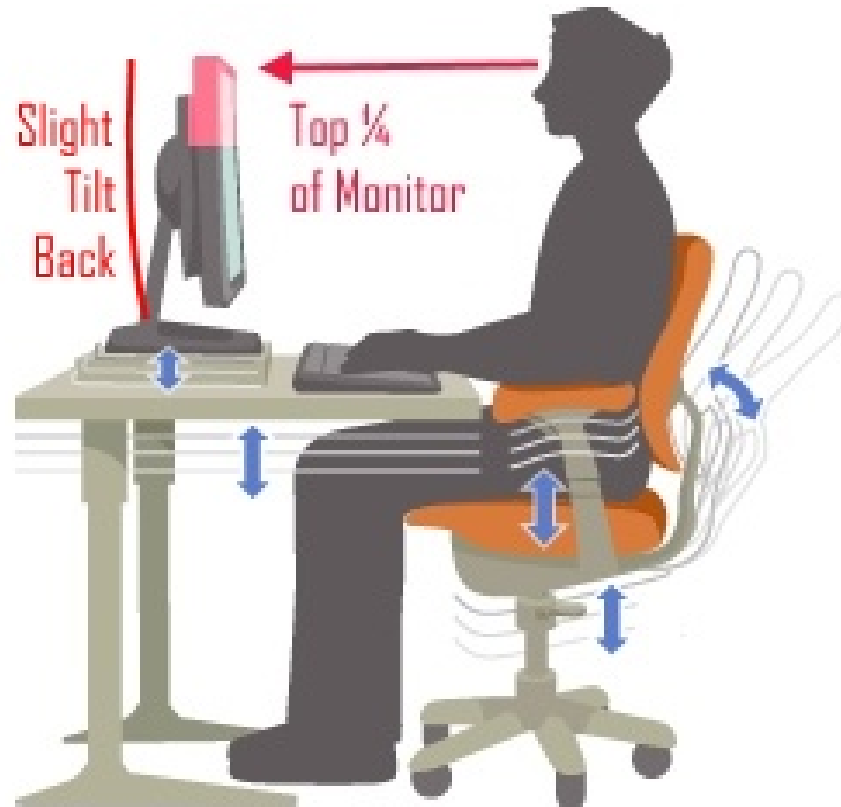


Monitor and Document Placement

- Improper monitor position can lead to a variety of postural problems
- Risk Factors?

Monitor Height

- Align the top of the monitor at, or slightly below, eye level.



