Injuries in Sport - a problem?
Perspectives, Definitions, Approaches

Uwe G. Kersting
Objectives

• Get an introduction to the IS modules
• Get an outline of the lecture concept
• Be able to define injury
• Report your own injury history
• Be able to locate Biomechanics in the context of research on injuries
• Review basic injury definitions
Contents

1. Introduction to course concept
2. Core areas and links
3. Injury Examples
4. Definitions of injury
5. Perspectives on injuries
6. Terminology and preview of epidemiology
Course concept

What these mini modules are about:

• Part of a course/programme/degree
• Not a ‘stand alone application’
• Links to exercise physiology, biology, mechanics → Biomechanics course, 2\textsuperscript{nd} year
• Tasks to be worked through within and after the lectures
• Elements of the course combine several levels or aspects of learning
You are going to

• describe, analyse and evaluate the incidence, severity, and cause of sports injuries.
• review and design injury recording systems
• understand of the mechanisms of injuries
• learn about pathology/histology of tissue response to loading
• basic biological processes as the foundation of tissue repair
• analyse, explain and evaluate the biomechanical and physiological principles behind sports injury
• design and evaluate strategies for prevention of sports injuries
• explain, analyse and evaluate methods of recovery from sports injuries
Course Expectations

What keeps you fit:

- Go through lectures and recommended readings prior to them
- 3rd semester will be focused on biomechanical aspects
- Ask, if you need help!
What’s gonna happen next?
Injury 'life'
Details

Non-contact?
Injury 'life'

Contact
Definitions of Sports Injury

All injury leaves pain in the memory except the greatest injury, that is death, which kills memory with life.

Exceptions: chemicals, radiation, biological organisms, ...

(Whiting & Zernicke): ... damage sustained by tissues of the body caused by physical trauma.

(Van Mechelen): ... all types of damage that occur in relation to sporting activities.

(Haddon): ... energy (amount, rate, transfer) exceeds material/structural capacities ...
Perspectives of Injury

Historical
Psychological
Safety Professional’s
Economic
Health Professional’s
Epidemiological
Scientific

→ Chapter 1,
(Whiting & Zernicke, textbook)
Perspectives of Injury

Historical:
numerous historical indications for injuries as inseparable part of human life

injury statistics change with historical changes
Perspectives of Injury

Psychological:

Pre: medical & psychosocial history
   player status, life stress, training status

During: emotional stress, injury site,
   unexpectedness

Post: compliance with treatment, perceived
   effectiveness, pain, social support, fans,
   media

Important: Injury is viewed
in the context of a process
- not just a one-off event!
Perspectives of Injury

Safety professional:
1. prevent hazardous situations
2. reduce incidence or severity of injury by education

Three basic strategies:
- educate persons at risk
- change laws (→ rules)
- provide automatic protection devices
Perspectives of Injury

Economic:
- direct costs - treatment
- morbidity costs - ‘unproductiveness’
- mortality costs - community loss (YoLL)
General, simplified model
by a health ‘manager’

Sport & Population

Cost:
accident stats, establishment of programmes, health implications, ...

Benefit:
well-being, health, longer life span, reduced # of hospitalisations ...

(Martin, 2006 (Keynote @ ECSS))
Perspectives of Injury

Health Professionals:
- emergency medical personnel
- physicians
- nurses
- physiotherapists
Perspectives of Injury

Epidemiological:
How many, how often, what kind, to whom?

descriptive – analytical
What type – which body part

incidence – severity?

relative risk – absolute risk?

Volleyballs skader i DK (Jørgensen, 1989)

<table>
<thead>
<tr>
<th>Anatomisk lokalisation</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoved &amp; tænder</td>
<td>1,4%</td>
</tr>
<tr>
<td>Skulder</td>
<td>10,1%</td>
</tr>
<tr>
<td>Albue</td>
<td>1,4%</td>
</tr>
<tr>
<td>Håndled</td>
<td>1,4%</td>
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<tr>
<td>Fingre</td>
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<tr>
<td>Ryg</td>
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<tr>
<td>Lår</td>
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<tr>
<td>Knæ</td>
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</tr>
<tr>
<td>Ankel/fod</td>
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</tr>
<tr>
<td>Andet</td>
<td>2,9%</td>
</tr>
</tbody>
</table>
Perspectives of Injury

Scientific:
anatomy
physiology
psychology
engineering
physics (mechanics)

Understand mechanisms, quantify injury-related responses, identify tolerance limits, improve injury assessment, organise research efforts
Core Areas (this block)

Epidemiology - numbers, ratios, odds

Tissue Biology - structure, cells, cellular processes

Biomechanics - loads and their effects
IS injury survey

What happened?

When? Competition - training - recreation

Which structures were damaged?

Immediate effects?

How long to heal?

Long term effects? Ongoing?
Structure (1)

BIOMECHANICS
Science of forces and their effects on AND inside the body

large scale:
movements, forces prod. by muscles and external reaction forces ...

small scale:
forces in single structures, tissues, cells ...

