IN THE NAME OF GOD
Work-related Musculoskeletal Disorders

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What Does Ergonomics Mean?

“Make the work fit the person, not the person fit the work”
Benefits of Ergonomics Include:

- Safer jobs with fewer injuries
- Increased efficiency and productivity
- Improved quality and fewer errors
- Improved morale
WORK-RELATED MUSCULOSKELETAL DISORDERS
WMSDs are sometimes referred to using other unfamiliar terms such as:

1. Cumulative Trauma Disorders – CTD
2. Repetitive Trauma Disorders – RTD
3. Repetitive Strain Injuries – RSI
4. Repeated Motion Disorders – RMD
5. Overuse Syndromes
Signs or Symptoms of WMSDs

- Painful joints
- Pain in wrists, shoulders, forearms, knees, etc.
- Pain, tingling or numbness in hands or feet
- Fingers or toes turning white
- Shooting or stabbing pains in arms or legs
- Back or neck pain
- Swelling or inflammation
- Stiffness
- Burning sensations
- Weakness or clumsiness in hands; dropping things
ERGONOMICS

Work-Related Musculoskeletal Disorders (WMSDs) are occupational disorders that involve soft tissues such as muscles, tendons, ligaments, joints, blood vessels and nerves.
Ergonomical (Job) Risk Factors

- Sustained or Repeated Application of Force
- Sustained Awkward Postures
- Rapid, Repeated Motion
- Vibration
- Mechanical Contact Stress
- Cold Temperatures
- Static Postures
What is The Musculoskeletal System?

The Musculoskeletal System includes the following:

1. Bones – The load-bearing structure of the body
2. Muscles - Tissue that contract to create movement
3. Tendons – Tissues that connect muscles to bones
4. Ligaments – Tissues that connect bones to bones
5. Cartilage – Tissue that provides cushioning and reduces friction between bones
6. Nerves – Communication system that links muscles, tendons and other tissue with the brain
7. Blood Vessels – Tubes that circulate nutrients throughout the body
What Are Examples of WMSDs?

1. **Sprain** – Overstretching or overexertion of a ligament that results in a tear or rupture of the ligament
2. **Strain** – Overstretching or overexertion of a muscle or tendon
3. **Tendonitis** – Inflammation of the tendon inside the sheath
4. **Tenosynovitis** – Inflammation of the sheath around the tendon
5. **Carpal Tunnel Syndrome** – Compression of the median nerve as it passes through the carpal tunnel in the heel of the hand
What are Examples of WMSDs?

6. **Tennis elbow or Golfer’s elbow** – Medical term is *Epicondylitis* – inflammation of the tendons at the elbow.

7. **Trigger Finger** – Common term for *tendonitis* or *tenosynovitis* that causes painful locking of the finger(s) while flexing.

8. **Pitcher’s Shoulder** – *Rotator cuff tendonitis* – inflammation of one or more tendons at the shoulder.

9. **White Finger** – Medical term is *Reynaud’s Phenomenon* – constriction of the blood vessels in the hands and fingers.

10. **Digital Neuritis** – Compression of the nerves along the sides of the fingers or thumbs.
Injury in the Sport
Examples of work
Anatomy of a Tendon

- Tendon Sheath
- Tendon
- Muscle
Tendonitis

• Tendon function:
  – Transmit force from muscle to bone

• Micro tears of tendon occur daily

• Typically repair themselves

• With repeated loading repair is not adequate

• Pain / Inflammation
Anatomy of DeQuervain’s Tendonitis
What Causes DeQuervain’s?

- Wringing washcloths, clothes
- Typing on the computer keyboard
- Cutting with scissors
- Sewing or pinching
- Stirring food for a long period of time
- Opening jars
Carpal Tunnel
Carpal Tunnel

- Best known MSD
- Compression of the median nerve at the wrist
- Tunnel made up of nine flexor tendons and one peripheral nerve
- Numbness and tingling on the thumb side of the hand
Transverse carpal ligament: This very strong ligament forms the "roof" of the carpal tunnel.

Median nerve: This nerve carries sensation to and from the fingers and powers the movement of the thumb.

Carpal tunnel: The space in the center of the wrist containing the flexor tendons and the median nerve.

Carpal bones: A U-shaped cluster of eight bones at the base of the palm forms the floor and two sides of the tunnel.

