

**Sports Medicine Association of Serbia and Montenegro**

**Prevention of Sports Injuries**

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**Risk factors for Sports Injuries**




- Intrinsic (inherent to the athlete)**
  - Not modifiable (age, gender, ethnicity - genetics)
  - Modifiable (biomechanics, muscle strength, flexibility)
- Extrinsic - factors not inherent to athlete (training, nutrition, equipment, environment and others)**




**Primary vs. secondary prevention**

**Primary prevention: Prevention of injury**

**Which is more important? Primary or secondary prevention?**

**What are the risk factors for injury in recreational athletes?**

5028 men, 1285 women

**The risk factors for injury in recreational athletes are:**


- past injury
- not weight lifting >2/week
- not stretching >2/week
- training > 2/week (increased frequency of load)

An injury was defined as any self-reported soft tissue or bone injury that occurred within the previous 12 months

Weight lifting, Stretching, Physically active

Present (blue), Absent (orange)

Hootman JM, Macera CA, Ainsworth BE, Addy CL, Martin M, Blair SN, Med Sci Sports Exerc, 2002; 34(5): 838 to 844

**What are the risk factors for acute muscle injury in sport?**



**A past history of muscle injury is the single most important risk factor for a muscle injury (6-16 X greater risk)**

Risk ratio

Past hx (<8 weeks), Past hx (>8 weeks), Age > 23 years, Other past muscle injury

Hamstring, Triceps

Orchard JW: Am J Sports Med 2001; 29(3): 300-303



**What is the best predictor of a hamstring strain or a groin strain in soccer rugby players?**

Prospective cohort study, 306 football players

Pre-season history, muscle flexibility, past history, Follow-up incidence documented

**Players with a past history of a hamstring or groin injury were respectively 11.6 and 7.3 times more likely to sustain a second injury**

Arnason A, Sigurdson SB, et al, Am J Sports Med (Suppl) 32 (1) 2004

**What is the best predictor of an acute hamstring strain in club rugby players?**

- Prospective cohort study
- 101 Club rugby players
- Pre-season strength, flexibility, past hamstring history documented
- Follow-up for 60 weeks
- 23 hamstring injuries

**Players with a past history of a hamstring injury are 8.23 times more likely to sustain a hamstring injury (despite normal muscle strength and flexibility)**


Lombard R, Schwellnus M, 2004

**In 2000, 20% of a league's most important factors for injury prevention**


**In injury prevention, secondary prevention is one of the most important challenges**



1. Adequate warm-up
2. Regular effective stretching
3. Normal muscle strength and balance
4. Correct sports "equipment"
5. Adequate and correct training
6. Correct biomechanics
7. Correct use of strapping and bracing
8. Optimum nutrition
9. Normal psychological status
10. Lifestyle / habits



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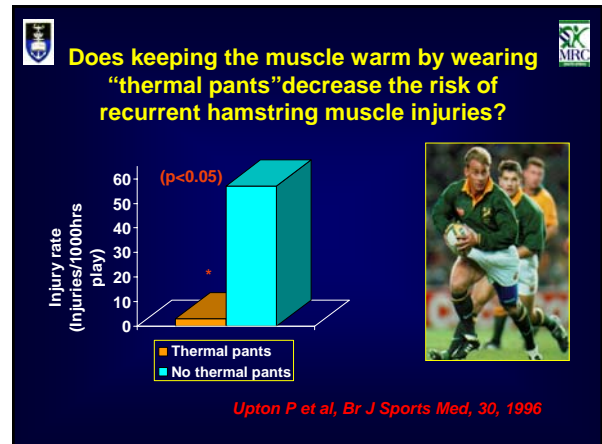
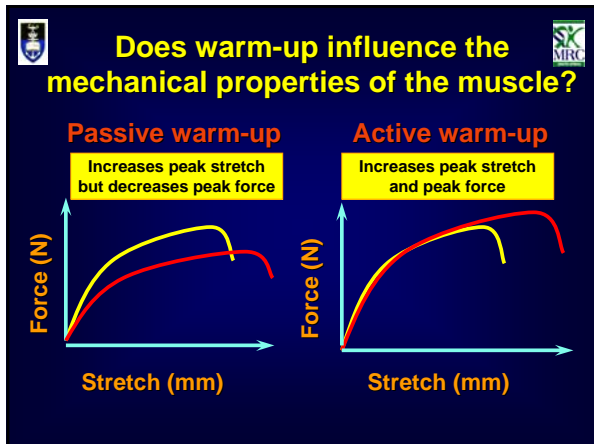
**Factors in the primary and secondary prevention of sports injuries**

