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Employee of Toronto2015 Organizing Committee

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None

Potential for conflict(s) of interest:
None
Objectives

1. To be able to describe the anatomy and physiology of the shoulder joint in motion

2. To be able to identify injury risk factors with common wheelchair sports

3. To be able to apply concepts of evidenced based rehabilitation into training
Fusion of Science and Sport

Functional Anatomy

Sport Mechanics

Athlete Risk Factors

Rehabilitation and Recovery
Non-Contractile
Labrum
Anatomy: Anterior View

- Clavicle
- Trapeze part, conoid part of coracoclavicular ligament
- Superior transverse scapular ligament and scapular notch
- Coracoid process
- Coracoacromial ligament
- Supraspinatus tendon (cut)
- Coracohumeral ligament
- Greater tubercle, lesser tubercle of humerus
- Intertubercular synovial sheath (communicates with articular synovial cavity)
- Subscapularis tendon (cut)
- Biceps brachii tendon (long head)
- Capsular ligament
- Outline of subscapular bursa
- Opening of subscapular bursa to shoulder joint
Stability with Mobility

Dynamics of Movement
- Joint Shape and Position
- Producing Freedom of Range

Structures for Stability
- Strength
- Shock Absorption
Shoulder Anatomy - Contractile

- Supraspinatus
- Acromion
- Spine of Scapula
- Infraspinatus
- Edge of Scapula
- Teres Minor
- Clavicle
- Supraspinatus muscle
- Subscapularis muscle
- Biceps
Dynamic Movement

Shoulder Joint Range of Motion

Outward rotation

Inward rotation
Functional Anatomy

Contractile
- Rotator Cuff
  - Supraspinatus
  - Infraspinatus
  - Subscapularis
  - Teres Minor
- Biceps/ Triceps
- Deltoid
- Subscapular stabilizers

Non-Contractile
- Labrum
- Ligaments
- Capsule
- Bursa
- Nerves
- Bones
Dominant Symptoms

- Pain
Dominant Symptoms

- Pain
- Stiffness
- Weakness
Dominant Symptoms

- Pain
- Stiffness
- Instability
- Weakness
Shoulder Pathology

- **Impingement**
  
  "Pinching sharpness"

- **Instability**
  
  "Pops and shifts"

- **Inflammation**
  
  "Hurts to move through range"

- **Immobility**
  
  "Can’t move it"
Shoulder Pathology

- **Impingement**
  - Tendon
  - Bursa
    - “Pinching sharpness”

- **Inflammation**
  - Acute Strain
  - Tendonopathy
    - “Hurts to move through range”

- **Instability**
  - Joint/ Labrum
  - Muscles
    - “pops and shifts”

- **Immobility**
  - Frozen Shoulder
  - Arthritis
  - Fracture
    - “Can’t move it”
Fusion of Science and Sport

Functional Anatomy

Sport Mechanics

Athlete Risk Factors

Rehabilitation and Recovery
Sport Mechanics

Basketball
Rugby
Athletics
Tennis

Archery  Dance  Fencing  Curling  Shotput
## Sport Mechanics

<table>
<thead>
<tr>
<th>Pull</th>
<th>Push</th>
</tr>
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<tbody>
<tr>
<td>Propulsion</td>
<td>Propulsive</td>
</tr>
<tr>
<td>Repetitive</td>
<td>Repetitive</td>
</tr>
<tr>
<td>Reach/ Shoot</td>
<td>Grab/ Hold</td>
</tr>
<tr>
<td>Stability and Rotation</td>
<td>Pivotal turns,</td>
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</tbody>
</table>
Key Mechanical Factors

- Propulsion
  - Repetition plus Force against Resistance
  - Athletics (Speed)
- Reach
  - Basketball (and Release)
  - Tennis (and Swing)
  - Rugby (and Throw)
- “Out of Reach”
  - Pivots, Manoeuvres, Awkward moments
How common are shoulder problems

Mobility – 40%, Push, F>M, Age


Prevalence and intensity of shoulder pain was significantly higher with patients with tetraplegia than paraplegia.

What is the incidence of Shoulder problems with Sport?