Flexor tendons: These tendons encircle the median nerve and form the major contents of the tunnel.
CARPAL TUNNEL SYNDROME

Median Nerve
Flex. Pol. Longus
Transverse Carpal Lig.
Flex. Dig. Superficialis
Flex. Dig. Profundus

Tingling
Surgical Release of Tunnel

The ligament is released and the tunnel springs open, easing pressure on the nerve.
Tennis Elbow Syndrome
Micro-tearing at the Elbow
Cubital Tunnel Syndrome

Anatomy of the Elbow

- Biceps Muscle
- Biceps Tendon
- Radius
- Annular Ligament of Radius
- Ulna
- Ulnar Nerve
- Posterior Band
- Intermediate Band
- Anterior Band
- Humerus
- Ulnar Collateral Ligament
Cubital Tunnel Syndrome
Cubital Tunnel Syndrome
Cubital Tunnel Syndrome
Ulnar Nerve

Ulnar Nerve

Area of sensation

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Cubital Tunnel Syndrome

Symptoms

Area of Pain

Area of numbness
Cervical Spine Injuries

- Acute injuries typically trauma induced and involve excessive movement/s of the spine and injury to related structures

- Chronic conditions result from poor posture, muscle imbalances, decreased flexibility and/or repetitive movement related to activity
Cervical Spine Injuries

- Brachial plexus injuries (stinger/burner)
  - Compression or distraction
- Cervical nerve root impingement
  - Degenerative disc changes
  - Acute disc injury
- Sprain/strain syndrome
  - Difficult to differentiate
- Vertebral artery impingement
Cervical Injuries

- Brachial Plexus (C5-T1) “burners or stingers”
  - MOI: stretch or compression
  - S/S: burning or stinging neck/arm/hand, muscle weakness, supraclavicular tenderness, neck pain
  - chronic: numbness, tingling, and weakness lasts longer
Brachial Plexus Pathology

- Neurological findings
  - Burning, pain
  - Muscle weakness
  - Point tenderness
  - Mechanism of Injury
Brachial Plexus Injury

- **Compression force** – nerve roots pinched between adjacent vertebrae
  - Increased risk if spinal stenosis (narrowing of intervertebral foramen) exists

- **Distraction force** – tension or “stretch” force on nerve roots
  - Most common at C5/C6 levels but may involve any cervical nerve root
  - Erb’s point – 2-3 cm above clavicle anterior to C6 transverse process, most superficial passage of brachial plexus
Brachial Plexus Injury

• Signs and symptoms
  – Immediate and significant pain
  – “Burning” or radiating pain in upper extremity
  – Dropped shoulder on affected side
  – Myotome and dermatome deficiencies at affected nerve root levels

• Generally, symptoms minimize or resolve quickly

• If recurrent, takes less trauma to induce symptoms and longer for symptoms to diminish
Cervical Nerve Root Impingement

- Disc related conditions
  - Degenerative disc changes
  - Disc herniations – most at C5/C6 or C6/C7 levels
  - Often presents with head in position of least compression on affected nerve root/s
  - Similar neuro symptoms to brachial plexus injuries at involved level/s
- Narrowing of intervertebral foramen
  - Exostosis (bone spur)
  - Facet degeneration
Cervical Nerve Root Impingement

- Causes:
  - Spinal stenosis
  - Disc herniations (C5-6 or C6-7) are most common
  - Chronic Muscular Tension/Facet Joint Syndrome

- Pain characteristics:
  - Radiating pain into upper extremity

- Upper quarter screening reveals:
  - Sensory deficits and/or muscle weakness
Sprain/Strain Syndrome

- Since unable to directly palpate facet joints, difficult to differentiate pain/spasm associated with sprain of joint capsule from strain of musculature
- Inflammation from sprain/strain may irritate nerve roots in close anatomical orientation to affected area and produce neuro symptoms
- Severe sprains (dislocations) will present with postural change due to joint disassociation
Cervical Strains and Sprains

• **S/S:**
  - limited
  - diffuse tenderness,
  - no peripheral pain or paresthesia,
  - normal neurological
Cervical Disk, Nerve Impingement, or Fracture/Dislocation

• S/S:
  – Abnormal neurological
  – Peripheral pain or paresthesia,
  – specific tenderness
Rotator cuff muscles

- Supraspinatus, infraspinatus, teres minor, subscapularis
- Form cuff around humeral head
- Keep humeral head within joint (counteract deltoid)
- Abduction, external rotation, internal rotation
Rotator cuff tendonitis

• Some argue this is same as impingement
• Acute or chronic
  – Acute – more likely to have calcific deposits
• Pain along lateral arm (outer deltoid)
• Pain with numerous activities, lying on the affected side, overhead movements
• RF – relative overuse, age, osteophytes, trauma, inflammatory processes (RA)
Tx of tendonitis

- Rest
- Heat or ice
- Ultrasound (physical therapy)
- NSAIDs
- Subacromial steroid injection
Rotator cuff tear

- 50% pts do not have preceding trauma
- Usually in supraspinatus
- Shoulder weakness, pain, loss of motion
Sx of rotator cuff tear

- Shoulder weakness
- Localized pain over upper back
- Popping/catching sensation when shoulder is moved
- Night pain is characteristic

- Sx vary depending on direction of the torn tendon fibers
  - Parallel: pain
  - Transverse: weakness, loss of function
Exam for rotator cuff tear

- Range of motion
- Strength
- Drop arm test
  - Arm abducted with elbow straight
  - See if pt can smoothly lower arm
  - If arm drops, then test is positive for tear
  - Highly specific but only 21% sensitive
Radiology for rotator cuff tears