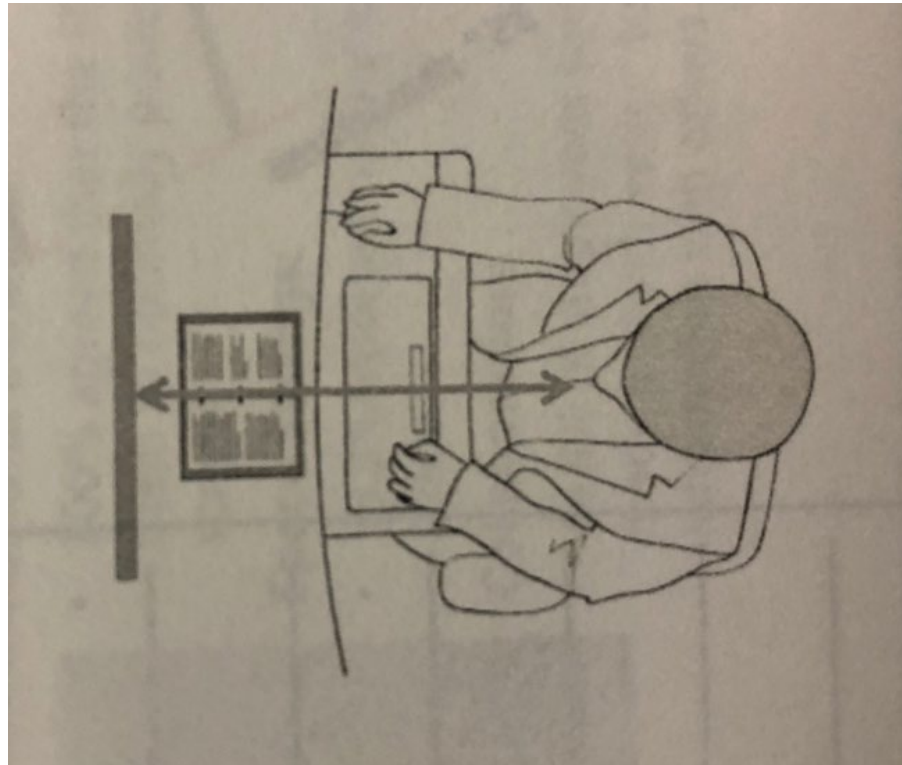
Monitor Depth and Angle

- Place the monitor at least an arm's length away while reclining
- OSHA recommends 20'' – 40'', no less than 15'' from eyes



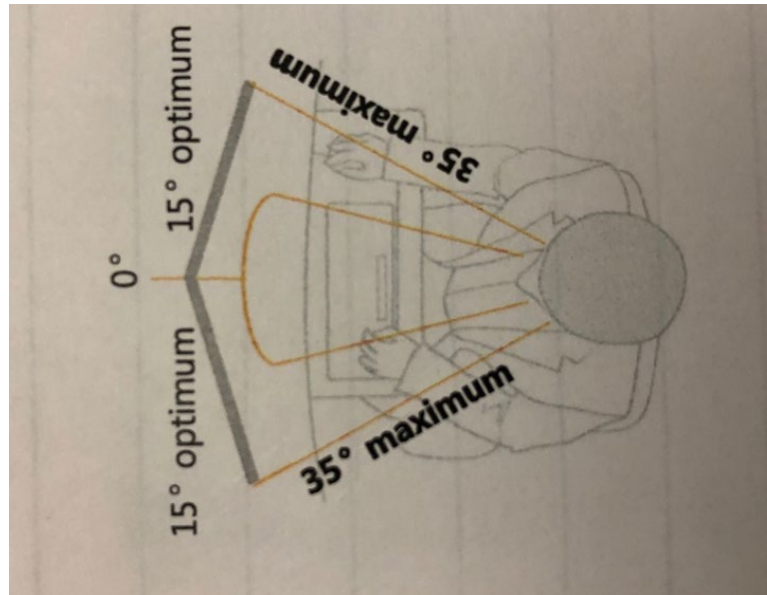
Monitor Alignment

- Center keyboard spacebar and monitor with the midline of the body.



Multiple Monitor Dilemma

- Monitors must be positioned further away, which can negatively affect our ability to view the screen
- Users prefer a viewing distance of 30-33 inches, minimum distance is 16 inches.



Laptop Challenges

- Laptop users are exposed to a variety of postural risk factors because the keyboard and monitor are fixed and non-adjustable.
- Using a separate keyboard and mouse on a keyboard tray allows for proper hand and wrist posture
- An adjustable laptop holder or external monitor improves upper body posture.

