Reconditioning Post Injury: Part 1
Musculoskeletal Injuries: Mechanisms and Causes

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Available at: https://works.bepress.com/rob_orr/31/
Reconditioning post injury: PT 1
MSI: Mechanisms and Causes

Why?

• Understand how IOT optimise reconditioning and prevention
  • How force is transferred
  • Look at tissue properties
  • Panjabi’s stability and control principle
  • Causes of MSI
Reconditioning post injury: PT 1
MSI: Mechanisms and Causes

Force Transfer

- From muscle to bone
Properties of tissues

Structural Properties of Ligaments

Load-Deformation Curve

- Toe-in
- Linear region
- Zone of progressive microfailure
- Energy absorbed to failure
- Rupture
Properties of tissues

Load-deformation curve for Bone-Ligament-Bone Complex

Nordin, M., & Frankel, V. H. (2001). *Basic biomechanics of the musculoskeletal system.* Lippincott Williams & Wilkins.
Stability

Control System

Passive System

Active System

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Stability in action

Control System

Passive System  Active System

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Scenario 1: Faulty Control

- **Delayed / Slow Commands**
  - Neurological injury?
  - Faulty Joint Position Sense?
  - Fatigue?

**Control System**

**Passive System**
- **Excessive Load**
  - Ligamentous damage
  - Skeletal damage

**Active System**
- **Excessive Load**
  - Muscle damage
  - Tendon damage

**Reconditioning post injury: PT 1**

**MSI: Mechanisms and Causes**
Scenario 1: Faulty Control

- Faulty Commands
  - Poor motor patterns (Global vs local / technique)
Scenrio 1: Faulty Control

- Faulty Commands
  - Poor motor patterns (Global vs local)

- Excessive Load
  - Ligamentous damage
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- Excessive Load
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Scenario 2: Weak muscles

- Excessive Load
  - Ligamentous damage
  - Skeletal damage

Muscles too weak to overcome force
- General weakness
- Weakness through specific ROM (inner/outer ROM
- Strong muscle but external force too great
- Previous injury

Excessive Load
- Muscle damage
- Tendon damage

Control System

Passive System

Active System

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Scenario 2: Weak muscles

- Muscles too weak to overcome force
  - FATIGUE

**Control System**

**Excessive Load**
- Muscle damage
- Tendon damage

**Passive System**

- Ligamentous damage
- Skeletal damage

**Active System**

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Scenario 3: Osseoligamentous System Dysfunction

- Excessive Load
  - Ligamentous damage
  - Skeletal damage

- Pain
  - Muscle spasm increases load to muscle and bone
  - Alters movement mechanics (up/down Kinetic chain)

- Control System

- Excessive Load
  - Muscle damage
  - Tendon damage

- Passive System

- Active System
Scenario 3: Osseoligamentous System Dysfunction

- Excessive Load
  - Ligamentous damage
  - Skeletal damage

- Dysfunction in movement
  - Joints don’t work properly increasing muscle work or loading other joints

- Control System

- Passive System

- Active System

- Excessive Load
  - Muscle damage
  - Tendon damage
Known Causes of MSI

Intrinsic Factors
- Previous Injury
- Muscle weakness
- Poor biomechanics
- Poor fitness

Extrinsic Factors
- Clothing
- Equipment
- Work Environment
Known Causes of MSI

1. Forceful exertions
   - Acceleration
   - Force (F=MxA)
Known Causes of MSI

1. Forceful exertions
   - Acceleration
   - Force (F=MxA)
   - Awkward movement / positions

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Known Causes of MSI

2. Work posture
   • Passive
   • Kinetic
Known Causes of MSI

3. Repetitions and Duration

• Volume
• Intensity
Known Causes of MSI

4. Vibration
   • Low frequency continuous vibration
Known Causes of MSI

5. Work area
   • Physical space
Known Causes of MSI

5. Work area

- Physical space
- Occupational demands
Known Causes of MSI

5. Work area

- Physical space
- Occupational demands
- Environmental
Known Causes of MSI

6. Tools
   • Passive
   • Active
Known Causes of MSI

7. Position and Nature of Load
   - Position (COG)
Known Causes of MSI

7. Position and Nature of Load

- Position (COG)
- Nature (‘Live’ vs ‘Dead’/ Size)
Known Causes of MSI

8. Load handling

- No Lift policies
Reconditioning Post Injury: Part 2
Musculoskeletal Injuries: Types & reconditioning programs

Rob Orr (Bond University)
Why?

