Prevention and Risk Factors

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Director of Non Invasive Cardiac Laboratory
Chief of Medical Staff Fiorentina Soccer Team

Muscular Injuries

Incidence about il 30-40% in different sports.

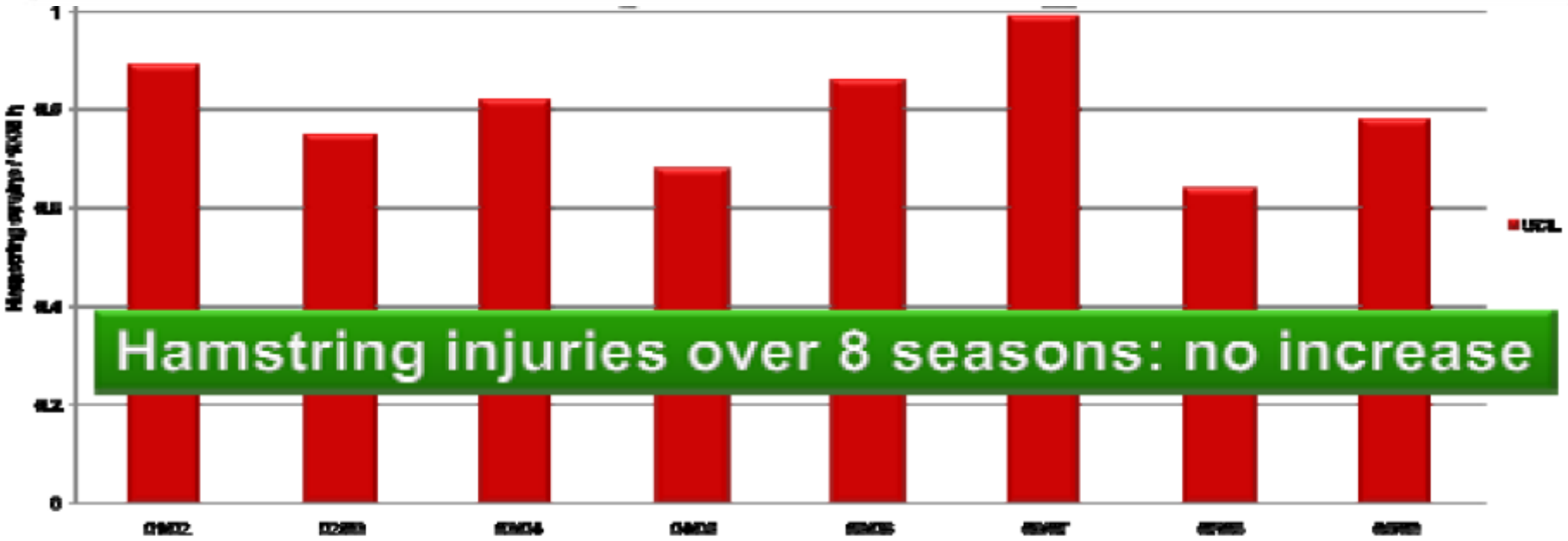
The epidemiology of United States high school soccer injuries, 2005-20°7.
Yard EE, Schroeder MJ, Fields SK, Collins CL, Comstock RD.
Am J Sports Med. 2008 Oct;36(10):1930-7
Effects of soccer-specific strains on the locomotor system]
Kittel R, Dittrich M, Fleege R, Lazik D, Wick D.
Sportverletz Sportschaden. 2008 Sep;22(3):164-8.
Epub 2008 Sep 23. German
Muscular strength, functional performances and injury risk in professional and junior elite soccer players.
Lehance C, Binet J, Bury T, Croisier JL.
Scand J Med Sci Sports. 2008 Mar 31
•Watkins J, Peabody P Sports injuries at a sports injury clinic.
J Sports Med Phys Fitness 1996 Mar;36(1):43-8
•Dec;239(1557):703-9

Muscle injury - the most common at top level !

Tears/strain/cramp (all muscle injuries except contusions)

causing absence from training and/or matches

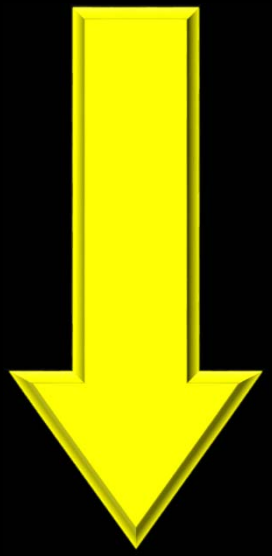
- **24-34% of all injuries**



Hamstring injuries over 8 seasons: no increase

Ekstrand et al, 2010

Muscular Injuries due to



Direct Trauma ***Indirect Trauma***

Predisposing Factors for muscular Injuries

- Muscular disphormism
- Unpleasant Climate
- Balance Deficit
- Flexibility/elasticity –strength Deficit
- Previous muscular injuries
- Inadeguate warm-up
- Local or general fatigue
- neuro-muscular coordination deficit
- Nutritional and hydrosalin imbalances
- behaviour
- Psychological factors