	Primary prevention	Secondary prevention
Warm-up	?	?
Stretching	?	?
Muscle strength/balance	?	?
Equipment	?	?
Training	?	?
Biomechanics	?	?
Strapping and bracing	?	?
Nutrition	?	?
Psychology	?	?
Lifestyle	?	?

**1. Warm up**

- Increase muscle temperature by 1° C
- General vs. local
- Active vs. specific
- Decreased risk of injuries
- Animal studies
- Epidemiological studies
- Effect on performance

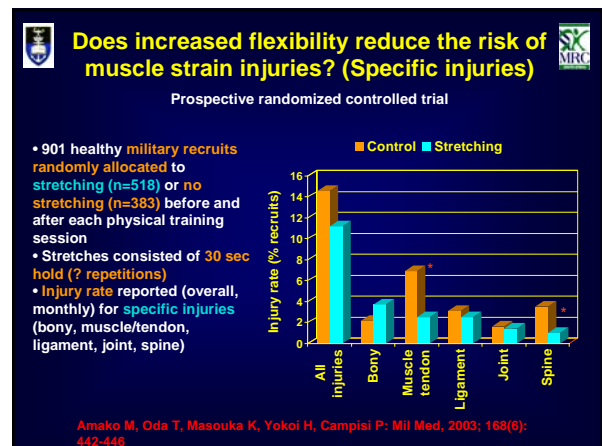
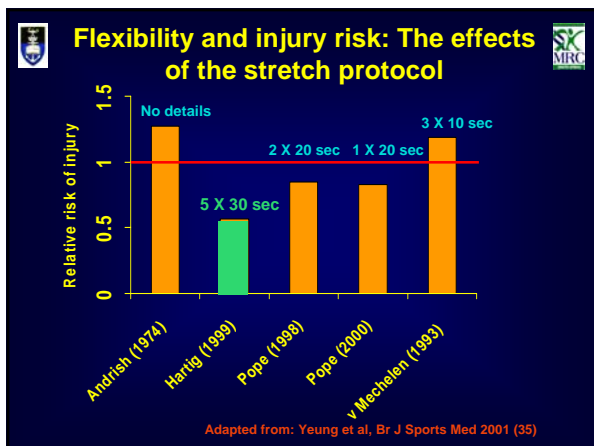




- ### Factors in the primary and secondary prevention of sports injuries
- |                         | Primary prevention | Secondary prevention |
|-------------------------|--------------------|----------------------|
| Warm-up                 | ?                  | Some evidence        |
| Stretching              |                    |                      |
| Muscle strength/balance |                    |                      |
| Equipment               |                    |                      |
| Training                |                    |                      |
| Biomechanics            |                    |                      |
| Strapping and bracing   |                    |                      |
| Nutrition               |                    |                      |
| Psychology              |                    |                      |
| Lifestyle               |                    |                      |

## 2. Stretching

### Does stretching decrease the risk of injuries?



### Does decreased flexibility increase the risk of muscle strain injuries in soccer players with no previous injury? (Primary prevention)