- Need to know what the injury is
- Pathological factors will influence rate of tissue healing
- Lack of pain and normal functional movement is not an indication that the injury and its cause have been resolved.
Injury Classifications by Mechanism

- **Traumatic**
  - EG: Ankle sprain / Muscle strain / Fracture
  - Causes: Extrinsic / Intrinsic

- **Overuse**
  - EG: PFPS, RC Impingement, Compartment Syndromes
  - Causes: Extrinsic / Intrinsic

- **Recurrent**
  - Recurrent injuries are those that continue to re-occur
  - Causes: Faulty Mechanics / Insufficient healing – recovery / Lack of re-strengthening / Faulty sensory information - Joint position sense / Loss of ROM
Types of Injury

- **Hard Tissue / Bony (Osseous)**
  - Fractures / Joint Displacement
  - Arthritis / Joint Degeneration

- **Soft Tissue**
  - Muscle Strains / Ligament Sprains
  - Tendonitis / Tendo-alegias (Lateral Epicondylitis / Lateral Epicondylealgia)
  - Contusions / Hematomas
  - Bursitis

- **Neural Tissue**
  - Neuropraxias / Direct injury to the CNS / PNS
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MSI: types & reconditioning programs

Fractures
Fractures

• MOI include:
  – Direct impact
  – Indirect impact (FOOSH)
  – Overuse (Stress Fracture)
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MSI: types & reconditioning programs

Fractures

- Oblique
- Comminuted
- Spiral
- Compound
Fractures

• Healing may be impaired by:
  – **Local Factors**
    • Movement
    • Interposition of soft tissue in fracture gap
    • **Infection**
    • Poor blood supply
    • **Poor nutrition**
    • Age
    • Poor general health
    • Poly-pharamcy (steroids)
Fractures

• **Predictors of Fracture Healing**
  – Spiral fracture in UL (children) - 3/52
  – Spiral fracture UL (adult) – 6/52
  – Spiral fracture LL 2x as long to unite – 12/52
  – Transverse fracture takes twice as long again
  – Fractured femur add 25%
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Joint Displacement

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Joint Displacement

- **Types**
  - *Subluxation* – *displacement of part of a joint*
  - *Dislocation* – *complete displacement of the joint*

- **MOI includes:**
  - A direct force (*Eg Knee in the shoulder*)
  - An indirect force (*FOOSH or ABD& ER*)
  - Overuse (Supraspinatus weakness/Instability)

- **Common Sites**
  - *Glenohumeral Joint*
  - *Acromioclavicular*
  - *Patella*
  - *Fingers*
Muscle Strains

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Muscle Strains

- MOI - Indirect injury caused to muscle by excessive stretch
  - Occurs where highest proportion of FT II fibres, examples include:
    - Rectus Femoris
    - Biceps Femoris
    - Medial Gastrocnemius
  - Muscle moved in eccentric manner
Muscle Strains

Grades

• **Mild / First Degree Strain**
  – Weakness mild or absent

• **Moderate / Second Degree Strain**
  – Notable loss of muscle fibers
  – Weakness

• **Severe / Third Degree Strain**
  – Reduced muscle function
  – Complete rupture - Myofascial separation complete
• **Long Term Sequelae**
  - Partial tear predisposes to complete tear
  - Fibrosis
  - Fatty replacement
  - Very rarely ossification
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MSI: types & reconditioning programs

Ligament sprains
Ligament sprains

• MOI = explosive movement with forces that cause a joint to move beyond its normal ROM and design
  – Tackled to the side of the knee
  – Slip and Fall
Grades

- **Mild / First Degree Sprain**
  - Pain reproduced by stretching the ligament
  - Local tenderness
  - Minor swelling / bleeding
  - Strapping may help
Grades

• **Moderate / Second Degree Sprain**
  - Major swelling with some bleeding
  - Increased dysfunction and instability
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MSI: types & mechanisms

