Injury Prevention?
Injury prevention!

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Objectives

- Introduce the concept of injury prevention in sports
- Present information on injury statistics
- Propose a framework for the study of injury prevention in elite sports
- Demonstrate the practice of sports injury prevention for selected injuries
- Report the current practice of injury prevention programs at the sports medicine department

Injury Prevention

What is it?

How it is done?

What do you need to know?

Every one involved in sports needs to know:

- What is the risk of injury?
- Which injuries are most common?
- How much time is lost from such injuries?
- How can injury be predicted or prevented?
- How effective are the preventive measures that are implemented?

Caine DJ 1996

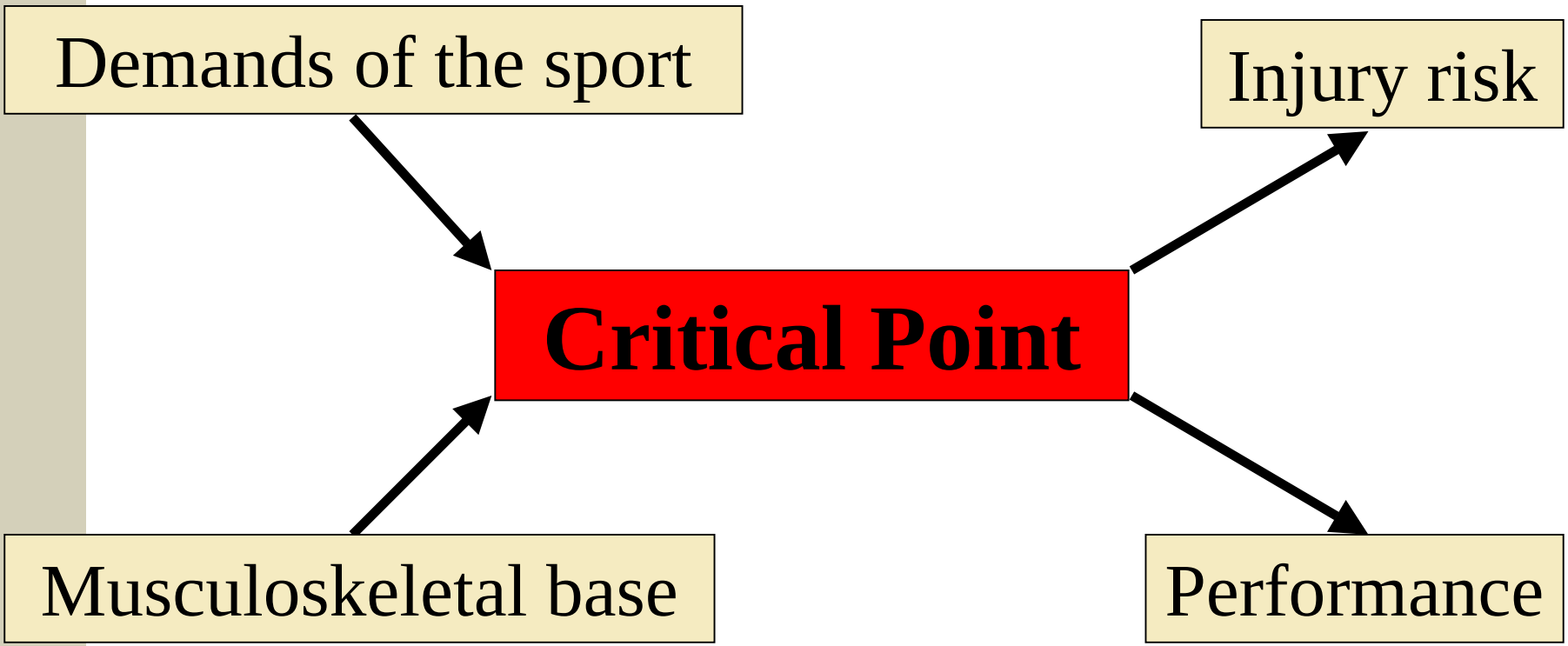
Sports Injury

injury

Abnormal loading + Normal tissues

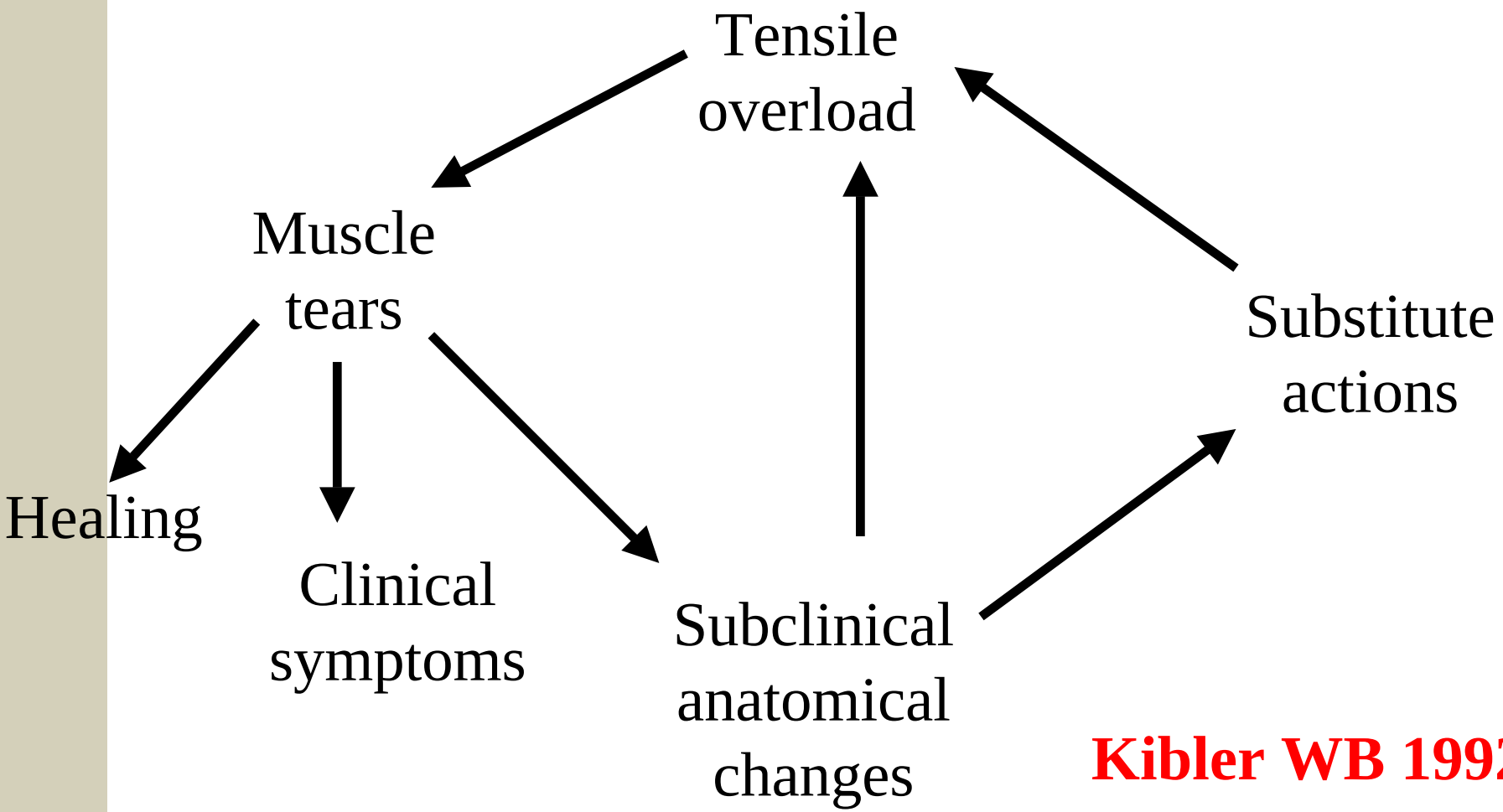
Normal loading + Abnormal tissues

Concept of Sport Specificity



Chandler TJ & Kibler WB 1996

Muscular Overload Injury



Kibler WB 1992

Extrinsic Factors in Sports Injury

Exposure

- Types of sports
- Exposure time
- Position in the team
- Level of competition

Training

- Type
- Amount
- Frequency
- Intensity

Environment

- Type of playing surface
- Indoor vs outdoor
- Weather conditions
- Time of season
- Human factors

Equipment

- Protective equipment
- Playing equipment
- Footwear, clothing

Taimela S et al, 1990; Lysens R et al 1991

