Ergonomics in Sonography

Marissa Pentico, MS, OT/L
Duke Ergonomics Division
Occupational and Environmental Safety Office

Janet Ellis, RT(R), RDMS, RVT
Duke Radiology Ultrasound
What is Ergonomics?

Ergonomics is the science of matching jobs to workers and products to users.
Musculoskeletal Disorders (MSDs)

- What are MSDs?
  - Tendon disorders
    - Tendinitis, tenosynovitis
  - Peripheral nerve disorders
    - Carpal tunnel syndrome
  - Muscle strains
    - Lumbar strain
Musculoskeletal Disorders (MSDs)

- Know the Signs:
  - Decreased grip strength
  - Decreased range of motion
  - Deformity
  - Loss of function

- Know the Symptoms:
  - Pain
  - Numbness
  - Tingling
Sonographers and MSDs
Occupational Risk Factors for MSDs

- Repetitive Motion
- Awkward Posture
- Static Posture
- Force
- Contact Stress
- Vibration
- Cold Temperatures

Which of these do you experience on a daily basis?
Occupational Risk Factors for Sonographers

Repetitive Motion – repeated manipulation of transducer and controls.
Occupational Risk Factors for Sonographers

Awkward Posture – postures often adopted when reaching and bending the wrist while scanning the opposite side of a patient.
Occupational Risk Factors for Sonographers

Static Posture – arms are held away from the body for long periods of time causing static loading of the muscles in neck, back, shoulders, and upper extremities.
Occupational Risk Factors for Sonographers

Force – pushing into soft tissue, especially with bariatric patients.
Occupational Risk Factors for Sonographers

Contact Stress – can occur on the hip or side of the trunk when making contact with the metal sides of beds or stretchers.
Non-Occupational Risk Factors

Some examples of these are:

- Smoking
- Obesity
- Sedentary Lifestyles
- Hobbies, Home Activities
- Endocrine System Disorders
- Age
- Hormones
10 Basic Ergonomics Principles

Based on “The Rules of Work”
by Dan MacLeod
(Taylor and Francis, 2000)
#1 - Use Neutral Postures

Neck

Avoid
#1 - Use Neutral Postures

Back

Avoid
#1 - Use Neutral Postures

Shoulders

Avoid
#1 - Use Neutral Postures
Shoulders

Avoid
#1 - Use Neutral Postures

Wrist:

Avoid
#1 - Use Neutral Postures
Wrist

Avoid
#2 - Reduce Excessive Force

- Use lifts, slides and rollers
- Improve grips (pinch vs. palmar)
Palmar Grip
#4 - Perform Tasks at Proper Heights

- Consider the population
- Adjustable heights
- Avoid extremes
- Arrange frequently used items at elbow height
#5 - Reduce Excessive Motions

- Let tools/equipment (ie chairs) do the work
- Reduce the range of motion
- Keep equipment and patients oriented close to you
- Slide rather than lift or pick up
#6 - Minimize Fatigue and Static Load

- Grasping and pinching loads
- Continuous standing
- Continuous sitting
- Incorporate movement into your day
#7 - Minimize Pressure Points

- **Seating**
  - Avoid surface contact
  - Contour items
  - Provide padding
  - Distribute the pressure
#8 - Provide Clearance

- Design for tall people
- Provide knee space
- Ensure hand clearance
- Ensure visual access
#9 - Move and Stretch

- Allow for alternate postures
- Design for sit-stand
#9 - Move and Stretch

- Allow for changes in chair positioning
#10 - Maintain a Comfortable Environment

- Lighting
- Temperature
- Vibration
- Noise
Ergonomic Recommendations
Engineering Controls

- Ultrasound Machine Features
- Stools
- Arm supports
- Pannus sling
- Probe ring
Individual/Personal Controls