Type II Sprain
- ligaments torn slightly
Grades

• **Severe / Third Degree Sprain**
  - Complete rupture
  - Immediate pain and loss of function
  - Joint unstable
  - Conservative approach (splint for 6 weeks) or Surgery
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MSI: types & mechanisms

Type III Sprain
- ligaments torn completely
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MSI: types & reconditioning programs

Ligament sprains

• Common Sites
  – Ankle
    • ATFL, CFL
  – Knee
    • MCL, LCL, ACL, PCL
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Tendonitis
Tendonitis

• MOI (Overuse)
  – Acute or Chronic
Tendonitis

Grade

• 1
  – Pain after activity only

• 2
  – Pain at the start of the activity that disappears
  – Pain Returns after the activity
  – Does not restrict activity
Tendinitis

Grade

• 3
  – Pain at the start of the activity that continues during and after the activity
  – Restriction of activity

• 4
  – Pain during everyday activities
  – Progressing and getting worse
Tendonitis

Common Sites

– Shoulder
  • Rotator Cuff (supraspinatus)
  • Long Head of Biceps

– Elbow
  • Lateral Epicondyle – Tennis Elbow (Although may be more than just a tendonitis)
  • Medial Epicondyle – Golfers elbow
  • Brachilias – Rope Climbing, Chin Ups
Tendonitis

Common Sites

— Knee
  • Quads tendon
  • Hamstring tendon
  • Adductor tendon

— Ankle
  • Achilles Tendon
The Repair Stage

General Tissue Healing Rates

- Muscle: 6 Weeks
- Tendons: 3 – 6 Weeks
- Ligaments: 12 Weeks
- Bones/Joints: 6 – 12 Weeks
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Considerations when developing a recon / rehab program

• Input versus Output
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MSI: types & reconditioning programs

Skinny running was way easier than fat running.
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Considerations when developing a recon / rehab program

• Quality of intake
Considerations when developing a recon / rehab program

- Cardio Vascular

What is the amount of moderate physical activity recommended by ACSM to maintain body weight?
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Considerations when developing a recon / rehab program

• Logistics
Considerations when developing a recon / rehab program

• Medication
Reconditioning post injury: PT 2
MSI: types & reconditioning programs

Considerations when developing a recon / rehab program

- The training high
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Considerations when developing a recon / rehab program

• What am I going to do today?
Considerations when developing a recon / rehab program

- What caused the injury?
• Patient Mobility
The Programming Approach

- Rehabilitation specific considerations:
  - MOI and other injuries
  - Chronic or Acute injury
  - Conservative vs Surgical treatment
  - Surgery
  - PWB, NWB, FWB
  - Constraints (Braces, slings, crutches)
  - Employment and Role
  - Stage of Rehabilitation (post Sx, RTW)
Indirect Programming Considerations

- Other areas under load
  - **Indirect loading** (Pushing through the heels of the feet during a Seated Shoulder Press)
  - **Available ROM** (Knee ROM available and the Lat Pulldown)
  - **Limb Position and Swelling** (Limb in a lowered position)
The Rehabilitation Exercise Programming Process

- Review the Referral
  - Review limitations
  - Aim of program

- Assess the Patient
  - Subjective (Painful activities, Latency of exercise effects?)
  - Objective (Girths, Strength, CV)

- Patient Goals
  - From referring practitioner
  - From patient
The Rehabilitation Exercise Programming Process...2

- Develop the Program
  - Exercises
  - Loading parameters (Sets, Reps, Rest etc)

- Implement Program
  - D.E.P. Process
  - Supervision

- Reassess after 1st session
  - Latency / Swelling
  - Heat / Stiffness
  - Pain
The Rehabilitation Exercise Programming Process...3

- Adjust program as required
  - Additional liaison with practitioner as required
  - Adjustments will need to be reassessed

- Reassess
  - Reports
  - Progression
  - Completion of Rx??
When training a WII police officer

- Consider the mechanism of injury
- Consider the potential causes (rehab/prehab)
- Consider the tissue (load deformation and recovery)
- Consider the nature of the injury
- Consider the wider impacts
- Develop and continually reassess and monitor the program
Reconditioning Post Injury

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