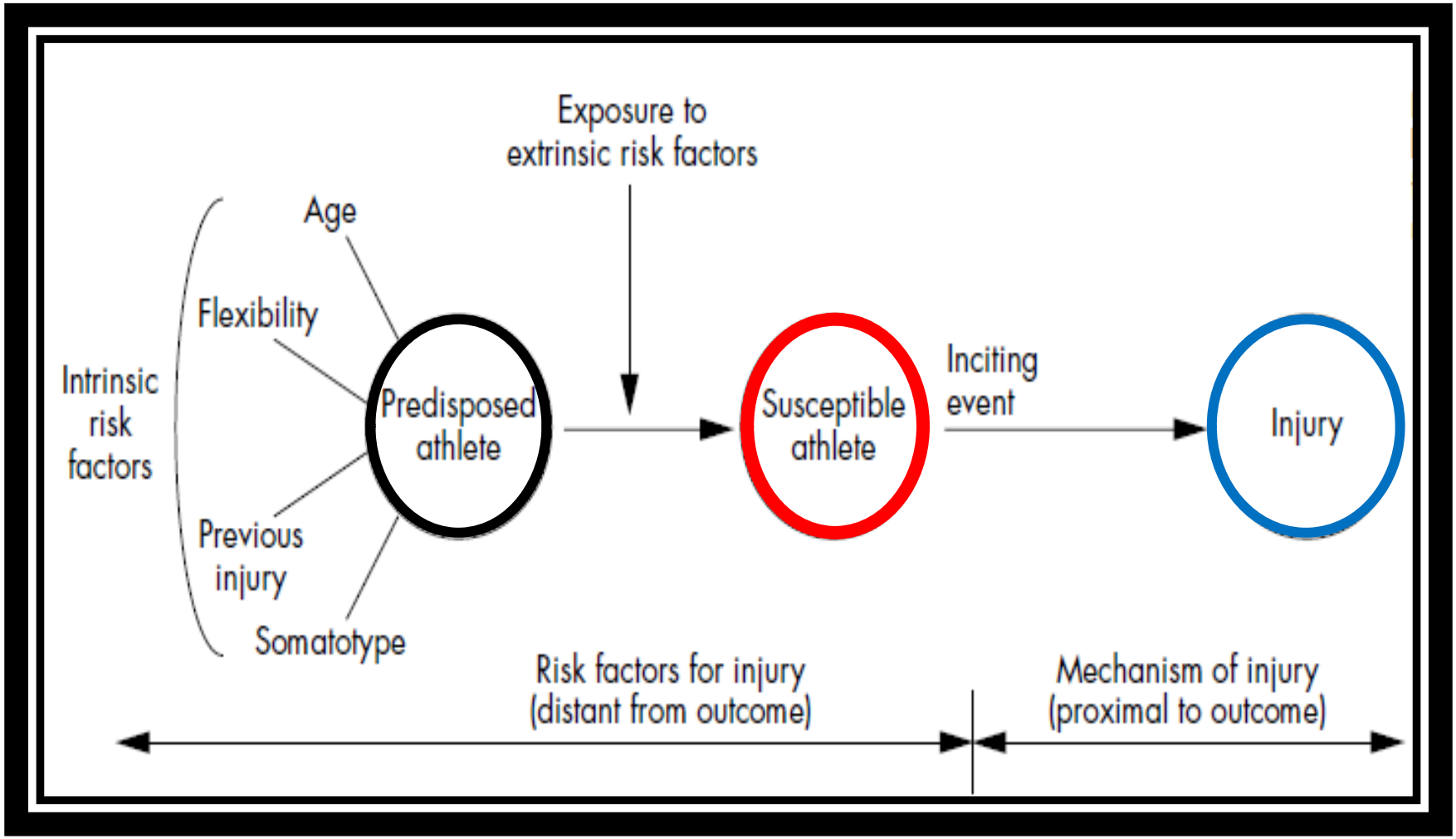
REVIEW

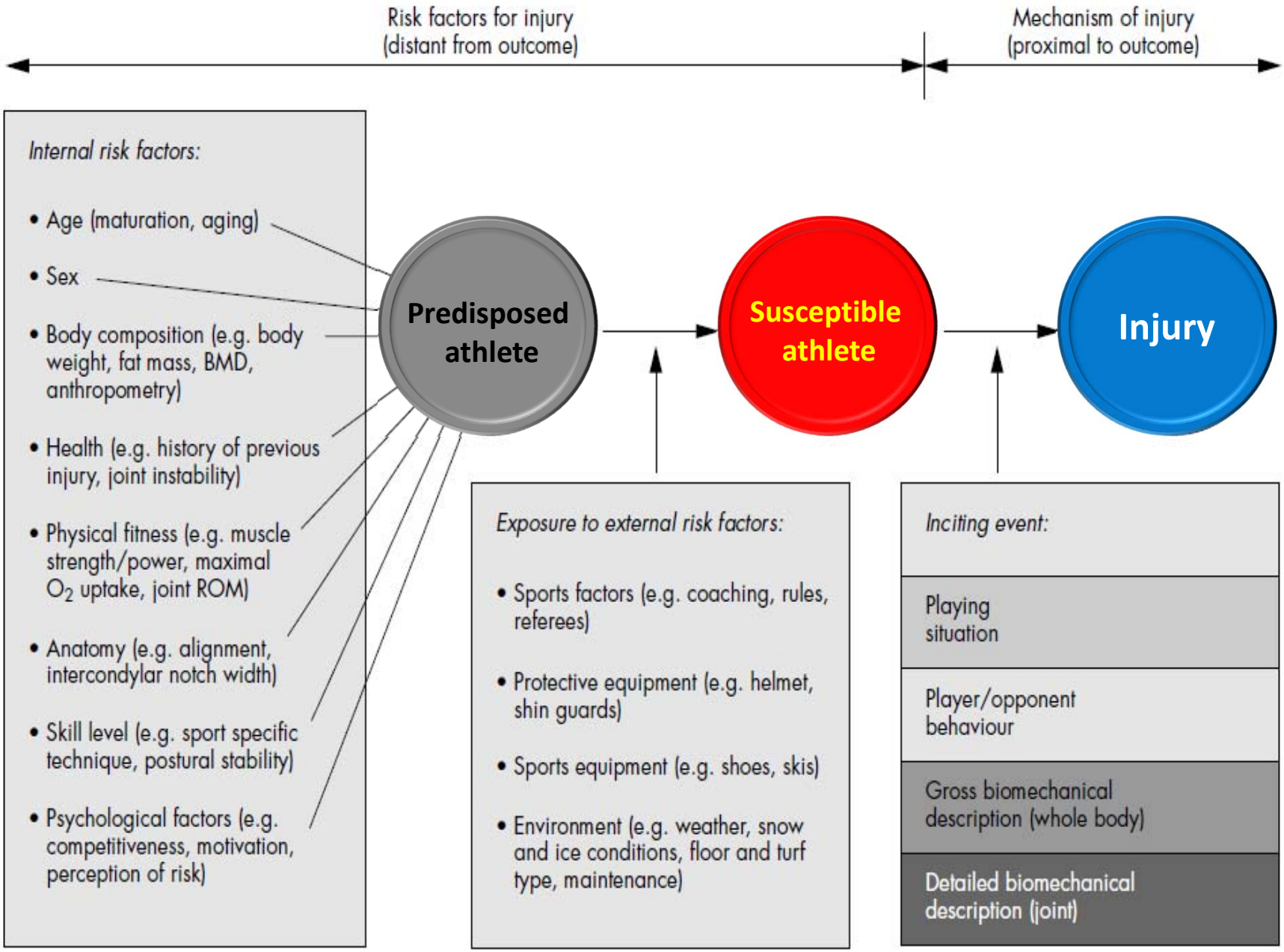
Understanding injury mechanisms: a key component of preventing injuries in sport

R Bahr, T Krosshaug

Br J Sports Med 2005;**39**:324–329. doi: 10.1136/bjsm.2005.018341

Interaction between internal and external risks factors




Risk factors for injury
(distant from outcome)
Mechanism of injury
(proximal to outcome)
Internal risk factors:
• Age (maturation, aging)
• Sex
• Body composition (e.g. body weight, fat mass, BMD, anthropometry)
• Health (e.g. history of previous injury, joint instability)
• Physical fitness (e.g. muscle strength/power, maximal O_2 uptake, joint ROM)
• Anatomy (e.g. alignment, intercondylar notch width)
• Skill level (e.g. sport specific technique, postural stability)
• Psychological factors (e.g. competitiveness, motivation, perception of risk)
Predisposed athlete
Susceptible athlete
Injury
Exposure to external risk factors:
• Sports factors (e.g. coaching, rules, referees)
• Protective equipment (e.g. helmet, shin guards)
• Sports equipment (e.g. shoes, skis)
• Environment (e.g. weather, snow and ice conditions, floor and turf type, maintenance)
Inciting event:
Playing situation
Player/opponent behaviour
Gross biomechanical description (whole body)
Detailed biomechanical description (joint)

Risk Factors for Lower Extremity Muscle Injury in Professional Soccer

The UEFA Injury Study

Martin Hägglund,*†‡ PT, PhD, Markus Waldén,‡ MD, PhD, and Jan Ekstrand,‡ MD, PhD
Investigation performed at Linköping University, Linköping, Sweden

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Background: Muscle injury is the most common injury type in professional soccer players. Despite this, risk factors for common lower extremity injuries remain elusive.

Purpose: To evaluate the effects of various player- and match-related risk factors on the occurrence of lower extremity muscle injury in male professional soccer.

Study Design: Cohort study; Level of evidence, 2.

Methods: Between 2001 and 2010, 26 soccer clubs (1401 players) from 10 European countries participated in the study. Individual player exposure and time loss muscle injuries in the lower extremity were registered prospectively by the club medical staffs during 9 consecutive seasons. Hazard ratios (HRs) were calculated for player-related factors from simple and multiple Cox regression, and odds ratios (ORs) were calculated for match-related variables from simple and multiple logistic regression, presented with 95% confidence intervals (CIs).

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more frequent duri … whereas adductor, hamstring, and calf injury rates increased during the competitive season.