Intrinsic Factors in Sports Injury

Physical characteristics

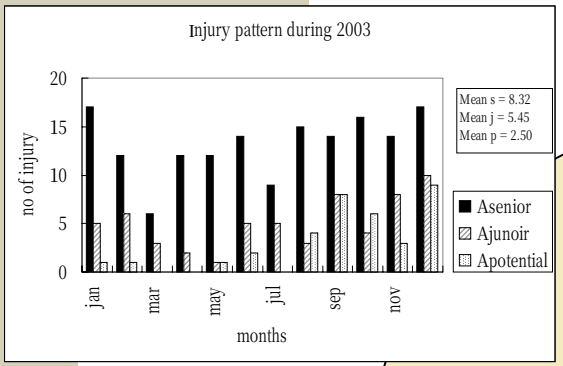
- Age
- Gender
- Somatotype
- Previous injury
- Physical fitness
- Joint mobility
- Muscle tightness, weaknesses
- Ligamentous instability
- Anatomical abnormalities
- Motor abilities
- Sports-specific skills

Psychological profile

- Motivation
- Risk taking
- Stress coping

Taimela S et al, 1990; Lysens R et al 1991

Epidemiology and Injury prevention



Epidemiology

Injury prevention

Injury Prevention Program Establishment

Establishing the extent of the injury problem: incidence, severity

Establishing the aetiology and mechanisms of sports injury

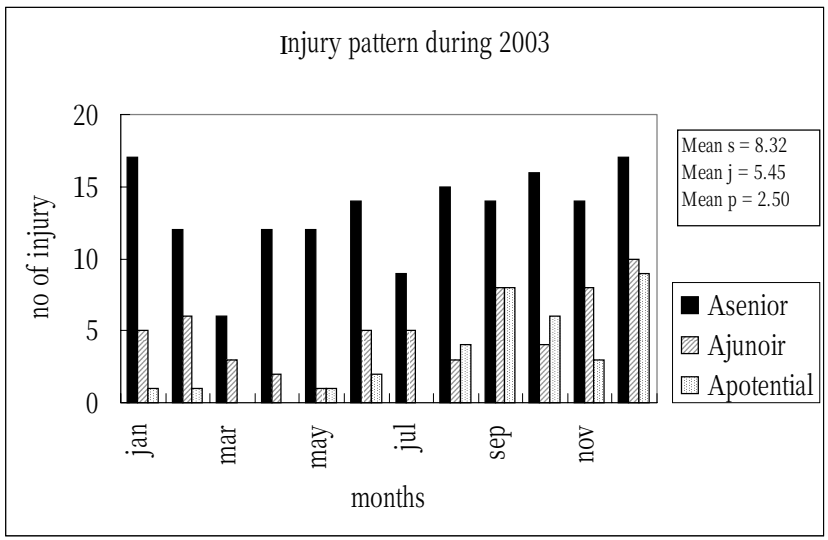
Introducing a preventive measure

Assessing its effectiveness by repeating step 1

vanMechelen 1992

Epidemiology

- Reliable, well-conducted studies not available
- Epidemiological data are culture-, sports, sports-habits- and country-specific



Rates of Injury by Type

	Sprains	Strains
Soccer	27.6-35%	10-47%
Basketball	2-34%	1-28.2%
Professional Baseball	5.5%	17.8%
Women Gymnastics	15.9-43.6%	6.4-47.1%
Cycling	9%	
Resistance Training	6-39%	

Rates of Injury by Sport

	Upper Extremity	Lower Extremity
Prof. Basketball	7-20%	36-78%
Prof. Baseball	42.9%	42.2%
Fencing	6.7-55.2%	27.6-55%
Tennis	35%	20%
Badminton	11.1%	82.9%
Squash	23%	48.1%
Racqueball	12.1%	31.8%
Resistance Training	10%	13%

Injury Onset by Sport

	Acute Trauma	Overuse
Tennis	70%	30%
Badminton	26%	74%
Squash	80%	20%
Racqueball	90%	10%

