Understanding Ergonomics and its Application to Occupational Therapy Practice

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Monday, March 22nd, 2021
Objectives

► Explain work-related risk factors and intensifiers
► Identify safe zones (in degrees) for each region of the body
► Describe self-management strategies to reduce work-related musculoskeletal disorders
► Discuss how ergonomics links to OT practice and theory
What is Ergonomics?

 ► The science of work – understanding the interactions among humans and other elements of a system (International Ergonomics Association, n.d.).

 ► The study of humans, objects, or machines and the interaction between them (Braveman & Page, 2012).

 ► The study of work performance with an emphasis on work efficiency, safety, and productivity (Jacobs, 2008).

 ► OT purpose in Ergonomics
   ► Optimize function and work performance through education, intervention, and adaptation (AOTA, 2017)
Work-Related Risk Factors

- Repetition (Frequency)
- Forceful Exertions
- Awkward or Sustained Postures
- Contact Stress
- Extreme Temperatures
- Vibration
- Work Schedule and Duration
- Organizational Stressors

(Sanders, 2004)
Repetition (frequency)
Forceful Exertions
Awkward or Sustained Postures
Contact Stress
Extreme Temperatures
Vibration
Work Schedule and Duration

► Part time versus full time
► Hours per day
► Days per week
► Overtime
► Breaks
Organizational Stressors

► Job demands
► Interpersonal relationships
► Flexibility
► Standards
Intensifiers

- Intensity or magnitude: strength of exposure
- Duration: length of exposure
- Temporal profile: pattern of exposure (workday, work week, etc.)
- Cold temperatures

(Sanders, 2004)
# Body Region Guidelines

<table>
<thead>
<tr>
<th>Body Part/Region</th>
<th>Safe Zone (in degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck (Flexion, lateral rotation, side bending)</td>
<td>20 degrees</td>
</tr>
<tr>
<td>Back (Flexion, rotation, side bending)</td>
<td>30 degrees</td>
</tr>
<tr>
<td>Shoulders (Abduction, flexion, extension, crossing midline)</td>
<td>30 degrees</td>
</tr>
<tr>
<td>Elbows (Flexion)</td>
<td>&gt; 90 degrees</td>
</tr>
<tr>
<td>Forearms</td>
<td>Mid-range pronation or supination</td>
</tr>
<tr>
<td>Wrist/hands (Flexion, extension, radial/ulnar deviation)</td>
<td>Neutral wrist is best 0-20 degrees of extension Avoid thumb extension</td>
</tr>
</tbody>
</table>
Work-Related Musculoskeletal Disorders (WRMSDs)

- Musculoskeletal disorders (MSD): injuries or disorders that affect muscles, nerves, joints, cartilage and spinal discs

- Work-related musculoskeletal disorders (WRMSDs) are conditions in which:
  - The work environment or work performance contribute to the condition
  - The condition is worsened or persists longer due to working conditions

(CDC, n.d.)

- Common characteristics of WRMSDs
  - The causes are multifactorial
  - Involve both mechanical and physiologic mechanisms
  - Related to intensity and duration of work
  - Symptoms can be poorly localized, non-specific, and episodic

(Jacobs, 2008)
Common WRMSDs

- Rotator Cuff Tendinitis
- Subacromial Bursitis
- Lateral Epicondylitis
- Carpal Tunnel Syndrome
- de Quervain’s Disease
- Trigger Finger
- Arthritis
- Pain (back pain most common)

(Sanders, 2004; CDC, n.d.)
Linking Ergonomics to OT Theory

► Canadian Model of Occupational Performance and Engagement (CMOP-E)
► Model of Human Occupation (MOHO)
► Person-Environment-Occupation (PEO) Model
► Biomechanical Frame of Reference
► Health Belief Model
► Transtheoretical Model

(Braveman & Page, 2012; Scaffa, Reitz, & Pizzi, 2010)
Ergonomic Assessments

- Rapid Upper Limb Assessment (RULA)
- Rapid Entire Body Assessment (REBA)
- Rapid Office Strain Assessment (ROSA)
- Job Strain Index
- Ergoscience Physical Work Performance Evaluation (PWPE)
- Quick Exposure Check (QEC)