Conclusion: Intrinsic factors found to increase muscle injury rates in professional soccer were previous injury, older age, and kicking leg. Injury rates varied during different parts of the season and also depending on match location.

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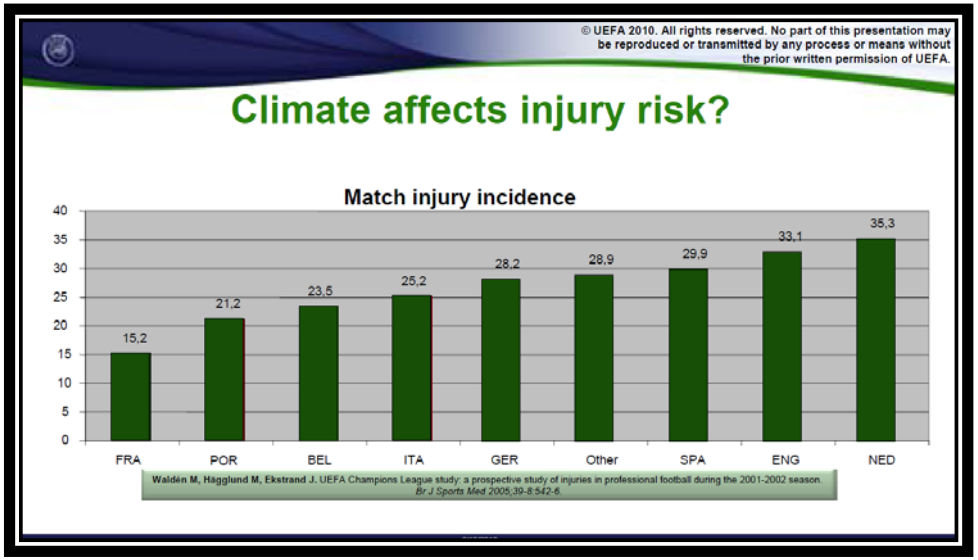
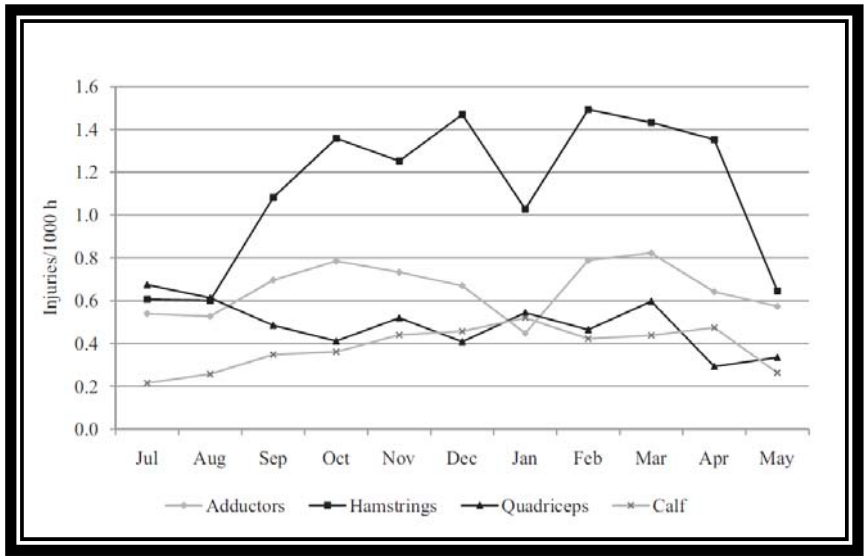
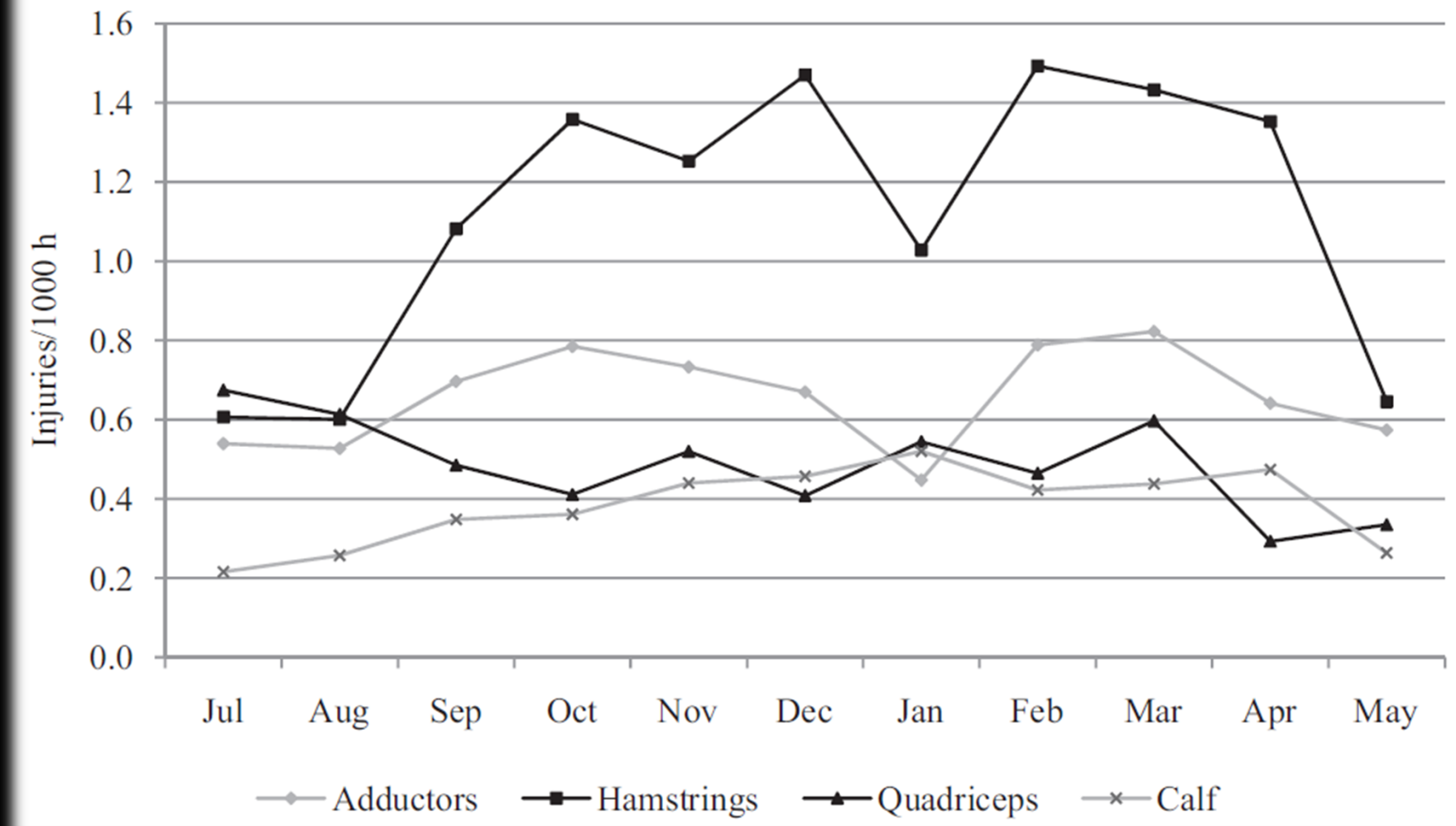
Am J Sports Med. 2012 Dec 21.