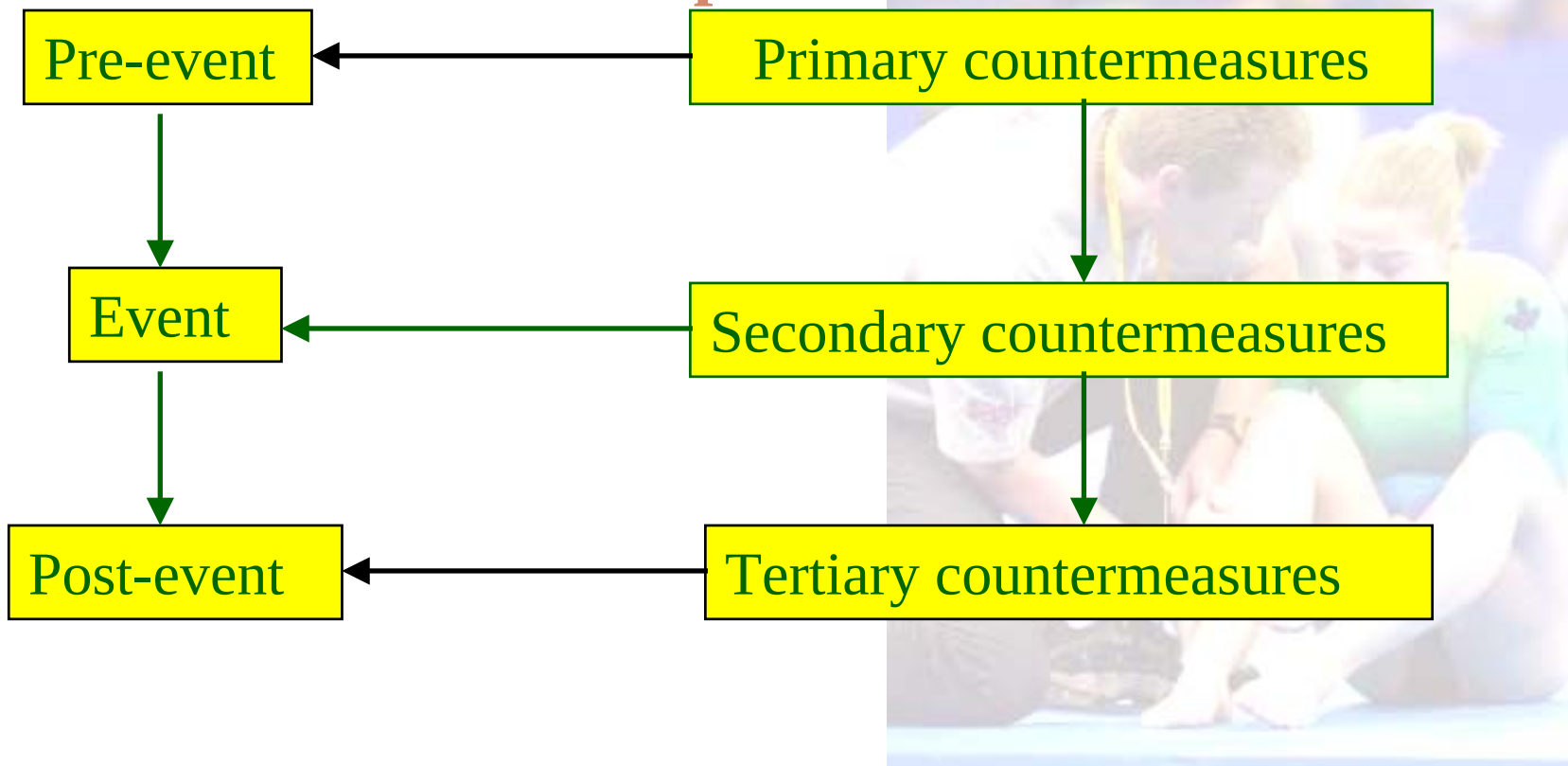
Incidence by Conditions

	Running	Track & Field
Achilles tendinitis	2.4-7.6%	2.4-7%
Tibial stress syndrome	19.5-29.6%	4.7-19.5%
Plantar fasciitis	9.4%	2.4%
Patella tendinitis		3-9.8%
IT band frictional syndrome	4-7%	1%
Non-specific knee pain	14.8-19.5%	
Other tendons	0.9-19%	

Injury Countermeasures

The injury chain

Opportunities for injury prevention



Primary countermeasures

- Lessons by accredited coach/ attention to playing techniques & biomechanics
- Modified rules for junior players
- Appropriate nutrition and hydration
- Safe playing environment
- Pre-participation screening
- Pre-season conditioning
- Appropriate training for level of play
- Prophylactic taping and bracing
- Adequate and appropriate warm-up and cool down
- UV protection
- Good quality and appropriate equipment:
  - footwear, rackets, balls

Secondary Countermeasures

- Safe playing surface
- Safe playing environment
- Footwear appropriate to surface and conditions
- Properly fit/ working equipment
- Adequate water intake during game

Tertiary Countermeasures

- Accessible, well-stocked first aid kit
- Prompt first aid by trained personnel (RICER)
- Appropriate high quality rehabilitation and graduated return to play
- Taping and bracing to prevent re-injury (if necessary)

Common Practice of Injury Prevention

- Stretching
- Taping and bracing
- General conditioning program
- Awareness of body signals (physical and psychological)
- Educational programs (self-care techniques, basic nutrition)
- Coaching (techniques, periodization, equipment)
- Rules, officiating

STRETCHING

- Muscle tightness
  - → incidence of strain injuries
- Stretching
  - → decreased muscle stiffness
  - → improved ROM
  - → decreased the risk of injury

Thacker SB et al. The impact of stretching on sports injury risk: A systematic review of the literature. Med Sci Sports Ex. 36(3), p. 371-378, 1999.

- Systematic review
- Formal meta-analysis using only randomized trials (RCT) or cohort studies
- Six out of 361 identified articles compared stretching with other methods to prevent injury
- Pooled analysis of 5 of the 6 studies found **stretching not sig. associated with a reduction in total injuries** (OR=0.93, CI 0.78-1.11)

Shrier I. Stretching before exercise does not reduce the risk of local muscle injury: A critical review of the clinical and basic science literature.

Clin J Sports Medicine. 9, 221-227, 1999.

- Systematic review to determine whether the clinical and basic science evidence supports the hypothesis that stretching before exercise prevents injury
- Clinical Evidence (12 out of 138 articles with control group)

  4 beneficial, 3 detrimental, 5 no difference
- Basic Science Evidence

  Not supportive of the hypothesis

Hart L. Effect of stretching on sport injury risk: a review. Clin J Sports Med. 15(2), p. 113- , 2005

Factors need addressing in future studies:

- Confounding variables
- Co-interventions
- Intervention (type, timing, and intensity of stretching routines)
- Generalizability across populations

  runner vs gymnast

  Recreational vs elite athletes

Our Recommendations

- Individualized programs recommended
- 30-second stretches for 2-3 times per muscle/ muscle groups
- Regular long-term stretching vs Acute stretching
- Temperature effects (passive warming or icing)
- Active warm-up

To stretch or not to stretch?

TAPING and BRACING

Handoll HH et al. Cochrane Database Systematic Review 2001

- Systematic review of 14 randomized trials for 8279 participants
- External ankle support (semi-rigid orthosis), air-cast brace, high top shoes, ankle disk training, muscle stretching, taping, boot inserts, health education programme and controlled rehabilitation
- Good evidence for the beneficial effect of ankle supports (semi-rigid brace and air-cast brace) to prevent **ankle sprains** during high risk sporting activities (e.g. soccer, basketball).