- Education
- Posture and body self-awareness training
- Stretching exercises
- Development of regular exercise regime
- Self administration of “Readiness Checklist”
<table>
<thead>
<tr>
<th><strong>Sonographer’s Checklist</strong></th>
<th><strong>6.</strong> Am I supporting my limbs properly throughout the entire examination?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is the patient close enough to me? Is my arm and elbow tucked in closely to my body in a comfortable position?</td>
<td>7. When I stand, am I carrying my body weight equally on both feet?</td>
</tr>
<tr>
<td>2. Did I adjust my chair or examination bed according to the body habitus of my patient in relation to my height?</td>
<td>8. Did I take a micro break? i.e. consciously releasing tension on the scanning hand for a few seconds.</td>
</tr>
<tr>
<td>3. Is my posture a comfortable and correct one so as not to cause any undue stress on my body?</td>
<td>9. Did I take a mini-break? i.e. removing the probe from the scanning hand, stretching the hand, arm and shoulders and glancing periodically away from the monitor to release eye tension?</td>
</tr>
<tr>
<td>4. Am I working with my wrist and neck in a straight and supported position?</td>
<td>10. Am I aware of any unusual symptoms, such as numbness, swelling or pain?</td>
</tr>
<tr>
<td>5. Is the monitor and keyboard positioned so that I can easily see and reach them?</td>
<td>(Gregory, 1998)</td>
</tr>
</tbody>
</table>
Individual/Personal Controls

- Arrange stretcher and machine
- Adjust equipment
- Position yourself
- Use support
- Alternate between sitting and standing
- Alternate hands
Administrative Controls

- Job and task rotations
- Work scheduling
- Appropriate rests
Case Study Example
Case Example

- RULA used to assess primarily the postures of the upper extremity, trunk and neck
- Case example of left lower extremity venous study to evaluate for deep vein thrombosis
- Three scanning positions assessed: standard, standing, and patient rotated
- Three sites of focus: popliteal area, calf, ankle
- Developed posture adjustment recommendations
The Three Scanning Positions

Standard  

Standing  

Rotated
Postural Considerations
# Neck

- **Best position:** Patient rotated

<table>
<thead>
<tr>
<th>Standard</th>
<th>Patient Rotated</th>
<th>Standing</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Standard Image" /></td>
<td><img src="image2" alt="Patient Rotated Image" /></td>
<td><img src="image3" alt="Standing Image" /></td>
</tr>
</tbody>
</table>
# Trunk

- **Best position: Patient rotated**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Patient Rotated</th>
<th>Standing</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Standard Image" /></td>
<td><img src="image2.png" alt="Patient Rotated Image" /></td>
<td><img src="image3.png" alt="Standing Image" /></td>
</tr>
</tbody>
</table>
# Shoulder

- **Best position: Standard**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Patient Rotated</th>
<th>Standing</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
</tbody>
</table>
Lower Arm Position

- Best position: Awkward for all 3 positions

<table>
<thead>
<tr>
<th>Standard</th>
<th>Patient Rotated</th>
<th>Standing</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
</tbody>
</table>
Forearm (Wrist Twist)

- Best position: Patient rotated

<table>
<thead>
<tr>
<th>Standard</th>
<th>Patient Rotated</th>
<th>Standing</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Standard Image" /></td>
<td><img src="image2" alt="Rotated Image" /></td>
<td><img src="image3" alt="Standing Image" /></td>
</tr>
</tbody>
</table>
**Wrist Position**

- Best position: Standard and rotated
- Grip

<table>
<thead>
<tr>
<th>Standard</th>
<th>Patient Rotated</th>
<th>Standing</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Standard Position" /></td>
<td><img src="image2" alt="Rotated Position" /></td>
<td><img src="image3" alt="Standing Position" /></td>
</tr>
</tbody>
</table>
Considerations:

- Sitting position (if feasible)
- Two sonographers (if feasible)
- Hesitations?
- Use in real life?
- Relearning?
- Length of exam time?
- Scanning with opposite hand?
Summary
Questions