(Sanders, 2004; Jacobs, 2008)
### RULA Employee Assessment Worksheet

**A. Arm and Wrist Analysis**

#### Step 1: Locate Upper Arm Position:
- Score:
  - 1 if shoulder is raised: +1
  - 1 if upper arm is abducted: +1
  - 1 if arm is supported or person leaning: -1

#### Step 2: Locate Lower Arm Position:
- Score:
  - 1 if arm is working across midline or out to side of body: Add +1

#### Step 3: Locate Wrist Position:
- Score:
  - 1 if wrist is bent from midline: Add +1

#### Wrist Score:
- Add scores from steps 1-3 above, locate score in Table A

#### Step 4: Wrist Twists:
- Score:
  - 1 if wrist is twisted in mid-range: +1
  - 1 if wrist is A or near end of range: +2

#### Step 5: Look-up Posture Score in Table A:
- Using values from steps 1-4 above, locate score in Table A

#### Step 6: Add Muscle Use Score
- If posture mainly static (i.e. held >10 minutes), or if action repeated occurs >4% per minute: +1

#### Step 7: Add Force/Loud Score
- If load < 4.4 lbs (instrumental): +0
- If load 4.4 to 22 lbs (intermittent): +1
- If load 4.4 to 22 lbs (static or repeated) +2
- If more than 22 lbs of load or shock load: +3

#### Step 8: Find Row in Table C
- Add values from steps 5-7 to obtain Wrist and Arm Score. Find row in Table C

### Table A: Wrist Posture Score

<table>
<thead>
<tr>
<th>Upper Arm</th>
<th>Lower Arm</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2.0</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>3.0</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>4.0</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>5.0</td>
</tr>
</tbody>
</table>

### B. Neck, Trunk and Leg Analysis

#### Step 9: Locate Neck Position:
- Score:
  - 1 if neck is twisted: +1
  - 1 if neck is side bending: +1

#### Step 10: Locate Trunk Position:
- Score:
  - 1 if trunk is twisted: +1
  - 1 if trunk is side bending: +1

#### Step 11: Legs:
- Score:
  - 1 if legs and feet are supported: +1
  - 1 if not: +2

#### Table B: Trunk Posture Score

<table>
<thead>
<tr>
<th>Trunk Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
</tbody>
</table>

### Scoring (final score from Table C)

- 1 or 2 = acceptable posture
- 3 or 4 = further investigation, change may be needed
- 5 or 6 = further investigation, change soon
- 7 = investigate and implement change

### Table C: Neck, Trunk and Leg Score

<table>
<thead>
<tr>
<th>Neck Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
</tbody>
</table>

### Procedure:

1. **Score: Wrist Score**
2. **Score: Wrist Twists**
3. **Score: Wrist Twists**
4. **Score: Muscle Use Score**
5. **Score: Force/Loud Score**
6. **Score: Find Row in Table C**
7. **Final Score**: Add values from steps 5-7 to obtain Wrist and Arm Score. Find row in Table C

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**Task Name:**

**Reviewer:**

**Date:**

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This tool is provided without warranty. The author has provided this tool as a simple means for applying the concepts provided in RULA.
Interventions in OT Practice

- Conducting assessments and developing interventions for individual workers
- Providing health promotion and/or injury prevention education programs to groups of workers
- Designing and modifying workplace tools, equipment, or behaviors to prevent injury and increase performance
- Consulting with employers and insurance companies to reduce worker’s compensation costs and promoting workplace wellness
- Education and demonstration on proper body mechanics when performing heavy duty tasks
- Providing self-management education
- Helping workers successfully return to work after injuries

(AOTA, 2017; Johnston, Jull, Sheppard, & Ellis, 2013)
Self-management Strategies

► Stretch in the opposite direction
► Exercise
► Yoga
► Taking breaks during workday
► Staying hydrated
► Eating nutritiously
► Awareness of conditions and symptoms
► Consider the individual’s whole day