Prospective cohort study

- 146 male soccer players with no history of muscle injury in the lower extremities in the previous 2 years
- Flexibility of specific muscles (hamstring, quadriceps, adductor, calf) of the subjects was measured before the start of the season
- Players were monitored for specific muscle injuries (hamstring, quadriceps, adductor, calf).
- Pre-season ROM in the injured and non-injured groups

Muscle	Non-injured	Injured
Hamstring	~95	~85*
Quadriceps	~125	~115*

Witvrouw E, Dannaels L, Asselman P, D'Have T, Cambier D, Am J Sports Med, 2003; 31(1): 41 - 46

### Summary: Stretching and sports injury prevention

- Using the correct "dose" of stretching reduces the risk of specific injuries (muscle/tendon)
- Data from studies on specific injuries (muscle and tendon) show reduction in injury risk with flexibility training
- Flexibility and injury risk may be joint specific: possibly inherently stable joints – greater flexibility will reduce injury risk
- Inflexibility may be a more important independent risk in primary, but not secondary prevention of injury

### Factors in the primary and secondary prevention of sports injuries

Factor	Primary prevention	Secondary prevention
Warm-up	?	Some evidence
Stretching	Good evidence	?
Muscle strength/balance		
Equipment		
Training		
Biomechanics		
Strapping and bracing		
Nutrition		
Psychology		
Lifestyle		

### 3. Normal muscle strength and balance

- Muscle strength (Isokinetic dynamometry)
- Muscle imbalances
- Muscle activation or recruitment patterns

### Does decreased pre-season hamstring muscle concentric and eccentric peak torque increase risk of hamstring injury? (Primary)

Ecc Condition	Injured	Non-injured
Ecc 30	~1.7	~2.2*
Ecc 180	~1.4	~1.8*
Ecc 230	~1.5	~1.9*

Orchard J, Am J Sports Med, 25(1) 1997

Jonhagen et al, AmJ Sports Med, 22(2) 1994

### Does reduced hamstring eccentric / quadriceps concentric ratios reduce the risk of hamstring injury? (Primary)

Ratio	Seasonal injury rates (%)
< 0.9 (n=8)	~45
> 0.9 (n=28)	~10

Du Randt J, Scales N (unpublished data), 1999

### Does pre-season hamstring muscle strength predict recurrent hamstring injury risk (Secondary)

- Prospective cohort study
- 101 Club rugby players
- Pre-season muscle strength (isokinetic), muscle flexibility, and history of past hamstring injury documented
- Followed for 1 season and incidence of hamstring injuries was documented

Test	Injured (%)	Non-injured (%)
Con Quad	~2.5	~2.8
Ecc Quad	~3.5	~4.0
Con Ham	~1.8	~2.0
Ecc Ham	~2.5	~2.8
Con Ratio	~1.0	~1.0
Ecc Ratio	~1.0	~1.0
Ecc/Con	~1.2	~1.2

Lombard R, Schwellnus M, 2004

### Factors in the primary and secondary prevention of sports injuries

Factor	Primary prevention	Secondary prevention
Warm-up	?	Some evidence
Stretching	Good evidence	?
Muscle strength/balance	Good evidence	?
Equipment		
Training		
Biomechanics		
Strapping and bracing		
Nutrition		
Psychology		
Lifestyle		

### 4. Correct Sports "equipment"

- Footwear
- Socks
- Shorts / Tops
- Underwear
- Racquets

### Do "shock absorbing" insoles reduce the risk of injuries during training? (Primary)

Randomized controlled clinical trial  
12 week training  
Incidence of overuse injuries documented

Category	Injuries/1000hrs
All	~38
Stress #	~2
Tibial bone stress	~8

Schwellnus et al Am J Sports Med 6(2), 1990

### Does a soft "shock absorbing" insert decrease the risk of bone stress injuries of the lower leg?

Group	Odds Ratio
Control	1.0
Insoles	~0.5


Gillespie WJ, Grant I. Interventions for preventing and treating stress fractures and stress reactions of bone of the lower limbs in young adults (Cochrane Review). In: The Cochrane Library, Issue 1, 2003

