

# **Understanding Ergonomics and its Application to Occupational Therapy Practice**

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# 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

# 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

MARCH 2021

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

February 2021  
Sun: 1, 8, 15, 22, 29  
Mon: 2, 9, 16, 23, 30  
Tue: 3, 10, 17, 24, 31  
Wed: 4, 11, 18, 25  
Thu: 5, 12, 19, 26  
Fri: 6, 13, 20, 27  
Sat: 7, 14, 21, 28

March 2021  
Sun: 7, 14, 21, 28  
Mon: 1, 8, 15, 22, 29  
Tue: 2, 9, 16, 23, 30  
Wed: 3, 10, 17, 24  
Thu: 4, 11, 18, 25  
Fri: 5, 12, 19, 26  
Sat: 6, 13, 20, 27

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# 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



# Body Region Guidelines

Body Part/Region	Safe Zone (in degrees)
<b>Neck</b> (Flexion, lateral rotation, side bending)	20 degrees
<b>Back</b> (Flexion, rotation, side bending)	30 degrees
<b>Shoulders</b> (Abduction, flexion, extension, crossing midline)	30 degrees
<b>Elbows</b> (Flexion)	> 90 degrees
<b>Forearms</b>	Mid-range pronation or supination
<b>Wrist/hands</b> (Flexion, extension, radial/ulnar deviation)	Neutral wrist is best 0-20 degrees of extension Avoid thumb extension





# 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

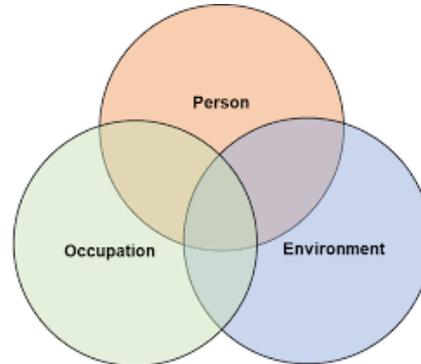
(Jacobs, 2008)

# Common WRMSDs

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

# 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



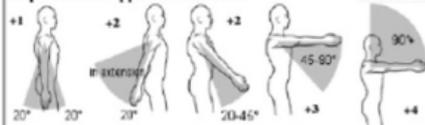
# Ergonomic Assessments

- ▶ 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)

**A. Arm and Wrist Analysis**

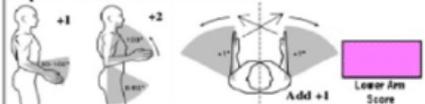
**Step 1: Locate Upper Arm Position:**



Step 1a: Adjust...  
 If shoulder is raised: +1  
 If upper arm is abducted: +1  
 If arm is supported or person is leaning: -1

Upper Arm Score

**Step 2: Locate Lower Arm Position:**



Step 2a: Adjust...  
 If either arm is working across midline or out to side of body: Add +1

Lower Arm Score

**Step 3: Locate Wrist Position:**



Step 3a: Adjust...  
 If wrist is bent from midline: Add +1

Wrist Score

**Step 4: Wrist Twist:**

If wrist is twisted in mid-range: +1  
 If wrist is at or near end of range: +2

Wrist Twist Score

**Step 5: Look-up Posture Score in Table A:**

Using values from steps 1-4 above, locate score in Table A

Posture Score A

**Step 6: Add Muscle Use Score**

If posture mainly static (i.e. held > 10 minutes),  
 Or if action repeated occurs 4X per minute: +1

Muscle Use Score

**Step 7: Add Force/Load Score**

If load < 4.4 lbs (intermittent): +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 or repeated or shocks: +3

Force/Load Score

**Step 8: Find Row in Table C**

Add values from steps 5-7 to obtain Wrist and Arm Score. Find row in Table C.