(Roll, Tung, Chang, Sehremelis, Fukumura, Randolph, & Forrest, 2019; Koneru & Tanikonda, 2015; Chismark, Stein, Curran, Asher, & Tavoc, 2010)
WRMSDs in OT Practitioners

- Work-related injuries among OTs (Passier & McPhail, 2011)
  - High prevalence of WRMSDs in OTs
  - Many of these initially occur early in career
  - High rate of reoccurrence (59%)
  - Most common areas: lower back, neck, and shoulders
  - Many therapists continued to work despite their injuries

- Association among WRMSDs, job stress, and job attitude of OTs (Park & Park 2017)
  - 85% of OTs had WRMSDs involving at least site
    - Strongly correlated with repetitive motions and improper posture
  - Body site most involved: low back, hand or wrist, and shoulder
  - Occurrence of WRMSDs in OTs was associated with increased job stress and negative job attitude
References


Panel Discussion

- Asia Kim, CHES®, OTS – Midwestern University
- Dana Lingle, OTD, OTR/L, CHT – Midwestern University

- Level IIA Fieldwork in Ergonomics and Health Promotion
  - Collaboration with Midwestern University College of Dental Medicine
  - Individual Workstation Clients
**Dental Ergonomics Assessment Results**

To assess risk factors in your occupation as a dental student, we used the Rapid Upper Limb Assessment (RULA). This is a tool used in ergonomics which has proven validity and reliability to determine postural risk factors. It provides a "snapshot" of you working on a procedure. To account for the dynamic nature of your job, we used our OT observation skills to observe you working over a period of time to provide us with more information about how you work. Below is a summary of your RULA scores:

<table>
<thead>
<tr>
<th>RULA Score</th>
<th>Write &amp; Type (purple)</th>
<th>Reach (right grey)</th>
<th>Reach (medium blue)</th>
<th>Posture (white)</th>
<th>Reach, Throat &amp; Leg (pink)</th>
<th>Total RULA Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**RULA Scoring:**
1 or 2 = acceptable posture
3 or 4 = further investigation, change may be needed
5 or 6 = further investigation, change soon
7 = Investigate and implement change

**Assessment:**

**Recommendations:**

- Stretch before starting and periodically during lab/clinic practice; also afterward
- Adjust your chair to provide lumbar support and to the proper height for you
- Adjust patient’s chair after you determine a comfortable position for you
- Position tools and materials within an easy reach
- When wearing loupes, move your chair to minimize neck flexion and lateral rotation

Form D
**NECK STRETCHES**

- **Place your arm behind your back.** Turn your head toward the other side. Hold for 10 seconds. Repeat on other side.

- **Overhead Stretch**
  - Clasp your hands and raise them up over your head, palms facing up. Hold for 10 seconds.

- **Chest Stretch**
  - Place your hands behind your neck. Slowly spread your elbows apart. Hold for 10 seconds.

- **Upper Back Stretch**
  - Pull your elbows back and squeeze your shoulder blades. Hold for 10 seconds.

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**POSTURE EXERCISES**

- **Chin Tuck**
  - Pull your chin straight back. Hold for 10 seconds.

- **Overhead Stretch**
  - Clasp your hands and raise them up over your head, palms facing up. Hold for 10 seconds.

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**EXERCISES AND STRETCHES FOR WRIST AND HAND**

- **Move your hand side to side.**
- **Open and close your hand.**
- **Bend your thumb over toward the base of your pinkie finger.**
- **Hold your arm out in front. Keep your elbow straight and your palm down. Use other hand to stretch your wrist. Hold for 10 seconds.**

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**SHOULDER EXERCISES**

- **Roll your shoulders back.**
- **Reach over your head.**
- **Reach back.**
- **Shrug your shoulders.** Hold for 3 seconds. Do 2-3 sets of 10.

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Ergonomic Tips

#1. "ADAPT YOUR UNIT TO YOU"

#2 Place most frequently used items in convenient locations

#3 Adjust patient to a height that reduces strain on neck/back

#4 Adjust your chair when needed

#5 Maintain a neutral posture

#6 Keep both feet flat on floor

#7 Avoid gripping instruments too tightly

#8 Take small breaks

#9 Perform stretches and exercises for problem areas

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