### Factors in the primary and secondary prevention of sports injuries

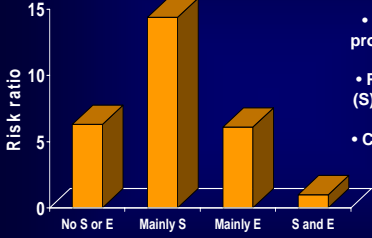
Factor	Primary prevention	Secondary prevention
Warm-up	?	Some evidence
Stretching	Good evidence	?
Muscle strength/balance	Good evidence	?
Equipment	Sport specific	Sport specific
Training		
Biomechanics		
Strapping and bracing		
Nutrition		
Psychology		
Lifestyle		

## 5. Adequate and correct training

- Frequency
- Duration
- Type (Strength, endurance)
- Intensity
- Progression
- Periodization



## Does pre-season strength (S) and endurance (E) training reduce the risk of injury in Rugby? (Primary)

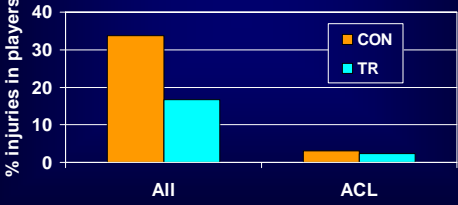


- Randomized trial 2 provincial rugby teams over one season
- Pre season strength (S) and endurance (E) training
- Calculate risk ratio of all injuries

Upton P, MSc thesis, Univ. Of Cape Town 2001

## Does pre-season training reduce the injury risk in soccer? (Primary)

300 female soccer players (ages 14-18 years)  
Studied over a 1-year period  
42 players (TR group) were randomly selected to participate in a 7-week training program before the season  
Control, CON=248



Injury Type	CON (%)	TR (%)
All	~33	~17
ACL	~3	~2


Heidt et al., Am J Sports Med 2000; 28(5)

## Factors in the primary and secondary prevention of sports injuries

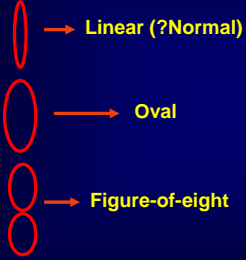

	Primary prevention	Secondary prevention
Warm-up	?	Some evidence
Stretching	Good evidence	?
Muscle strength/balance	Good evidence	?
Equipment	Sport specific	Sport specific
Training	Good evidence	?
Biomechanics		
Strapping and bracing		
Nutrition		
Psychology		
Lifestyle		

## 6. Correct biomechanics

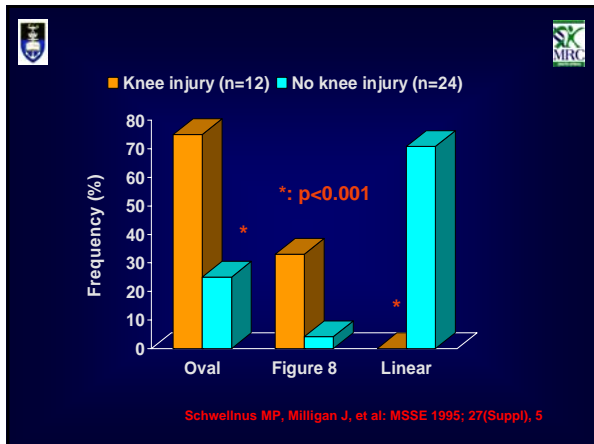
- Pelvic control and stability
  - Knee alignment
  - Patellar anatomy
  - Quadriceps angle
- Lower leg alignment
  - Rearfoot
  - Forefoot