Am J Sports Med. 2012 Dec 21.

Seasonal distribution of lower extremity muscle injury rates (injuries/1000 h of total exposure).



Am J Sports Med. 2012 Dec 21.

Risk Factors

Adductor Injury → More common in the dominant (kicking) leg (56%; P = .015)

Hamstring Injury → No influence from leg dominance

Quadriceps Injury → More frequent in the dominant leg (63%; P\.001)

Calf Injury → Evenly distributed between the legs

Am J Sports Med. 2012 Dec 21.

Risk Factors for Adductor Injury

- Adductor injuries were more common in the dominant (kicking) leg (56%; P = .015). Simple analysis of player related factors identified 2 significant variables—being a goalkeeper and having previous adductor injury and these remained significant in the multiple analysis Simple analysis showed that match-related factors associated with adductor injury were other cup match and playing the match away ; away match was significant also in the multiple analysis

Risk Factors for Hamstring Injury

- No influence from leg dominance was found on hamstring injury (dominant leg 50%; P = .889). According to simple analysis, taller players and goalkeepers were less likely to suffer a hamstring injury, whereas players with previous injury to the hamstrings, quadriceps, and calf muscles were more prone to injury Goalkeeper and previous hamstring injury remained significant in the multiple analysis Simple analysis showed that match related factors associated with hamstring injury were away match and playing a match in the fall, winter, or spring periods as compared with preseason The same variables were significant also in the multiple analysis

Risk Factors for Quadriceps Injury

- **Quadriceps injuries were more frequent in the dominant leg (63%; P\.001). According to simple analysis, goalkeepers had a decreased rate of quadriceps injury, whereas a previous injury to the quadriceps, adductors, or calf muscles increased the rate of injury. The same variables were significant in the multiple analysis Simple analysis identified no significant match-related risk factors, whereas according to multiple analysis, playing UCL matches were associated with a lower odds of quadriceps injury.**

Risk Factors for Calf Injury

- **Calf injuries were evenly distributed between the legs(dominant leg 52%; P = .521). Simple analysis showed that goalkeepers had a lower rate of calf injury, whereas a higher rate was observed among older players and among players with a previous calf injury, adductor injury, and hamstring injury. Multiple analysis identified the same significant variables Of the tested match-related variables, match play in the UCL had a higher odds that a calf injury would occur according to simple and multiple analysis**

Scand J Med Sci Sports 2009: 19: 243–251
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DOI: 10.1111/j.1600-0838.2008.00780.x

SCANDINAVIAN JOURNAL OF
MEDICINE & SCIENCE
IN SPORTS

Muscular strength, functional performances and injury risk in professional and junior elite soccer players