Surve et al. A fivefold reduction in the incidence of recurrent ankle sprains in soccer players using the sport-stirup orthosis. Am J Sports Med. 22(5): 601-606, 1994.

- Prospective study
- Document the effect of a semirigid orthosis on the incidence and severity of ankle sprain
- Senior soccer players divided into 2 groups:

Hxsprain (N=258): orthosis (0.14) vs control (0.86)

NoHxsprain (N=246): orthosis (0.31) vs control (0.31)

(injuries/ 1000 playing hours)

CONDITIONING PROGRAMS

- The “5 S’s” necessary for performance
  - Strength
  - Stamina
  - Suppleness (flexibility)
  - Synergy (balance)
  - Skill
- General and Sport-specific conditioning programs

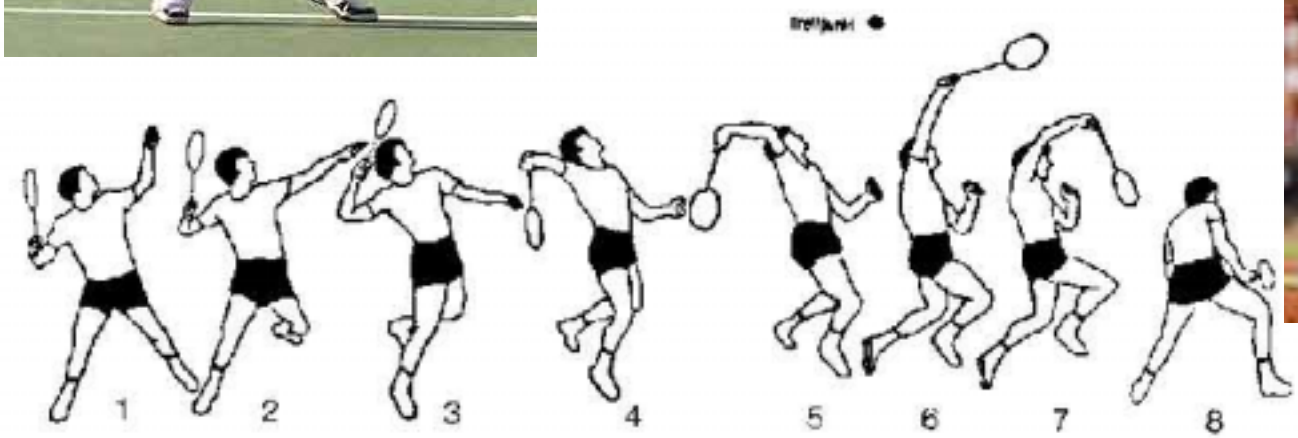
Hewett TE et al. The effect of neuromuscular training on the incidence of knee injury in female athletes: a prospective study. Am J Sports Med. 27: 699-706, 1999.

- Non-randomized prospective study
- Female high school soccer, basketball and volleyball players (n=829)
- Specific plyometric (jump) training program
- Results:

  Trained group: 0.12 injuries per 1000 AE

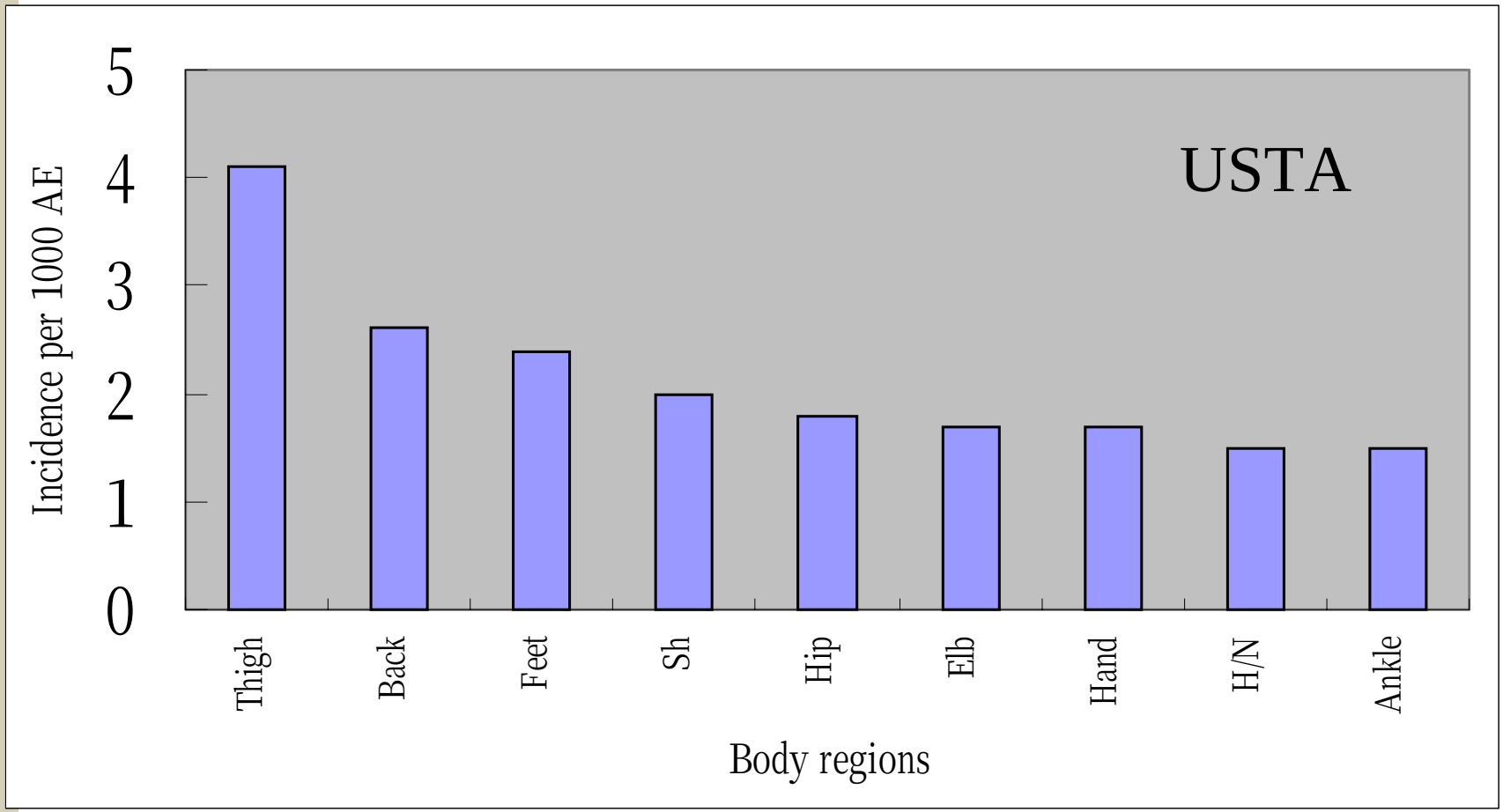
  Untrained group: 0.43 injuries per 1000 AE

