Preventing Common Soccer Injuries
A few observations about injuries

- Injuries are concentrated between the knee and foot, some thigh/groin + head
- Defense > strikers > midfield
- Match injury rate >>> training injury rate
- Injuries increase with time in each half
- Female ACL rates > male ACL rates
- Within abilities
  - Injuries tend to increase with age
- Within age
  - Injuries increase with level of play
Opportunities for preventing injuries

• The laws of the game
• High standard of refereeing in all competitions
• Preparation for the game
• Management of injuries
• Prevention by education and regular exercise (The 11)
• Fair Play
The preventive research model

1. Establish the extent of the injury problem:
   - Incidence
   - Severity

2. Establish the etiology and mechanism of sports injuries

3. Introduce preventive measures

4. Assess effectiveness by repeating step 1
The preventive research model

1. Establish the extent of the injury problem:
   - incidence
   - severity

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## Overall injury rates

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>youth</td>
<td>10/1000 ph</td>
<td></td>
</tr>
<tr>
<td>adolescents</td>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td>college</td>
<td>25</td>
<td>22</td>
</tr>
<tr>
<td>professionals</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td><strong>Overall match</strong>*</td>
<td>25-30</td>
<td>13-24</td>
</tr>
<tr>
<td><strong>Overall training</strong></td>
<td>3-7</td>
<td>3-4</td>
</tr>
</tbody>
</table>

* International competition rates >2-3x
Soccer’s top 4 (time loss) injuries (in professionals)

<table>
<thead>
<tr>
<th>Injury</th>
<th>% of overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hamstring strains</td>
<td>12%</td>
</tr>
<tr>
<td>Knee sprains</td>
<td>9%</td>
</tr>
<tr>
<td>Ankle sprain</td>
<td>14%</td>
</tr>
<tr>
<td>Groin strains</td>
<td>12%</td>
</tr>
</tbody>
</table>
The preventive research model

1. Establish the extent of the injury problem:
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   - Severity

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Risk Factors of Soccer Injury
Risk factors of injury

- **Player related**
  - Sex, age
  - Physical characteristics
  - Joint laxity
  - Fitness, skill level
  - Position, psychological factors
  - Sports behavior
  - Flexibility (leg, groin)
  - Previous injury

- **Environment related**
  - Equipment
  - Fields and surfaces
  - Weather
  - Quality of training
  - Training load
  - Training/match ratio
  - Rules and refereeing
  - Foul play
  - Opponent’s behavior
Risk factors of injury: what do we have control over?

- **Player related**
  - Sex, age
  - Physical characteristics
  - Joint laxity
  - Fitness, skill level
  - Position, psychological factors
  - Sports behavior
  - Flexibility (leg, groin)
  - Previous injury

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  - Equipment
  - Fields and surfaces
  - Weather
  - Quality of training
  - Training load
  - Training/match ratio
  - Rules and refereeing
  - Foul play
  - Opponent’s behavior
Risk factors of injury
what does the evidence say?

- **Player related**
  - Sex (ACL), age
  - Physical characteristics
  - Joint laxity
  - Fitness, skill level
  - Position, psychological factors
  - Sports behavior
  - Flexibility (leg, groin)
  - Previous injury (#1!)
  - +6-8x for ankle/hams

- **Environment related**
  - Equipment
  - Fields and surfaces
  - Weather
  - Quality of training
  - Training load
  - Training/match ratio
  - Rules and refereeing
  - Foul play
  - Opponent’s behavior

Injury prevention programs are very effective for most factors... Except opponent’s behavior and foul play
Tackling: The most dangerous part of the game

<table>
<thead>
<tr>
<th>Framework sector</th>
<th>Tackled</th>
<th>Tackling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high</td>
<td>Clash of heads</td>
<td>Clash of heads</td>
</tr>
<tr>
<td>High</td>
<td>Two footed</td>
<td>Side</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jumping vertically</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Two footed</td>
</tr>
<tr>
<td>Standard</td>
<td>Front</td>
<td>Sliding-in</td>
</tr>
<tr>
<td></td>
<td>Side</td>
<td>Staying on feet</td>
</tr>
<tr>
<td></td>
<td>Sliding in</td>
<td>Upper-body contact</td>
</tr>
<tr>
<td></td>
<td>Staying-on-feet</td>
<td>One-footed</td>
</tr>
<tr>
<td></td>
<td>Jumping vertically</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Upper-body contact</td>
<td></td>
</tr>
<tr>
<td></td>
<td>One-footed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Use of arm/hand</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>Behind</td>
<td>Front</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Behind</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use of arm/hand</td>
</tr>
<tr>
<td>Very low</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Mechanisms of injury

- Hamstring strain
- ACL
- Ankle sprain
1. A high school injury

2. The younger the first ACL, the greater the chance of having a 2nd or more

3. Prevent the 1st tear
**Basic mechanisms of injury**

<table>
<thead>
<tr>
<th>Injury</th>
<th>Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ankle sprain</td>
<td>Medial impact to an unstable landing spraining lateral ligaments</td>
</tr>
<tr>
<td>Knee sprain</td>
<td>Unstable landing in a near erect stance</td>
</tr>
<tr>
<td>Muscle strain</td>
<td>Strong muscle contraction while muscle is being stretched when sprinting</td>
</tr>
</tbody>
</table>
The preventive research model

