Work-Related Musculoskeletal Injuries

Yahira Acevedo-Santiago, MD, Staff Physiatrist

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Objectives

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- Definition
- Relevance
- Risk factors
- Types of injuries
- Symptoms and Examples
- Treatment and Prevention

Definition

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- ***Work-Related Musculoskeletal Injuries***
  - System and connective tissue diseases and disorders occurring when event or exposure leading to them is a bodily reaction (bending, climbing, crawling, reaching, twisting), overexertion or repetitive motion

- Does NOT include: slips, trips, falls or similar incidents/accidents

Why is it important?

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- High costs to employers
  - Absenteeism
  - Lost productivity
  - Increased costs
    - Health care
    - Disability
    - Worker's compensation

Why is it important?

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- Musculoskeletal disorders
  - 70 million physician office visits in USA
  - 130 million total health care encounters
    - Outpatient
    - Hospital
    - Emergency Room

Why is it important?

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- Economic burden
  - Compensation cost, lost wages, lost productivity
    - $45-$54 billion annually
- Cost to employers
  - Per Liberty Mutual, overexertion injuries cost employers $13.4 billion/year
    - Lifting, pushing, pulling, holding, carrying, throwing

Risk Factors

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- Arm, hand, spine and leg movements
  - Bending, straightening, gripping, holding, twisting
  - Heat, cold, vibration
  - Associated with work patterns
    - Fixed/constrained body position
    - Continual repetition
    - Force on small parts of body (hand/wrist)
    - Fast pace – not allowing sufficient recovery in between

Daily Life ≠ Continual Repetition/Forceful/High Speed

Types of injury

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Muscle

- Prolonged or fast muscle contraction with short recovery

Tendon

- Repetitive work and/or awkward postures
- Tendinitis (acute)
- Tendinopathy (chronic/repetitive)

Types of injury

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Nerve

Repetitive, awkward postures

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Tissue swelling

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Nerve compression

Ligament/vertebral disc

Repetitive work, sudden and/or awkward postures

Symptoms

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- Pain
- Joint stiffness
- Muscle tightness
- Redness/swelling
- Numbness
- Tingling
- Pins/needles sensation

Stages

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Early

- Aching/pain during work shift
- Goes away after shift and days off

Intermediate

- Aching/tiredness start early in work shift
- Persist at night

Late

- Aching, fatigue, weakness persists at rest
- Inability to sleep and perform light duty

Examples

- Carpal Tunnel Syndrome
- Myofascial pain syndrome
  - Neck/Low Back
- Back Injury
- Rotator Cuff Syndrome
- Arthritis
- Other tendinopathies/tenosynovitis

Treatment

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- Physiatrist Role
  - Physician who specializes in rehabilitation and treatment of muscle, tendon, nerve and bone/soft tissue disorders
  - Treatment of disorders that may cause temporary or permanent impairment
  - Focus in restoring function

Treatment

- Slight variation by location/mechanism/extent of injury
- Restriction of movement
  - Work restrictions, task modifications
  - Splint, brace use
- Modalities
  - Cold – acute injuries, short duration
  - Heat – sub-acute/chronic injuries

Treatment

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- Exercise
  - Physical therapy → Home exercise program
- Medication
  - Analgesics, anti-Inflammatories, muscle relaxers
- Procedures
  - Joint/spine/bursa injections (steroid); muscle injections (trigger point)
- Surgery
  - If compromising injury or everything else fails

Prevention

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- Ergonomics - Science of fitting workplace conditions and job demands to the capability of the working population
  - Goals
    - Reduce stress and eliminate injuries and disorders
      - Overuse of muscles
      - Bad posture
      - Repeated tasks

Prevention

- Occupational Health and Safety
- Workplace Controls

Prevention

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- Engineering Controls
  - Preferred approach – design job to take account of capabilities and limitations of workforce
    - Use of equipment, parts of products to reduce load/force
  - Change workstation layout
    - Adjustable-height workbenches or placement of equipment to decrease need to reach

Prevention

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- Administrative Controls
  - Policies and practices to reduce disorder/injury
  - Do not eliminate workplace hazards
  - Temporary
    - Reducing shift length or amount of overtime
    - Scheduling more breaks for rest/recovery
    - Rotating workers: higher demand ↔ lower demand
    - Training workers in recognizing early stages of injury

Prevention

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- Personal Protective Equipment
  - Barrier between worker and hazard
  - Respirators, ear plugs, safety goggles, chemical aprons, safety shoes, hard hats
  - Braces, wrist splints, back belts – questionable
    - May increase exposure to other injury by pressure on adjacent joint or additional force while using.