SHOULDER INJURY



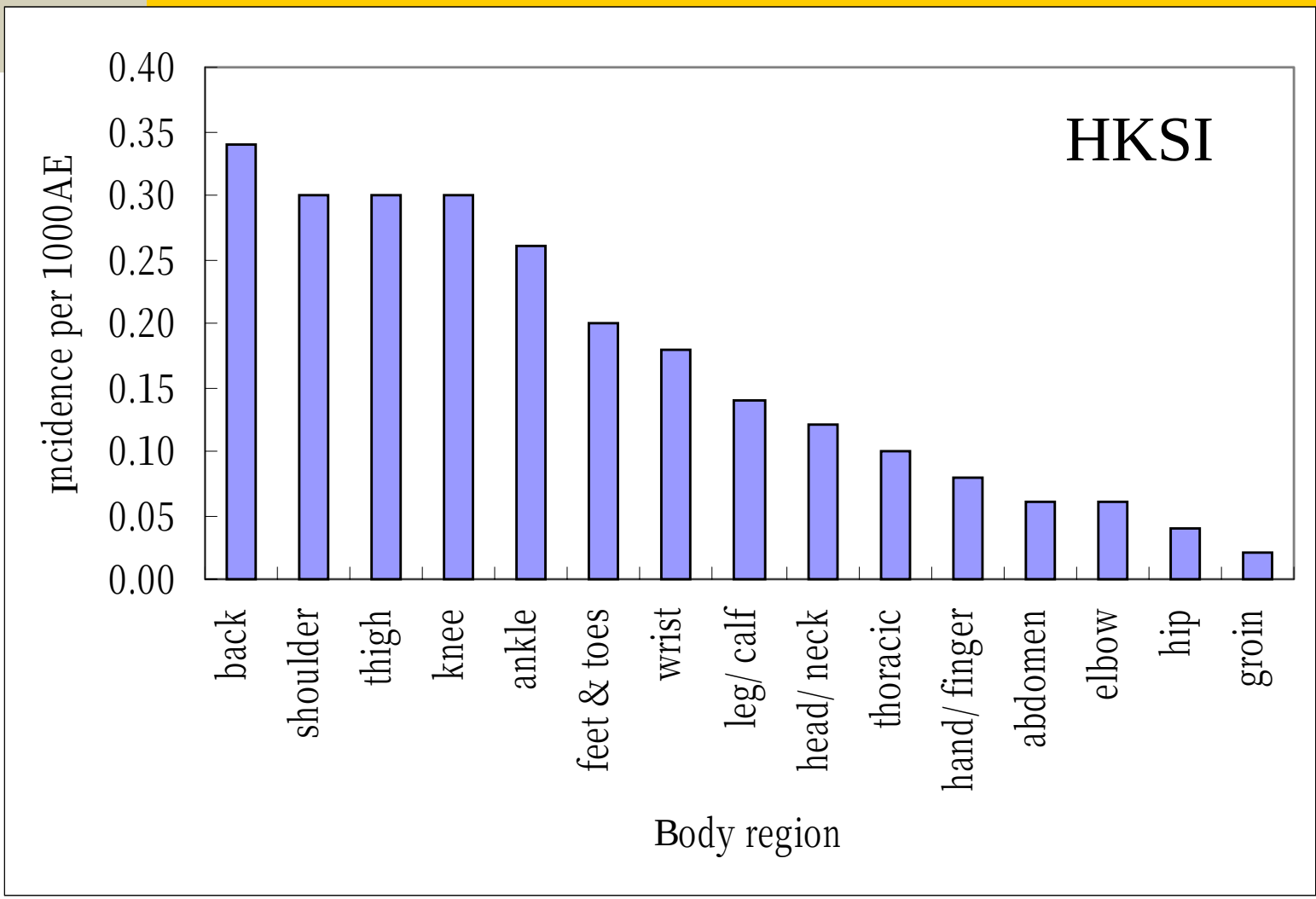
Hutchinson MR et al. Injury surveillance at the USTA Boys' Tennis Championships: a 6-yr study.

Med Sci Sports Ex. 27(6): 826-830, 1995.