1. Establish the extent of the injury problem:
   - Incidence
   - Severity

2. Establish the etiology and mechanism of sports injuries

3. Introduce preventive measures

4. Assess effectiveness by repeating step 1
Prevention programs from the medical literature

• Ekstrand 1984
  • ↓ flex = ↑ strains
  • ↓ Q/H strength in knee injured players
• Medical/therapist supervised program with numerous interventions
Prevention programs from the medical literature

• Heidt, 2000
  • High school girls in Cincinnati
  • 2 groups: 1 normal summer, other speed/strength/agility training for 7 weeks prior to camp

Avoidance of Soccer Injuries with Preseason Conditioning

Robert S. Heidt, Jr., MD*, Lisa M. Sweeterman, ATC, MS, Richelle L. Carlonas, MS*, Jeff A. Traub, MD* and Francis X. Tekulve, ATC

* Wellington Orthopaedic and Sports Medicine, Cincinnati, Ohio; Tekulve Acceleration Training, Cincinnati, Ohio
Prevention programs from the medical literature

• Mandelbaum, 2005
  • 2 yr project in CA
  • Guided warmup intervention
  • Details at www.aclprevent.com

Effectiveness of a Neuromuscular and Proprioceptive Training Program in Preventing Anterior Cruciate Ligament Injuries in Female Athletes

2-Year Follow-up

Bert R. Mandelbaum,* MD, Holly J. Silvers,† MPT, Diane S. Watanabe,* MA, ATC, John F. Knarr,* PT, ATC, Stephen D. Thomas,* MPT, Letha Y. Griffin,† MD, Donald T. Kirkendall,§ PhD, and William Garrett, Jr,§ MD, PhD
From the *Santa Monica Orthopaedic and Sports Medicine Research Foundation, Santa Monica, California, the †Peachtree Orthopaedic Clinic, Atlanta, Georgia, the §VA National Center for Health Promotion and Disease Prevention, Durham, North Carolina, and the §Duke University Medical Center, Durham, North Carolina
Prevention programs from the medical literature

- 120 team handball teams (>1800)
- A structured warm-up program to improve running, cutting, and landing technique as well as neuromuscular control, balance, and strength.
Prevention programs from the medical literature

• Junge, 2002
  • ~200 males 13-19y
  • Variety of core, plyometrics, balance, motor control activities at all training sessions

Prevention of Soccer Injuries: A Prospective Intervention Study in Youth Amateur Players

Astrid Junge,**†† PhD, Dieter Rösch,*§ MA, Lars Peterson,*∥ MD, Toni Graf-Baumann,**∥∥ MD, and Jiri Dvorak,**† MD

From the *Fédération Internationale de Football Association Medical Assessment and Research Center (F-MARC) and the †Schulthess Clinic, Zurich, Switzerland, the §Department of Sport and Sport-pedagogic, Pedagogic-University, Freiburg, Germany, ||Gothenburg Medical Center, Vastra Frölunda, Sweden, and the ∥Office for Management in Medical Research, Teningen, Germany
The F-MARC 11

- Designed to reduce the most frequent types of soccer injuries:
  - ankle sprains
  - muscle injuries
    - of thigh
    - groin
  - ligament injuries of knee

- All injuries via Fair Play
Hamstrings research

- Norway/Iceland prof football
- 2y baseline, 2y intervention
  - Stretching, flexibility, +/- or eccentric strength training

Prevention of hamstring strains in elite soccer: an intervention study.

Ankle research

- > 1000 m/f volleyball players, grp assignment by team
- Various balance board, ball & combined exercises; 5m per day
- 2/3 with history of ankle injury
The preventive research model

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Prevention programs from the medical literature

- Ekstrand 1984
  - ↓ flex = ↑ strains
  - ↓ Q/H strength in knee injured players
  - Medical/therapist supervised program with numerous interventions
  - 75% fewer injuries
  - + correlation of training time and success
  - - correlation of training time with injuries
  - ↑ training/match = ↓ injury rate
Prevention programs from the medical literature

- Heidt, 2000
  - High school girls in Cincinnati
  - 2 groups: 1 normal summer, other speed/strength/agility training for 7 weeks prior to camp

  - Their results
    - 35% reduction overall in injuries
    - 11 season ending injuries in UT group
    - 1 in trained group

Avoidance of Soccer Injuries with Preseason Conditioning

Robert S. Heidt, Jr., MD*, Lisa M. Sweeterman, ATC, MS, Richelle L. Carlonas, MS*, Jeff A. Traub, MD* and Francis X. Tekulve, ATC

* Wellington Orthopaedic and Sports Medicine, Cincinnati, Ohio; Tekulve Acceleration Training, Cincinnati, Ohio

[only 1 in 3 high school boys get adequate preseason training (Brooks, MSSE, 2007)]
Prevention programs from the medical literature