Prevention

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- Elements of ergonomic process (OSHA)
  - Provide management support
  - Involve workers
  - Provide training
  - Identify problems
  - Encourage early reporting of symptoms
  - Implement solutions to control hazards
  - Evaluate progress

Questions?

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yacevedosantiago@gsrh.org

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Neuroplasticity and its Application in Rehabilitation and Robotics

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Objectives

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- Define neuroplasticity and its application in rehabilitation.
- Explain the underlying motor recovery principles that support the use of lower extremity robotic technologies.
- Present the use of robotics in rehabilitation for those who have sustained spinal cord injury and stroke.

Rehabilitation is Changing

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- For the past 75 years, compensation for loss of function was the primary focus of rehabilitation
- The central nervous system was thought to be unresponsive to change and incapable of recovery
- However, research has shown that the brain and spinal cord are indeed plastic and can develop new neuronal interconnections so that new functions can be acquired and restored
- Neuroplasticity

Neuroplasticity

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It represents the adaptive capacity of the central nervous system to modify its own organization and function and to respond to changes in their environment.

The CNS may respond to this stimuli by reorganizing its structure, function, and/or neural connections.

Neuroplasticity is present in both healthy and damaged CNS.

Neuroplasticity in Healthy CNS

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- Musicians – how do I get to Carnegie Hall? "practice, practice, practice".
- Athletes – practice fundamentals – over and over and over.
- Why does this work? Muscles can't think – its the hardwiring of the CNS through repetition of activity that leads to improvement in performance

Potential for CNS Recovery

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"Neural plasticity is the mechanism by which the brain encodes experience and learns new behaviors. It is also the mechanism by which the damaged CNS relearns lost behavior in response to rehabilitation."

(Kleim, J & Jones T. 2008)

Promotion of Neuroplasticity

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Behavioral experience shapes the brain which can be maladaptive (compensation) or functionally adaptive (recovery)

Behavioral Compensation	Functional Recovery
Response to damage and behavioral attempts to compensate for effects of damage.	***Response to a behavioral experience that enhances functional outcome and promotes functional re-organization***

(Fisher, 2013)

Neuroplasticity – Practice Matters

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Skill acquisition through **PRACTICE** is thought to be an important variable (if not the most important variable) in the learning of motor skills and the promotion of neuroplasticity

Need for large quantities of **PRACTICE**

Plasticity of spinal neuronal circuits is largely task specific and use-dependent

Spinal neuronal circuits learn the sensorimotor task that is specifically practiced and trained