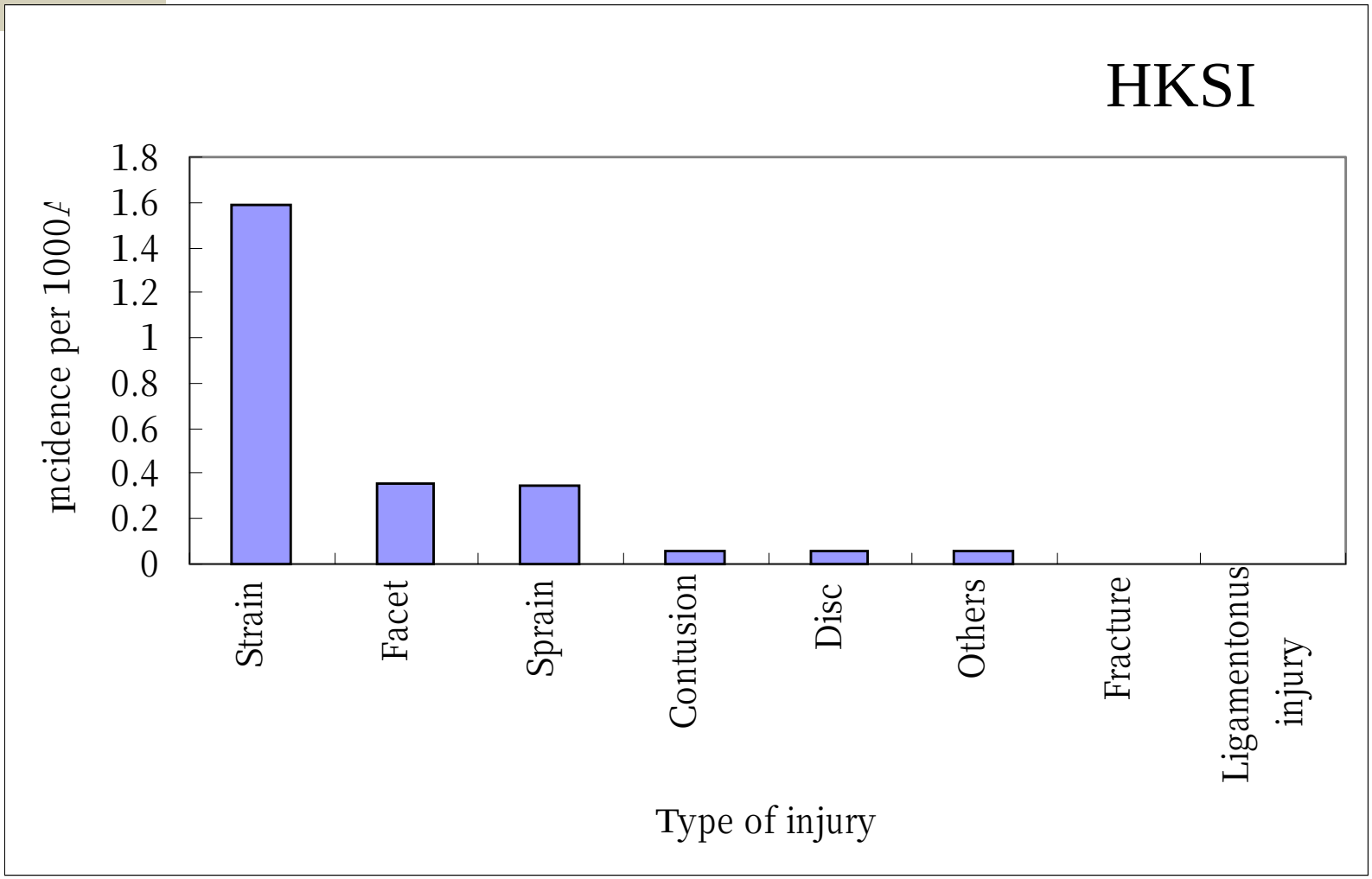


Badminton

Shoulder injury in elite badminton players



Shoulder injury in elite badminton players



Factors possibly related to shoulder injury in overhead athletes

- **Range of motion imbalance**

  Significant correlation between dominant shoulder internal rotation deficits and shoulder pain in professional tennis players — J Sci Med Sports, 2003

- **Rotators strength imbalance**

  Significantly greater dominant arm internal rotation isokinetic peak torques and works in elite junior tennis players — J Sci Med Sports 2003

- **Rotators fatigability imbalance**

  Significantly more fatigue-resistance of internal rotators than the external rotators in elite junior tennis players — JOSPT 1999

- **Scapula dyskinesis**

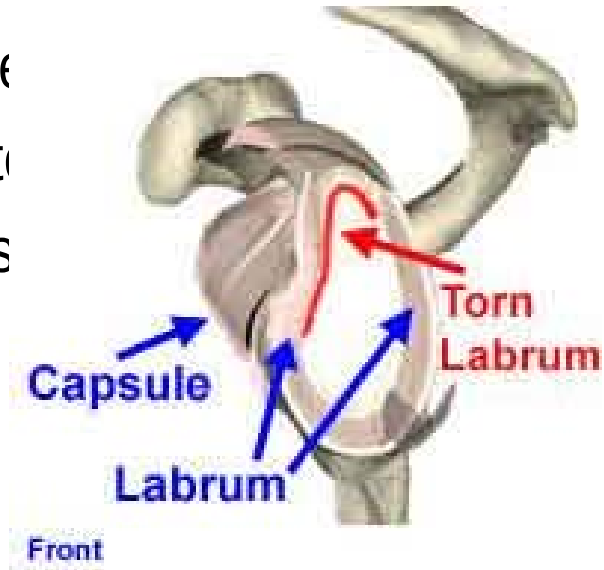
  Present in 68% of patients with rotator cuff abnormalities, 94% of labral tears, 100% of glenohumeral instability problems. — Clin Orthop 1992, J Sh Elb Surg 1997, Clin Sports Med 2000

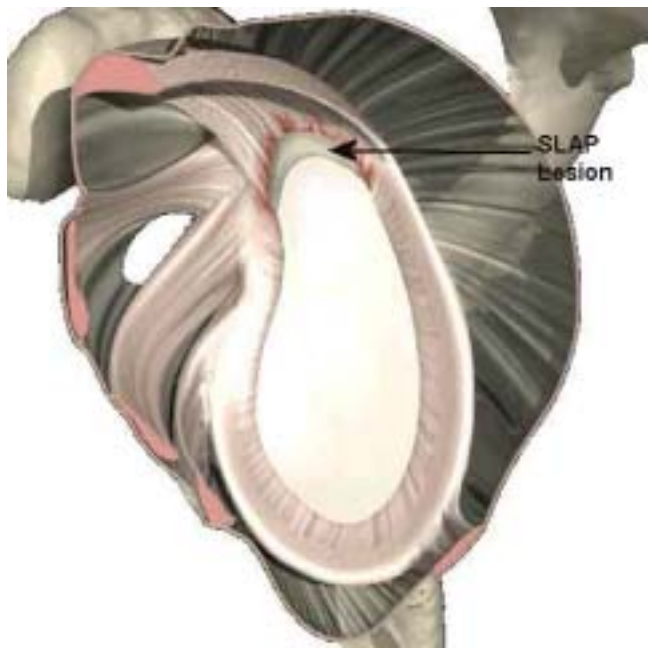
- **Technique effects, kinetic chain factors**

  Significantly reduced internal rotation torque with larger knee flexion during tennis serve — J Sci Med Sports 2003

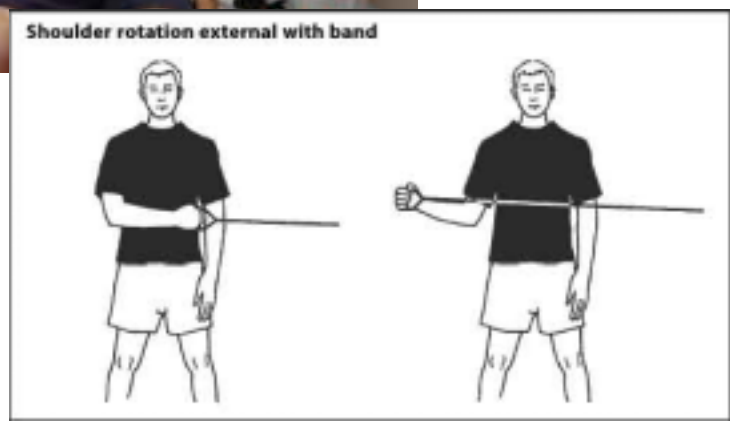
Possible mechanism of shoulder injury in overhead athletes

- Repetitive overstretching of the posteriorinferior (PI) capsule of the shoulder during follow-through
- Thickening and contracture of the PI capsule
- Shift in centre of rotation
- Increased bice
- Increased ant
- Increased pos
  stresses