- Mandelbaum, 2005
  - 2 yr project in CA
  - Guided warmup intervention
  - Details at www.aclprevent.com

- 30% fewer injuries with the program
- 65% fewer ACL injuries
Prevention programs from the medical literature

• 120 team handball teams (>1800)
• A structured warm-up program to improve running, cutting, and landing technique as well as neuromuscular control, balance, and strength.
• Fewer injuries:
  • Match, training
  • Overuse, acute
  • Knee, ankle, meniscus
  • Multiple, reinjuries
Prevention programs from the medical literature

- Junge, 2002
  - ~200 males 13-19y
  - Variety of core, plyometrics, balance, motor control activities at all training sessions
  - 1.2 injuries per control player
  - .75 injuries per intervention player
    - 37% fewer injuries
  - Other injury reductions
    - -41% overuse injuries
    - -55% training injuries
    - -24% match injuries
Injury rate reduced regardless of skill level – Junge 2002

Graph showing the reduction in injury rate with the intervention compared to the control group. The graph compares low skill and high skill levels:
- Low skill: -39% reduction
- High skill: -27% reduction
<table>
<thead>
<tr>
<th>Anatomical Region</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spine</td>
<td>-50%</td>
</tr>
<tr>
<td>Trunk</td>
<td>-80%</td>
</tr>
<tr>
<td>Groin</td>
<td>-80%</td>
</tr>
<tr>
<td>Thigh</td>
<td>-42%</td>
</tr>
<tr>
<td>Knee</td>
<td>-41%</td>
</tr>
<tr>
<td>Ankle</td>
<td>-5%</td>
</tr>
<tr>
<td>Foot</td>
<td>-43%</td>
</tr>
</tbody>
</table>
Hamstrings research

- Norway/Iceland prof football
- 2y baseline, 2y intervention
  - Stretching, flexibility, +/- eccentric strength tr’ng
- No ↓ hams injury with flexibility training alone
- Eccentric training + flex training ↓ hams injury compared with
  - Baseline (RR=.42)
  - Non-intervention teams (RR=.43)

Prevention of hamstring strains in elite soccer: an intervention study.

Arnason A, Andersen TE, Holme I, Engebretsen L, Bahr R. (ePub ahead of print)
Ankle research

- > 1000 m/f volleyball players, grp assignment by team
- Various balance board, ball & combined exercises; 5m per day
- 2/3 with history of ankle injury
- ↓ ankle sprains in intervention grp
  - Only in those with prior injury
- ↑ knee overuse in intervention grp
Quality of officiating?

Injuries per match @ U20 WC

<table>
<thead>
<tr>
<th>Year</th>
<th>1999</th>
<th>2001</th>
<th>2003</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Count</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

w/ senior level FIFA refs
Country-wide Campaigns

- Switzerland
- New Zealand
Preliminary insurance claims in NZ

New Soccer Entitlement Claims by gender where the injury site was knee or ankle

Month of injury

- 2004 Male
- 2004 Female
- 2005 Male
- 2005 Female
- 2006 Male
- 2006 Female
Key Scientific Points

- Injury prevention research follows a predictable model.
- Injuries in football are also predictable and are concentrated on the lower extremity.
- Mechanisms of injury are predictable by
  - legal contact with another player
  - mechanisms involving a single player
  - foul play.
    - 1/2 of all male injuries and 1/4 of all female injuries at world championship level are due to foul play
- Most common injuries are contusions, sprains, and strains and are generally minor.
- Since 1998, there has been an average of 2.7 injuries per match in FIFA tournaments.
  - Less than 10% of injuries lead to extended absence from play.
- General injury prevention programs can reduce injuries.
Key Scientific Points (con’t)

• Specific programs show promise for minimizing ankle sprains, hamstring strains, and ACL injuries.
• With >250M players worldwide, any reduction in injuries should have a public health impact.
• Modifying rules to include severe sanction on offending players can minimize foul play.
• Many player-related and environment-related risk factors for football injuries have been studied, but only a few appear to be strong risk factors:
  • Player-related factors include prior injury, flexibility, hamstring strength, and more.
  • Environment-related factors include training:match ratio, officiating, opponent behavior, and more.
Recommendations for coaches

• Begin injury prevention programs when players are young—at puberty or earlier.

• Common injuries in soccer can be minimized:
  • To reduce the incidence of hamstring strains, incorporate hamstring strengthening routines in training plans.
  • To reduce the incidence of recurrent ankle sprains, encourage or require players to use ankle supports.
  • To reduce the risk of tearing the anterior cruciate ligaments, incorporate in training schedules that include plyometric routines, balance training, hamstring strengthening, and coordination training.
Recommendations for coaches

- Stress improvements in overall fitness and soccer skills and—very importantly—**emphasis on fair play** as major training goals that may minimize injuries.
- Avoid scheduling too many matches and not enough training, both of which can result in reduced fitness, skill, and tactical development that can lead to underperformance and injuries.
- Ensure proper maintenance of playing fields to reduce injuries caused by irregular field surfaces.
- Initiate and/or support efforts within associations to improve officiating and to strengthen and enforce sanctions against those who engage in foul play.