## Does the pattern of knee movement in the down stroke of cycling increase the risk of knee injuries? (Primary)

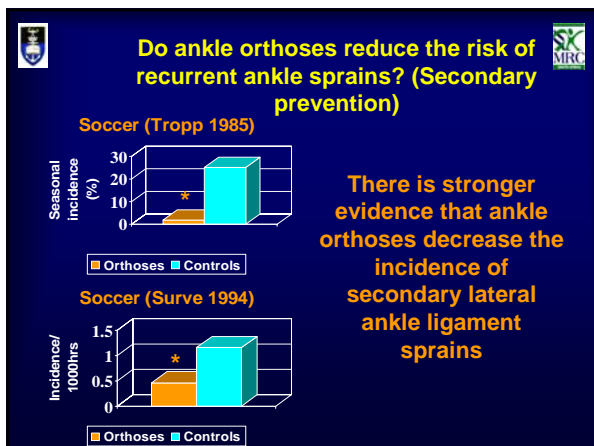
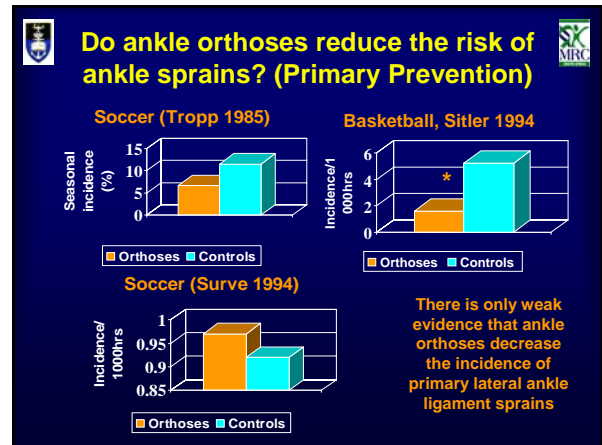
Schwellnus MP, Milligan J, et al: MSSE 1995; 27(Suppl), 5



### Factors in the primary and secondary prevention of sports injuries

	Primary prevention	Secondary prevention
Warm-up	?	Some evidence
Stretching	Good evidence	?
Muscle strength/balance	Good evidence	?
Equipment	Sport specific	Sport specific
Training	Some evidence	?
Biomechanics	Some evidence	Some evidence
Strapping and bracing		
Nutrition		
Psychology		
Lifestyle		

## 7. Correct use of strapping and bracing



### Factors in the primary and secondary prevention of sports injuries

	Primary prevention	Secondary prevention
Warm-up	?	Some evidence
Stretching	Good evidence	?
Muscle strength/balance	Good evidence	?
Equipment	Sport specific	Sport specific
Training	Some evidence	?
Biomechanics	Some evidence	Some evidence
Strapping and bracing	Little evidence	Good evidence
Nutrition		
Psychology		
Lifestyle		

**Factors in the primary and secondary prevention of sports injuries**

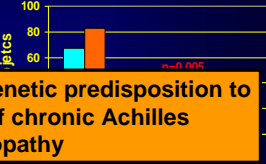
	Primary prevention	Secondary prevention
Warm-up	?	Some evidence
Stretching	Good evidence	?
Muscle strength/balance	Good evidence	?
Equipment	Sport specific	Sport specific
Training	Some evidence	?
Biomechanics	Some evidence	Some evidence
Strapping and bracing	No evidence	Good evidence
Nutrition	Some evidence	?
Psychology	?	?
Lifestyle	Some evidence	?

**What does the future hold?**  
Is there a genetic risk for sports injuries?



**Is there a genetic predisposition to chronic Achilles tendinopathy?**

• 53 Caucasian subjects diagnosed with chronic Achilles tendinopathy



**There appears to be a genetic predisposition to the development of chronic Achilles tendinopathy**

polymorphism (RLFPs) within the COL5A1 gene

■ Control ■ Achilles tendinopathy

Mokone GG, Gajjar M, September A, Schwellnus MP, Greenberg J, Noakes TD, Collins M, ACSM 2003

**Thank you for your attention**