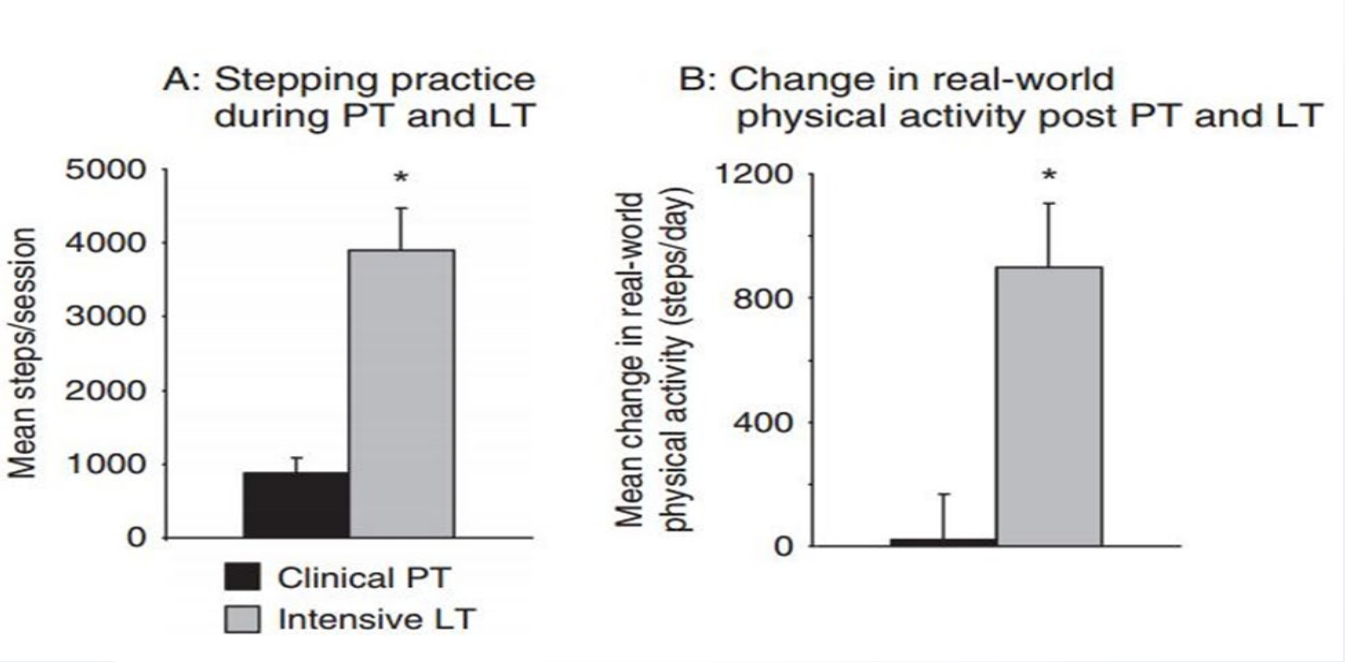
- Practice walking= better walking
- Practice standing = better standing
- Practice walking ≠ better standing

Neuroplasticity – Practice Matters

Significant relationship between amount of stepping practice (dose) versus response improvements in daily walking following physical therapy (Hornby, 2013)

Dose

Response



Exoskeleton Assisted Locomotor Training

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- Recent advances in robotic technology have led to emergence of lower limb exoskeletons
- Exoskeletons facilitate over ground walking in a reciprocating, relatively normal biomechanical position and facilitates repetition of movement
- Developed to address limitations of other forms of rehabilitation
- Provide legged mobility to individuals with lower extremity paralysis

Ekso GT - Video

https://www.youtube.com/watch?v=xKVWSsDbgXM&feature=youtu.be

Ekso GT

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- Reciprocating, powered LE exoskeleton
- Enables individuals with lower extremity paralysis to stand walk over ground with a four point reciprocal gait
- Walking is achieved by the user's forward lateral weight shift to initiate a step
- Battery-powered hip and knee motors drive the legs and replace neuromuscular function

- Applied over user's clothing. Weighs about 50 pounds (23kg)

Ekso GT

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Who?

Patients who have had a Spinal cord injury, stroke, brain injury , or other neurological conditions

How?

Therapists control power contribution and walking parameters

Ekso GT - Advantages

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- Normalized biomechanical position throughout gait.
- Achieves up to 7 degrees hip extension.
- Challenges balance recovery.
- Ability to vary robotic assistance as patient recovers
- Successfully used with Spinal Cord Injury; Stroke; and Brain Injury
- Not an end product, but a therapy tool / intervention to enable patients to maximize their recovery and their ability to walk unaided or with as little assistance as possible