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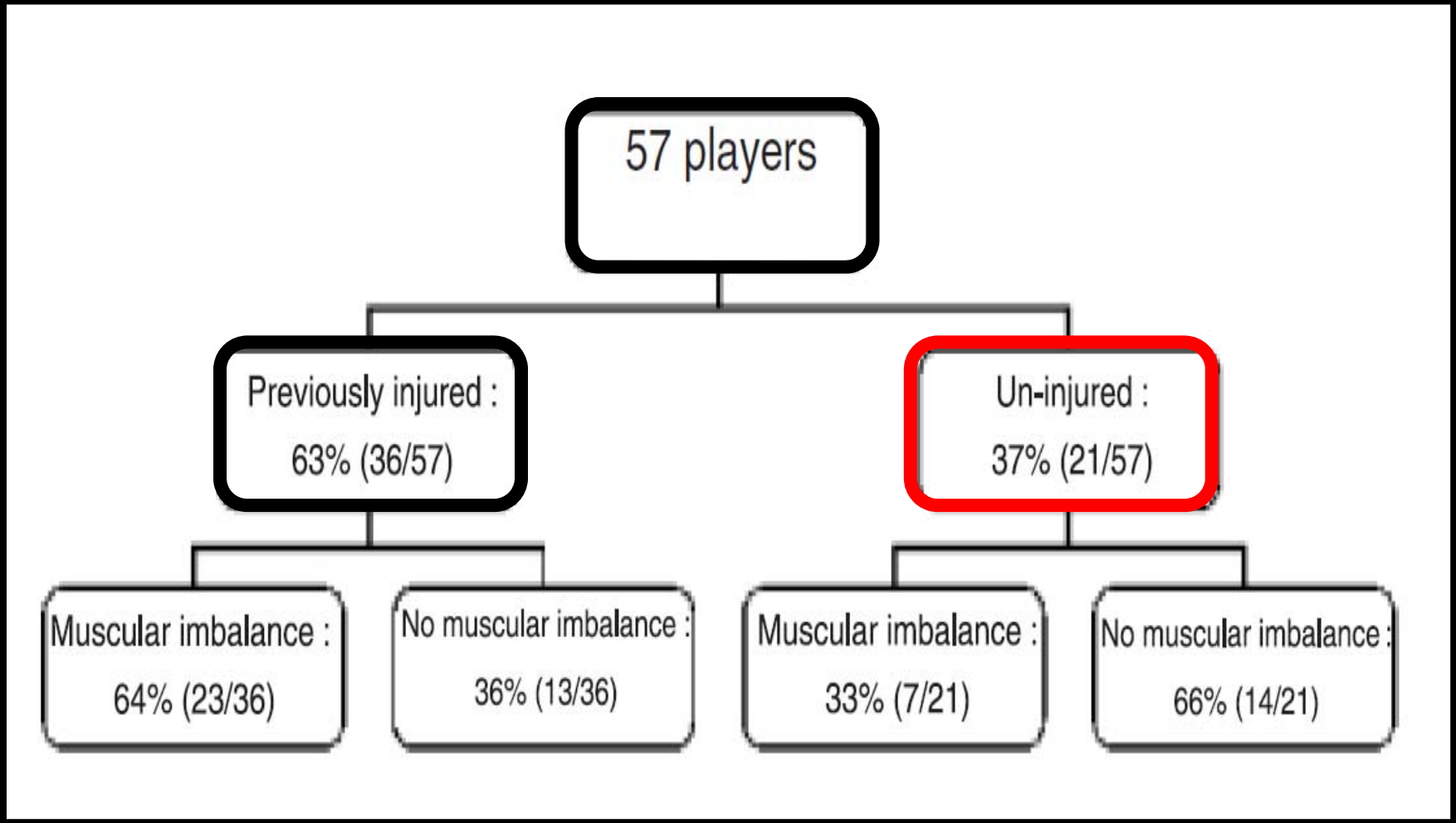
Accepted for publication 10 January 2008

Muscle strength and anaerobic power of the lower extremities are neuromuscular variables that influence performance in many sports activities, including soccer. Despite frequent contradictions in the literature, it may be assumed that muscle strength and balance play a key role in targeted acute muscle injuries. The purpose of the present study was to provide and compare pre-season muscular strength and power profiles in professional and junior elite soccer players throughout the developmental years of 15–21. One original aspect of our study was that isokinetic data were considered alongside the past history of injury in these players. Fifty-seven elite and junior elite male soccer players were assigned to three groups: PRO, $n = 19$; U-21, $n = 20$ and U-17, $n = 18$. Players benefited from knee flexor and extensor isokinetic testing consisting of concentric and eccentric exercises. A context of lingering muscle disorder was defined using statistically selected cut-offs. Functional performance was evaluated throughout a squat jump and 10 m sprint. The PRO group ran faster and jumped higher than the U-17 group ($P < 0.05$). No significant difference in isokinetic muscle strength performance was observed between the three groups when considering normalized body mass parameters. Individual isokinetic profiles enabled the identification of 32/57 (56%) subjects presenting lower limb muscular imbalance. Thirty-six out of 57 players were identified as having sustained a previous major lower limb injury. Of these 36 players, 23 still showed significant muscular imbalance (64%). New trends in rational training could focus more on the risk of imbalance and implement antagonist strengthening aimed at injury prevention. Such an intervention would benefit not only athletes recovering from injury, but also uninjured players. An interdisciplinary approach involving trainers, a physical coach, and medical staff would be of interest to consider in implementing a prevention programme.