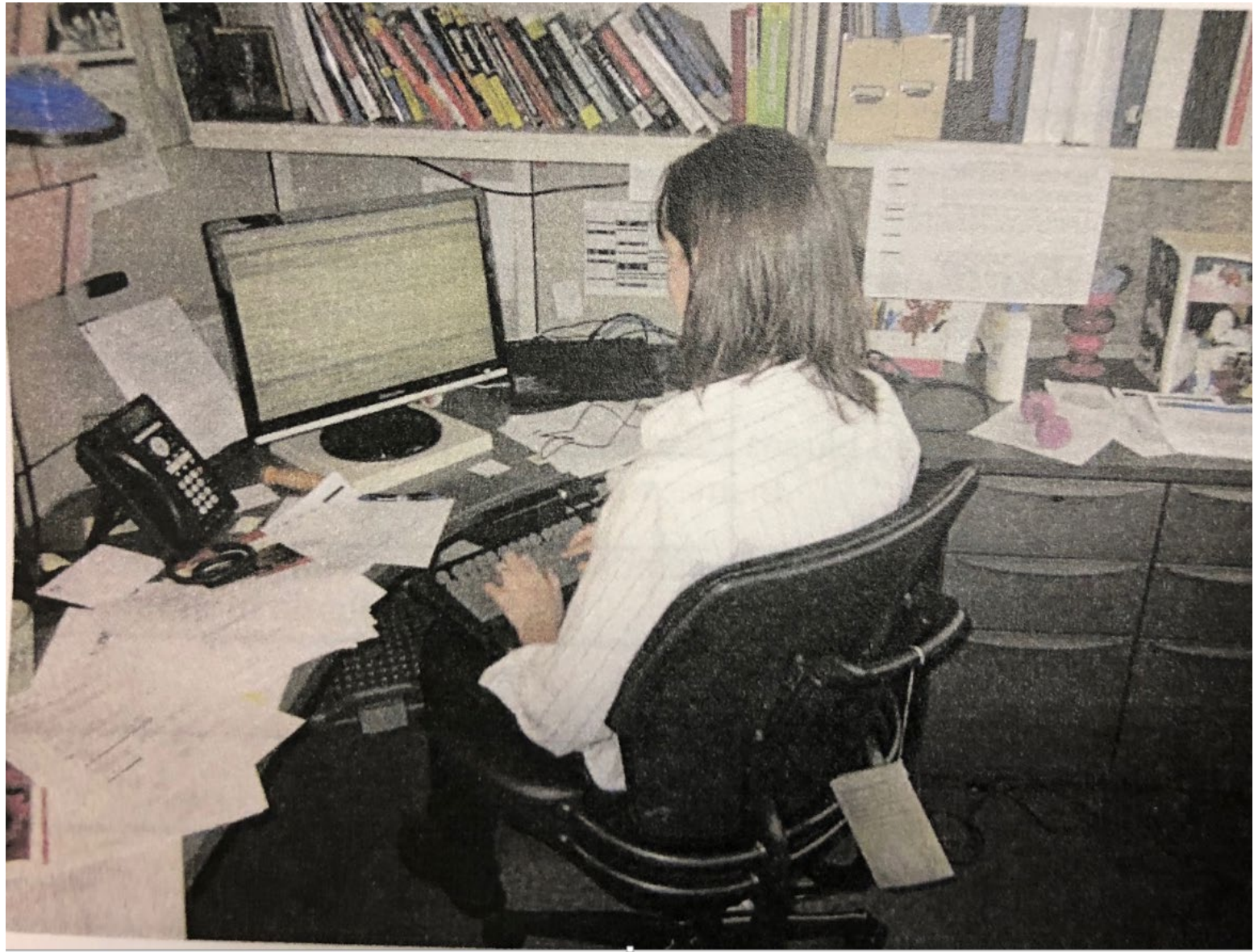


Recap

- Established a working knowledge of ergonomics principles and associated musculoskeletal risk factors
- Conducted a review of current ergonomic work tools
- Applied ergonomic principles to workstation design

Key Points to Remember

1. Ergonomics is a preventative, design based discipline
2. Ergonomic interventions can benefit the masses, not just those that are injured
3. Product interventions alone are not enough – training is an integral part of ergonomic success
4. See ergonomics as a benefit to YOU!





Sources

- <http://ehs.virginia.edu/Ergonomics.html>
- <http://ergo.human.cornell.edu/>
- <https://www.osha.gov/SLTC/ergonomics/>
- <https://ehs.unc.edu/workplace-safety/ergonomics/>