Women > Men
52% at Study
90% per Lifetime

Fusion of Science and Sport

Functional Anatomy

Sport Mechanics

Athlete Risk Factors

Rehabilitation and Recovery
Are certain sports higher risk?
Wheelchair Tennis

- Hyper-extension of shoulder
- Overhead smash
- Multi-directional
- Using arms to accelerate, manoeuvre and use racquet
High Risk Sport- WC Tennis

33 Elite WC Tennis Players, Random Health Questionnaire followed by Ultrasound

Dominant > Non-dominant Shoulder
- 21/33 (63%) Acromioclavicular pathology
- 14/33 (42%) Rotator Cuff Pathology

Negative Variables
- Age, Training time per day, Length of Career, Length of Time in Wheelchair

Positive Variable
- Wheelchair Tennis

Conclusion: What is predictable is preventable

Jeon et al; Ultrasonographic evaluation of the shoulder in elite wheelchair tennis players, J. Sport Rehab, 2010, 19, 2, 161-172,
Wheelchair fencers had higher overall injury incidence rate (3.9/1000 hours) than AFs (2.4/1000 hours).

Wheelchair fencers with poor trunk control were more vulnerable to injuries (4.9/1000 hours) than those with good trunk control (3.0/1000 hours).

Chung et al; Clinical Journal of Sport Medicine; Musculoskeletal Injuries in Elite Able-Bodied and Wheelchair Foil Fencers—A Pilot Study Volume 22(3), May 2012, p 278–280
Risk Factors
Athlete Risk Factors

1. Pre-existing
   - Impairment
2. Precipitators
   - new injury/ new equipment
3. Perpetuating
   - Deconditioning
4. Protective
   - Fitness, Recovery, Access to Treatment
Which of the following are Risk Factors for Rotator Cuff Disease?

- Smoking
- Alcohol
- Gender
- Age
- Previous Trauma
- Increased Body Mass Index
- Deconditioning
- Psychological Stress
Which of the following are Risk Factors for Shoulder Injury?

- Smoking
- Alcohol
- Gender
- Age
- Previous Trauma
- Increased Body Mass Index
- Deconditioning
- Psychological Stress
Is Gender a Risk Factor?

Prevalence and impact of musculoskeletal disorders of the upper limb in the general population.


Methods:
- 9,696 subjects, M&F, Cross-sectional Survey, Random
- Screening Questionnaire then a Symptomatic Exam

Results:
1. Shoulder Tendonopathy M:F 4.5% : 6.1%
2. Adhesive Capsulitis M:F 8.2% : 10.1%
Conclusions:

A consistent association between diabetes and shoulder disorders, some associations for weight-related factors as well as a possible preventive effect from physical exercise and sports suggest a metabolic pathophysiological process in shoulder disorders.

Risk factors of atherosclerosis and shoulder pain - Is there an association? A systematic review

European Journal of Pain (May 2008), 12 (4), pg. 412-426
Risk Factors

Shoulder Anatomy
- Increased Glenohumeral Laxity
- Shallow or narrow Joint

Shoulder Physiology
- Smaller Muscle mass for conditioning
- Habitual Postures

Shoulder Function
- Above Shoulder Positioning & Repetition
Fusion of Science and Sport

Functional Anatomy

Sport Mechanics

Athlete Risk Factors

Rehabilitation and Recovery
Rehabilitation and Recovery

1. Assess Trunk Control – Train CORE
2. Rotator Cuff Training – Predictable
3. Balance Mobility and Stability
4. Equipment
5. Lifestyle – Risk Factors
6. General Health Contribution
Key CORE Exercises
Rotator Cuff Conditioning
Stop Guessing and Start Assessing

1. Mobility
   - Sport requirements and Athlete Ability
     - GAP: Dynamic Stretching, Passive Positioning
     - Rehab: Soft Tissue Manual Therapy

2. Stability
   - Risk Factor analysis for instability
     - Gap: Strength – Rotator Cuff/ Subscapular/ Core
     - Rehab- Progressive, proprioceptive strengthenin
     - Structure - Labral /Ligament/ Capsular Tear
Recovery

Mini recovery within sport activity
- positional, variable intensity, active rest

Optimal Recovery between activity
- Light training days, Off days
  - Massage, Cool Tubs, Nutrition

Recovery within Periodization
- Extended Time off – 2-3 weeks for recovery