Muscular strength disorders among un-injuried and previously injured players.



Scand J Med Sci Sports 2009: 19: 243–251

Scand J Med Sci Sports 2003: 13: 244–250
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 ISSN 0905-7188
SCANDINAVIAN JOURNAL OF MEDICINE & SCIENCE IN SPORTS

Hamstring injury occurrence in elite soccer players after preseason strength training with eccentric overload

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Corresponding author: Carl Askling, Department of Sport and Health Sciences, University College of Physical Education and Sports, Box 5626, SE-114 86 Stockholm, Sweden

These results indicate that addition of specific preseason strength training for the hamstrings – including eccentric overloading – would be beneficial for elite soccer players, both from an injury prevention and from performance enhancement point of view.

premier league division teams in Sweden were divided into two groups; one group received additional specific hamstring training, whereas the other did not. The extra training was performed 1–2 times a week for 10 weeks by using a special device aiming at specific eccentric overloading of the hamstrings. Isokinetic hamstring strength and maximal running speed were measured in both groups before and training group. However, there were no obvious coupling between performance parameters and injury occurrence. These results indicate that addition of specific preseason strength training for the hamstrings – including eccentric overloading – would be beneficial for elite soccer players, both from an injury prevention and from performance enhancement point of view.

CURRENT OPINION

Sports Med 2010; 40 (11): 899-906
0112-1642/10/0011-0899/$49.95/0

Behaviour, the Key Factor for Sports Injury Prevention

Evert A.L.M. Verhagen, Maartje M. van Stralen and *Willem van Mechelen*

Department of Public and Occupational Health, EMGO Institute for Health and Care Research, VU University Medical Center, Amsterdam, the Netherlands