Shoulder Prevention Strategies

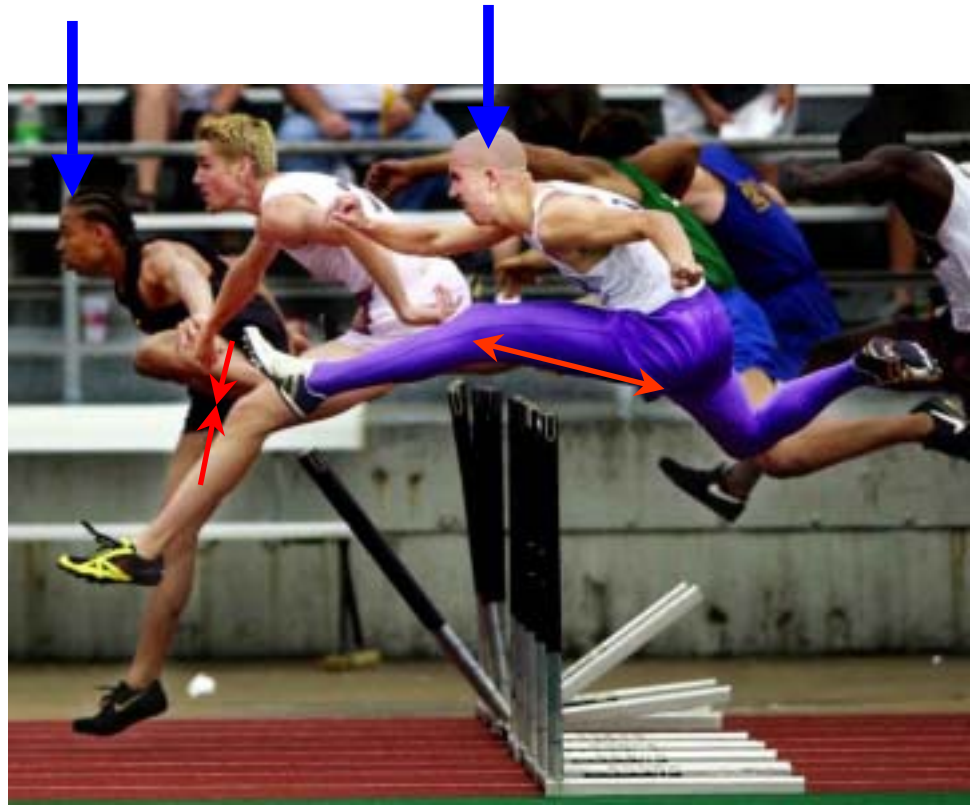


HAMSTRINGS INJURY

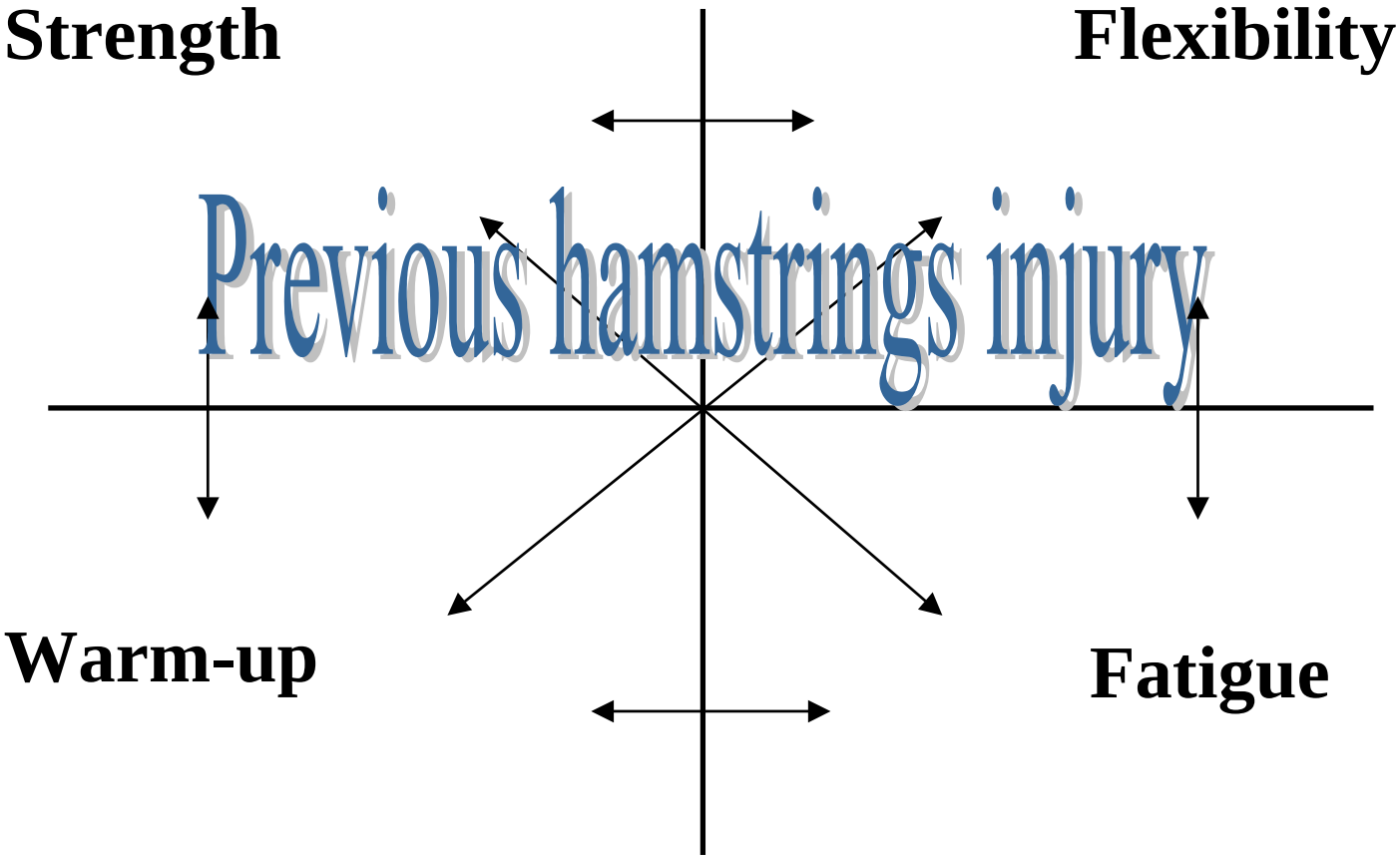
- Prevalence 11-15% (soccer, cricket, AUS football, athletics)
- Reinjury rate 12-34%
- Absence from sports
  (few days to a few months)

Possible mechanism

- Depends on the sports
- Running and sprinting:
  Occurs during later part of swing phase, from maximum eccentric contraction to concentric contraction in flexing the knee and extending the hip