Ekso GT - Inclusion Criteria

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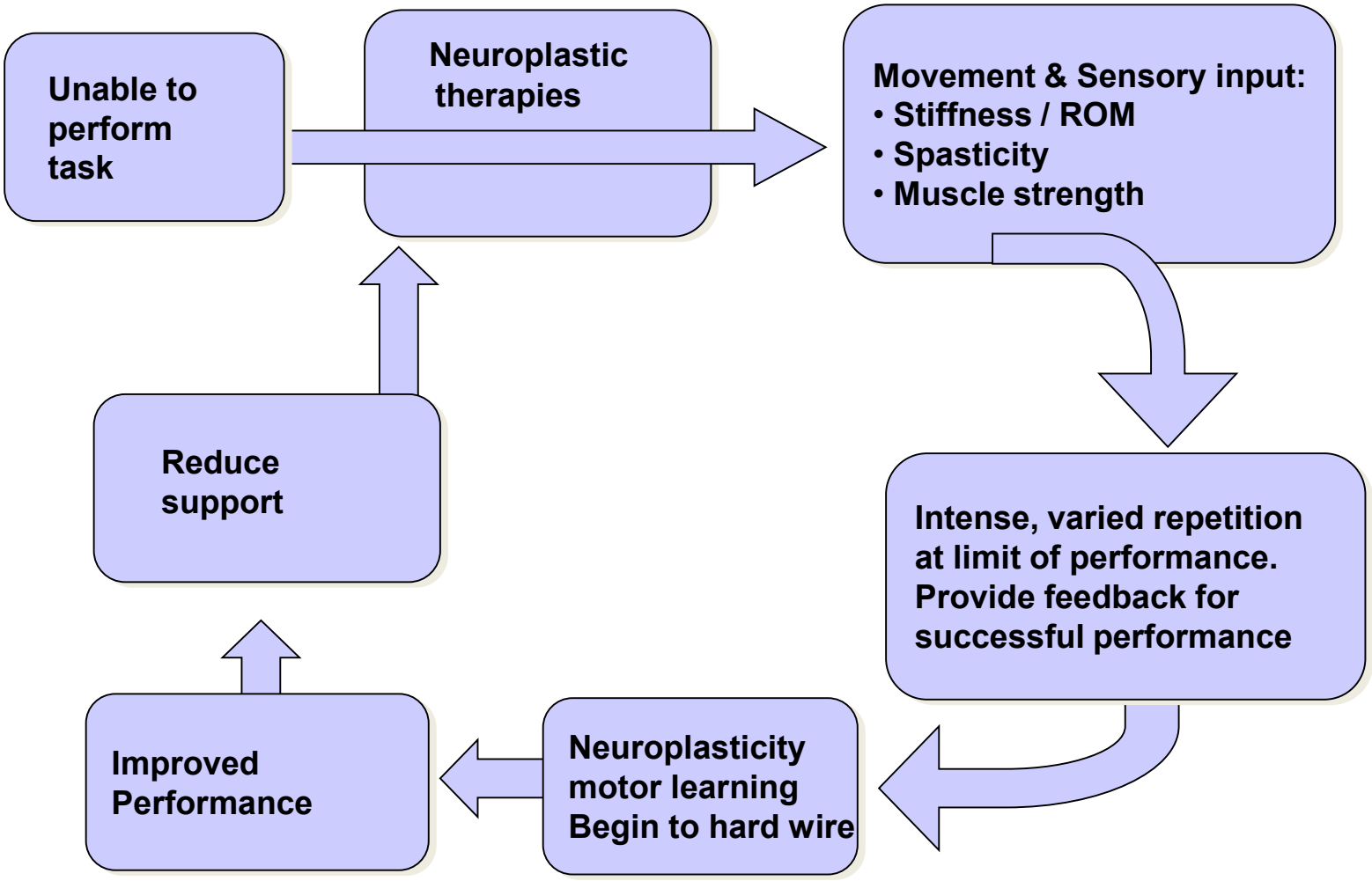
- Lower extremity paralysis/weakness (Unilateral or bilateral)
- 220 pound weight limit
- 5’ 2’’ – 6’ 2” height restriction
- Sufficient upper extremity strength to manage crutches or walker

Potential Influence of Neuroplastic Interventions on Functional Performance



THANK YOU

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