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Structure (2)

INJURY
Damage of body parts

degeneration:
Repeated application of loading at sub-destructive level

trauma:
Acute loading of body structures leading to breakdown
Synthesis (1&2)

BIOMECHANICS of INJURY

degeneration:
small scale
- 
large scale

trauma:
large scale
- 
small scale
Two approaches possible

Type of injury
- which structure was injured?
- in which way was it damaged (amount, tissues, type of force application, ...)?

Injury mechanism
- what happened (situation, which movements, external factors, ...)?
- How did the damaged segments move?
- How was the load/force distributed over time and location?
## Classification: injury

<table>
<thead>
<tr>
<th>Acute Injury</th>
<th>Danish Term</th>
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</thead>
<tbody>
<tr>
<td>Concussion</td>
<td>hjernerystelse</td>
</tr>
<tr>
<td>Contusion</td>
<td>kvæstelse</td>
</tr>
<tr>
<td>Sprain</td>
<td>forstuvning</td>
</tr>
<tr>
<td>Strain</td>
<td>forstrækning</td>
</tr>
<tr>
<td>Fracture</td>
<td>knoglebrud</td>
</tr>
<tr>
<td>Rupture</td>
<td>sprængning</td>
</tr>
<tr>
<td>Lesion</td>
<td>læsion</td>
</tr>
<tr>
<td>Haematoma</td>
<td>blodansamling</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Overuse Condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TENDINITIS</td>
<td>An inflammatory condition of a tendon. This usually occurs gradually, secondary to related overuse. Muscular weakness will often result in breakdown of the tendon following related activity. Tendinitis pain is primarily present with active or resisted movements which involve the muscle and tendon.</td>
</tr>
<tr>
<td>BURSITIS</td>
<td>An inflammation of a bursa following repeated movement. Both active and passive joint movement may elicit bursal pain.</td>
</tr>
<tr>
<td>TENOSYNOVITIS</td>
<td>An inflammation of a sheath covering a tendon. A crepitus, or grinding feeling, may be present in addition to pain with movement.</td>
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</tbody>
</table>

- **ITIS** = inflammation

### Characteristics

- (grouping) →
Bone fractures

Classification of fractures by

A Force application

B Fracture geometry
General facts on fractures

- It is a break in the continuity of a bone.
- It varies for individual bones according to age and gender (highest incidence in young males 15-24y and adults 65y of age and older).
- It can be classified as complete or incomplete and open or closed.
- Types of Fractures:
  - Typical complete fractures: closed, open, comminuted, linear, oblique, spiral, transverse, impacted, pathologic, avulsion, compression, displaced, extracapsular, intracapsular.
  - Typical incomplete fractures: greenstick, torus, bowing, stress, transchondral.
  - Common fractures: tibia, clavicle, and lower humerus (young persons); hands and feet (accidents in the workplace); upper femur, upper humerus, vertebrae, and pelvis (older or elderly adults, usually associated with osteoporosis).
Strains

Muscle and tendon strains
Partial or complete
Midsubstance or insertion/junction

Sprains

Sprain of a joint (includes ligament 'strains'/ 'tears')
Subluxation or dislocation (= Partial or complete?)
Plus: cartilage damage, meniscal damage, fractures, etc.

Grading (severity)

1st Degree - A stretching and/or micro-tear of tissue
2nd Degree - A partial tearing of tissue
3rd Degree - A complete tear of tissue
Dislocation and Subluxation Clinical Manifestations

- Pain (inflammatory exudate), swelling, limitation of motion, and joint deformity.
- If dislocation of fingers -> tenderness and deformity
- If shoulders -> pain is the key symptom
- If elbow -> the joint resists active or passive movement
- If hip -> severe pain and abnormal gait or limp or inability to bear full weight
Dislocation and Subluxation

- **Dislocation** is a temporary displacement of a bone.
- Are usually caused by trauma.
- If the contact between the two surfaces of a bone is only partially lost, then the injury is called **subluxation**.
- **They are most common in young people** (about 20y) and generally associated with fractures.
- Also, they may result from congenital or acquired disorders that cause muscular imbalance; unsuitability in the articulating surfaces of the bones (ex: rheumatoid arthritis); or joint instability.
- The joints most often dislocated or subluxed are: shoulder, elbow, wrist, finger, hip, and knee.
Dislocation and Subluxation
Evaluation and Treatment

• Evaluation is based on clinical manifestations and x-Ray.

• Treatment consists of reduction, immobilization and exercises to maintain normal range of motion in the joint.
Summary

The subject 'sport injuries' can be approached on multiple levels, from different points of view.

Different aspects have to be combined or integrated.

The integrating element is biomechanics, since all injury results from mechanical loads on biological structures (some exceptions).
Outlook

Injury is an inescapable fact of life and sports.

With near certainty we can assume that injury incidence and severity can be reduced.

To do so a fundamental understanding of factors and mechanisms involved is necessary.

→ Any special things you want to know/see???

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