Wrist & Arm Score

**SCORES**

**Table A: Wrist Posture Score**

Upper Arm	Lower Arm	SCORES					
		Wrist Twist	Wrist Twist	Wrist Twist	Wrist Twist		
1	1	1	2	2	3	3	3
	2	2	2	2	3	3	3
	3	2	3	3	3	3	4
2	1	2	3	3	3	4	4
	2	2	3	3	3	4	4
	3	3	4	4	4	4	5
3	1	3	4	4	4	4	5
	2	3	4	4	4	4	5
	3	4	4	4	4	5	5
4	1	4	4	4	4	5	5
	2	4	4	4	4	5	5
	3	4	4	4	5	5	6
5	1	5	5	5	5	6	7
	2	5	6	6	6	7	7
	3	6	6	7	7	7	8
6	1	7	7	7	7	8	9
	2	8	8	8	8	9	9
	3	9	9	9	9	9	9

**Table C: Neck, trunk and leg score**

Wrist and Arm Score	Neck, trunk and leg score						
	1	2	3	4	5	6	7+
1	1	2	3	3	4	5	5
2	2	2	3	4	4	5	5
3	3	3	3	4	4	5	6
4	4	3	3	4	4	5	6
5	4	4	4	4	5	6	7
6	4	4	5	5	6	7	7
7	5	5	6	6	7	7	7
8+	5	5	6	7	7	7	7

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

Final Score

**B. Neck, Trunk and Leg Analysis**

**Step 9: Locate Neck Position:**



Step 9a: Adjust...  
 If neck is twisted: +1  
 If neck is side bending: +1

Neck Score

**Step 10: Locate Trunk Position:**



Step 10a: Adjust...  
 If trunk is twisted: +1  
 If trunk is side bending: +1

Trunk Score

**Step 11: Legs:**

If legs and feet are working supported: +1  
 If not: +2

Leg Score

**Table B: Trunk Posture Score**

Neck Posture Score	Trunk Posture Score					
	1	2	3	4	5	6
1	1	2	2	3	3	4
2	2	3	3	4	4	5
3	3	3	4	4	5	6
4	4	4	5	5	6	7
5	5	5	6	6	7	7
6	6	6	7	7	8	8

**Step 12: Look-up Posture Score in Table B:**

Using values from steps 9-11 above, locate score in Table B

Posture Score B

**Step 13: Add Muscle Use Score**

If posture mainly static (i.e. held > 10 minutes),  
 Or if action repeated occurs 4X per minute: +1

Muscle Use Score

**Step 14: Add Force/Load Score**

If load < 4.4 lbs (intermittent): +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 or repeated or shocks: +3

Force/Load Score

**Step 15: Find Column in Table C**

Add values from steps 12-14 to obtain Neck, Trunk and Leg Score. Find Column in Table C.

Neck, Trunk & Leg Score

Task name: \_\_\_\_\_ Reviewer: \_\_\_\_\_ Date: \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_

# 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

# 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

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# Panel Discussion

- ▶ Asia Kim, CHES®, OTS – Northwestern University
- ▶ Dana Lingle, OTD, OTR/L, CHT – Northwestern University
- ▶ Level IIA Fieldwork in Ergonomics and Health Promotion
  - ▶ Collaboration with Northwestern 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:

RULA Scores →	Wrist & Arm (purple)	Neck (light green)	Trunk (medium blue)	Posture (white Table B)	Neck, Trunk & Leg (pink)	Final RULA Score
Student ↓						

**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
- 
- 
-

# NECK STRETCHES



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



Place your hand on top of your head. Gently bring your ear toward your shoulder. Hold for 10 seconds. Repeat on other side.



Squeeze your shoulder blades. Hold for 10 seconds.



Pull your chin straight back. Hold for 10 seconds.

# 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.



## 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.



# 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.



Hold your arm out in front. Keep your elbow straight and your palm up. Use your other hand to stretch your wrist. Hold for 10 seconds.

# SHOULDER EXERCISES



Roll your shoulders back.



Reach over your head.



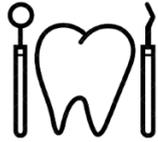
Reach back.



Shrug your shoulders. Hold for 3 seconds. Do 2-3 sets of 10.



Pull right arm across your body. Hold for 10 seconds. Repeat on left side.



# 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