- Interpret carefully
  - 34% asymptomatic pts (all ages) and 54% pts >60 yo have partial rotator cuff tears
  - Abnormal rotator cuff signal after trauma may represent strain rather than tear
- X-rays
  - Look for high riding humeral head
- Ultrasound
  - Highly operator dependent
- MRI
Rotator cuff tears
Tx of rotator cuff tears

- Ice, NSAIDs, restrict aggravating motions
- Weighted pendulum
- No arm slings
- Steroid injection if persistent sx
- Surgery – refer if young pts, full/large tears, dominant arm
  - Best if done within 6 weeks
- Acromioplasty and debridement
Overhead Lifting
Reynaud’s Phenomenon or “White Finger”

- Caused by operating vibrating machinery – especially in cold, damp weather
INCREASED RISK FACTORS
Awkward Postures
High Hand Force
Highly Repetitive Motion
Repeated Impact
Heavy, Frequent or Awkward Lifting
Moderate to High Hand-Arm Vibration
Awkward Postures

Being in these work positions for more than 2 hours total per day

- Hands above head
- Elbows above shoulder
- Back bent forward more than 30 degrees
- Neck bent more than 30 degrees
- Squatting
- Kneeling
Working with the Hands Above Head

For more than 2 hours per day
Working with the Elbows Above Shoulders

For more than 2 hours per day
Neck or Back Bent Forward More than 30º
For more than 2 hours per day
Neck or Back Bent Forward
More than 30°
For more than 2 hours per day
Neck or Back Bent Forward
More than 30°
For more than 2 hours per day
Squatting
For more than 2 hours per day
Kneeling
For more than 2 hours per day
High Hand Force
More than 2 hours per day of:
Pinching 2 or more pounds weight or 4 or more pounds force
High Hand Force
More than 2 hours per day of:

Gripping 10 or more pounds weight or force
Highly Repetitive Motion

Workers repeat same motion every few seconds for more than 2 hours per day with:

– neck
– shoulders
– elbows
– wrists
– hands
Highly Repetitive Motion

Intensive keying for more than 4 hours per day
Repeated Impact

Using hands or knees as a hammer
- more than 10 times per hour
- more than 2 hours per day
Repeated Impact

Using hands or knees as a hammer
- more than 10 times per hour
- more than 2 hours per day
Heavy, Frequent, or Awkward Lifting
Heavy, Frequent, or Awkward Lifting
Moderate to High Hand-Arm Vibration

Moderate Level
more than
2 hours/day
Moderate to High Hand-Arm Vibration

High Level
More than 30 Min/day
If the Employer Has “Caution Zone” Jobs, They Should:

- Begin an employee awareness education program
- Analyze the workplace for hazards
- Reduce any hazards they find
Wrist Bent

**Extension**

**Flexion**

**Ulnar Deviation**
Tendonitis Risk Factors

- Repetition
- Forceful exertion
- Awkward / sustained postures
- Mechanical Stress
Mechanical Stress
Heavy, Frequent, Awkward
Manual Handling

- Manual handling is transporting or supporting a load by hands or bodily force
- This includes:
  - Lifting
  - Carrying
  - Putting down
  - Pushing
  - Pulling
  - Moving
  - Supporting
Hand-Arm Vibration
What are the Symptoms?

- Tingling and numbness in the fingers
- In the cold and wet, fingers go blue then red and are painful
- You can’t feel things with your fingers
- Pain or tingling in your forearms at night which stop you from sleeping
- Loss of strength in your arms and hands
What are the Symptoms?
Who is at Risk?

• Those with a disease that reduces blood flow
• Workers in cold and damp conditions
Who is at Risk?

Workers using vibrating tools

Workers in contact with cold tools
How Can I Prevent it?

• Ask for low vibration tools
• Try a different approach to your job
• Use the right tool for the job
• Keep blades and cutting edges sharp
How can I Prevent it?

• Check to ensure that the tool has been properly maintained
• Reduce the amount of time you use the tool
• Keep the handles warm
Prevention

Low vibration tools
Use the right tool for the job
Tool maintenance
Reduce amount of time using the tool
Keep hands & handles warm
New approach to your job
Anti-vibration gloves
Muscular support of the Neck

- Sternocleidomastoid
- Levator scapulae
- Trapezius
Common Causes of Back Injuries

Twisting at the waist while lifting or holding a heavy load . . . this frequently happens when using a shovel.
Common Causes of Back Injuries

Reaching and lifting . . . over your head, across a table, or out the back of a truck . . . .
Common Causes of Back Injuries

Working in awkward, uncomfortable positions . . .
Common Causes of Back Injuries

Sitting or standing too long in one position . . . sitting can be very hard on the lower back . . . .
Common Causes of Back Injuries

It is also possible to injure your back slipping on a wet floor or ice ...
Prevent Back Injuries

- Avoid lifting and bending whenever you can
- Place objects up off the floor
- Raise/lower shelves.
- Use carts and dollies
- Use cranes, hoists, lift tables, and other lift-assist devices whenever you can
- Test the weight of an object before lifting by picking up a corner
- Get help if it’s too heavy for you to lift it alone
Thanks for your attention