Factors associated with recurrent hamstrings injury



Worell & Perrin, 1983

Hamstrings injury prevention

- **Flexibility**

  Significant improvement in flexibility in the intervention group (military basic trainees, 3 stretching sessions each day for 13 weeks, stretching held for 30 seconds for 5 times), associated with a lower injury incidence rate (16.7 % vs 29.1%). Am J Sports Med 1999

- **Strength**

  Significant increase in both concentric and eccentric strength in the training group (Swedish elite soccer players, 16 sessions of specific hamstrings strength training over a 10-week pre-season period) with increased running speed and decreased injury incidence during the 10-month study period (10/15 in the control group and 3/15 in the training group)

  Scand J Med Sci Sports 2003

Hamstrings Injury Prevention

- **Warm-up**

  Pre-conditioned (warmed) muscles required more force to fail, and could be stretched to greater length before falling than the control unconditioned muscles Am J Sports Med 1988

  Significant decrease in knee and ankle injuries in young handball players who participated in a structured warm-up program (4.8% of the intervention group vs 8.6% in the control group, RR 0.53) Aust J Physio 2005

- **Fatigue**

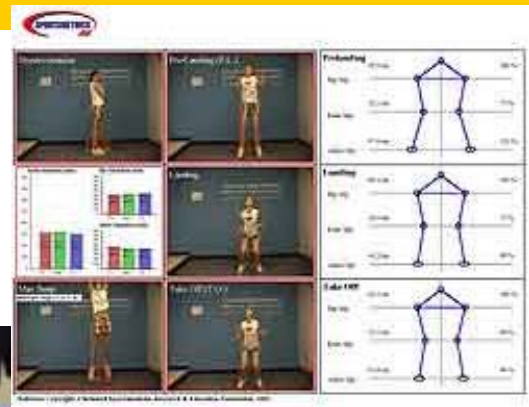
  The amount of energy absorbed in the fatigued muscles (25% and 50%) was 69.7 to 92% that of the energy absorbed in the control muscle. Fatigued muscles are able to absorb less energy before reaching the degree of stretch that causes injuries. Am J Sports Med 1996

Injury prevention at SMD

- Annual medical screening
- Musculoskeletal screening examination
- Basic injury epidemiological study

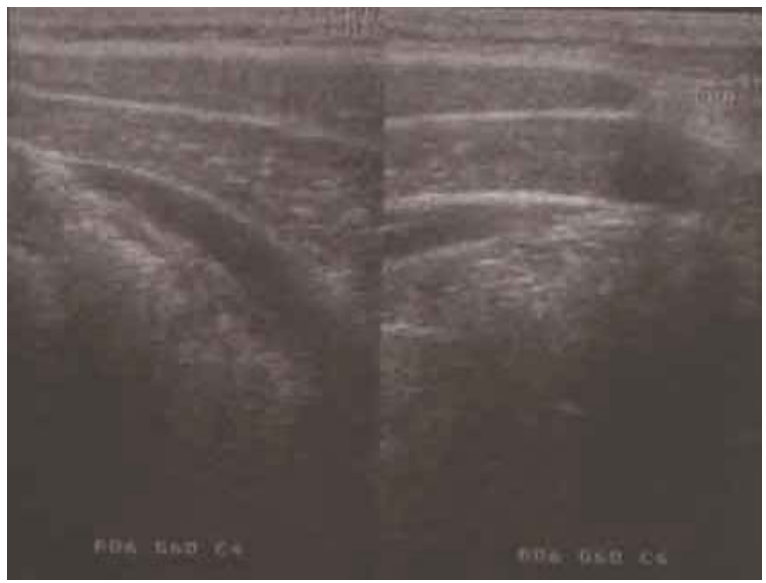
Injury prevention at SMD

- Video motion analysis (in collaboration with sports scientists and coaches)



Injury prevention at SMD

- Real-time ultrasound for assessment of deep abdominal and back muscles



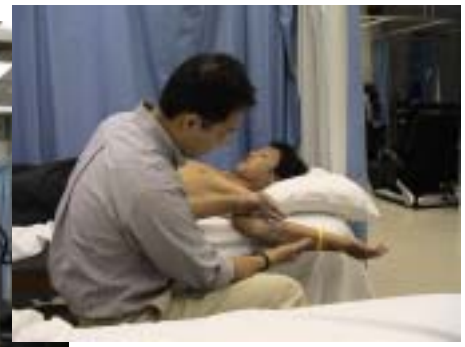
Injury prevention at SMD

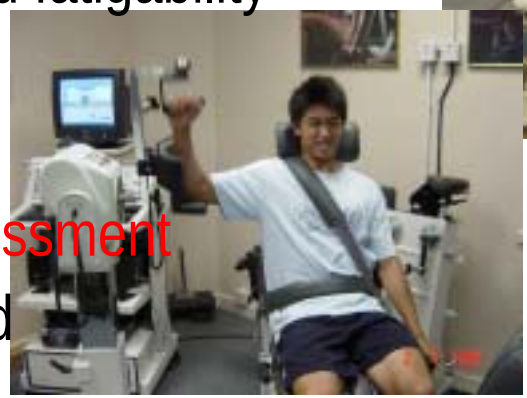
- Proprioception (joint position sense) assessment

Musculoskeletal screening exam

Components

- Health screening questionnaire
- Past injury history
- Present complaints
- General range of motion
- Shoulder ROM
- Shoulder isokinetic strength and fatigability
- Knee isokinetic strength
- Trunk muscle endurance times
- Lower limb biomechanical assessment
- Specific clinical tests as needed





A model of musculoskeletal testing

Measurable characteristics of muscle tissues

- Flexibility
- Strength
- Power
- Anaerobic endurance
- Aerobic endurance

injury prevention.xls

Kibler WB 1990

Musculoskeletal screening exam

Data management

- Data base for musculoskeletal profiling, analysis
- Recommendation to coaches regarding conditioning programs, training programs, palliative treatments, orthotics fabrication for lower extremity alignment correction
- Further assessment or referral as needed

Epidemiological study

- Service utilization review
- Injury data collection

  In need of a more comprehensive

  injury surveillance system
- Epidemiological study of specific sports

  e.g. badminton, squash……

  In need of structured well-planned prospective studies

Organized data collection and analysis

Recommendations

- **Preparticipation Evaluation**

  a) detection of the potential for sudden death during participation

  b) detection of factors that may predispose to new injury or worsening of preexisting injury

  c) detection of impediments to the athlete's performance

- **Practice/ Game Services**

  On-site medical support for high risk athletes

- **Monitoring programs**

  Keeping of training log/ journal, injury record

Further Research

Descriptive: establish the extent of the injury problem

Analytical: establish etiology and mechanisms of injury

Intervention:

Introduce preventive measures

Clinical trial: assess effectiveness by repeating














Thank You!