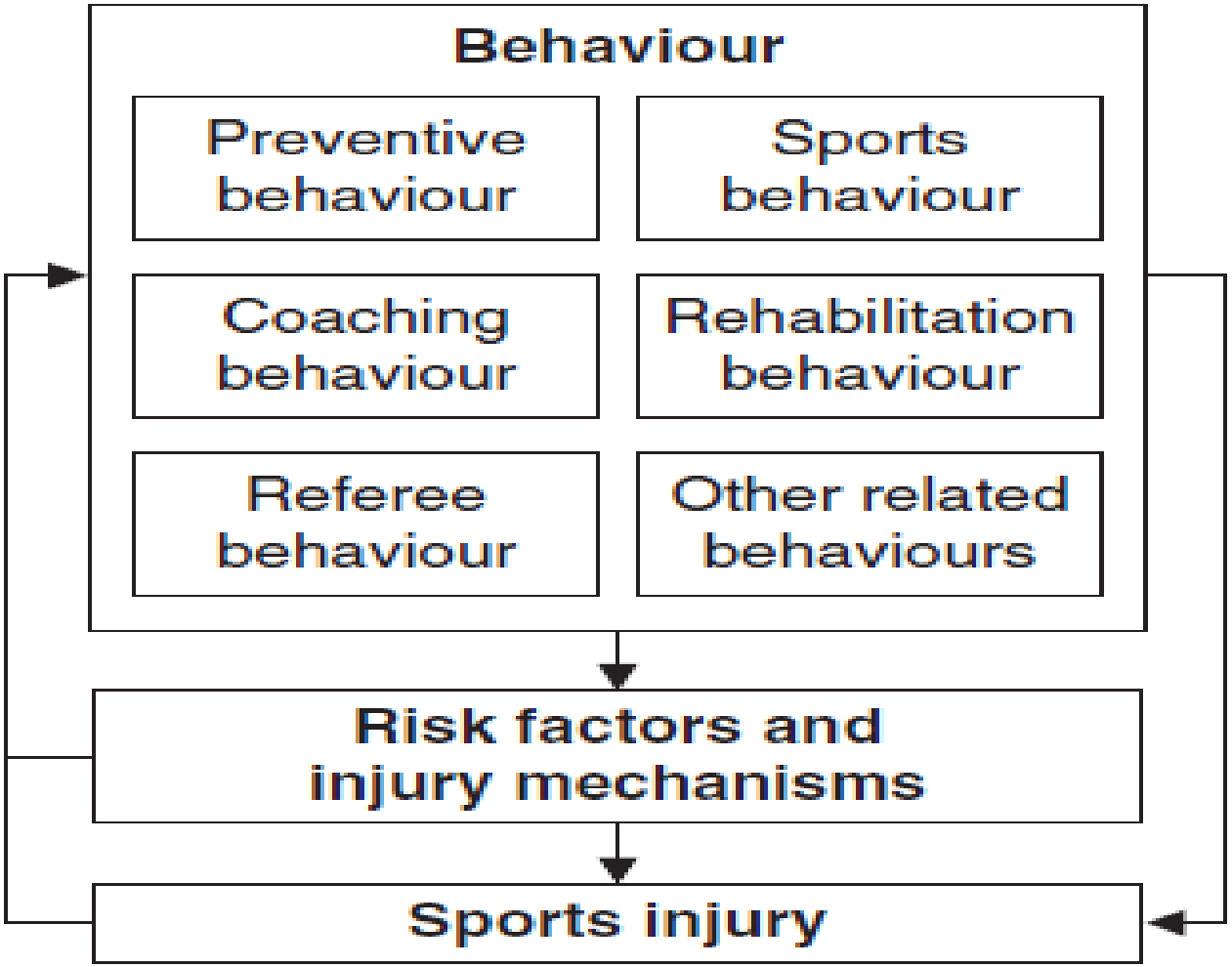
Abstract

Safety in sports and physical activity is an important prerequisite for continuing participation in sports, as well as for maintenance of a healthy physically active lifestyle. For this reason, prevention, reduction and control of sports injuries are important goals for society as a whole. Recent advances in sports medicine discuss the need for research on real-life injury prevention. Such views call for a more behavioural approach when it comes to actual sports injury prevention. Nevertheless, the role of behaviour in sports injury prevention remains under-researched. In order to push the field of sports injury prevention forward, this article provides an overview of the relationship between behaviour and sports injury risk.

Different types of behaviour relate to injury risk factors and injury mechanisms. Behaviour that influences risk factors and injury mechanisms is not confined only to the athlete. Various types of behaviour by, for example, the coach, referee, physical therapist or sports associations, also influence risk factors and injury mechanisms. In addition, multiple behaviours often act together. Some types of behaviour may directly affect injury risk and are by definition a risk factor. Other behaviours may only affect risk factors and injury mechanisms, and influence injury risk indirectly.

Recent ideas on injury prevention that call for studies on real-life injury prevention still rely heavily on preventive measures that are established through efficacy research. A serious limitation in such an approach is that one expects that proven preventive measures will be adopted if the determinants and influences of sports safety behaviours are understood. Therefore, if one truly wants to prevent sports injuries in a real-life situation, a broader research focus is needed. In trying to do so, we need to look at lessons learned from other fields of injury prevention research.

A conceptual model of the relationship between behaviour, injury risk factors and injury mechanisms, and sports injury.



Sports Med 2010; 40 (11): 899-906

REVIEW ARTICLE

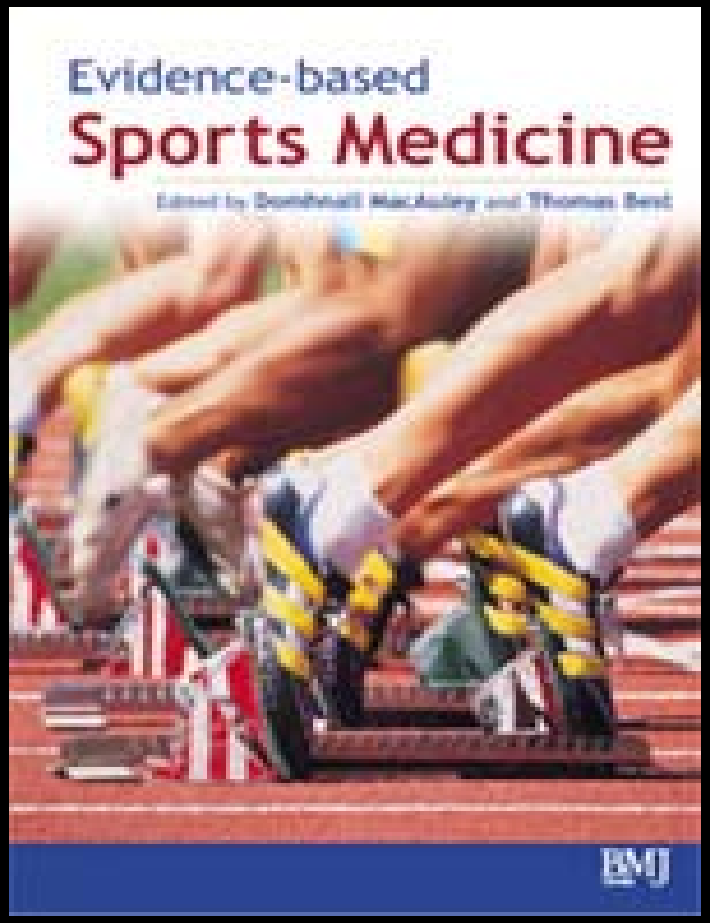
Sports Med 2004; 34 (7): 443-449
0112-1642/04/0007-0443/$31.00/0

Stretching and Injury Prevention

An Obscure Relationship

Erik Witvrouw,[1] *Nele Mahieu*,[1] *Lieven Danneels*[1] and *Peter McNair*[2]

1 Department of Rehabilitation Sciences and Physical Therapy, Faculty of Medicine and Health Sciences, Ghent University, Ghent, Belgium
2 School of Physiotherapy, Physical Rehabilitation Research Centre, Auckland University of Technology, Auckland, New Zealand



Does stretching prevent injuries?

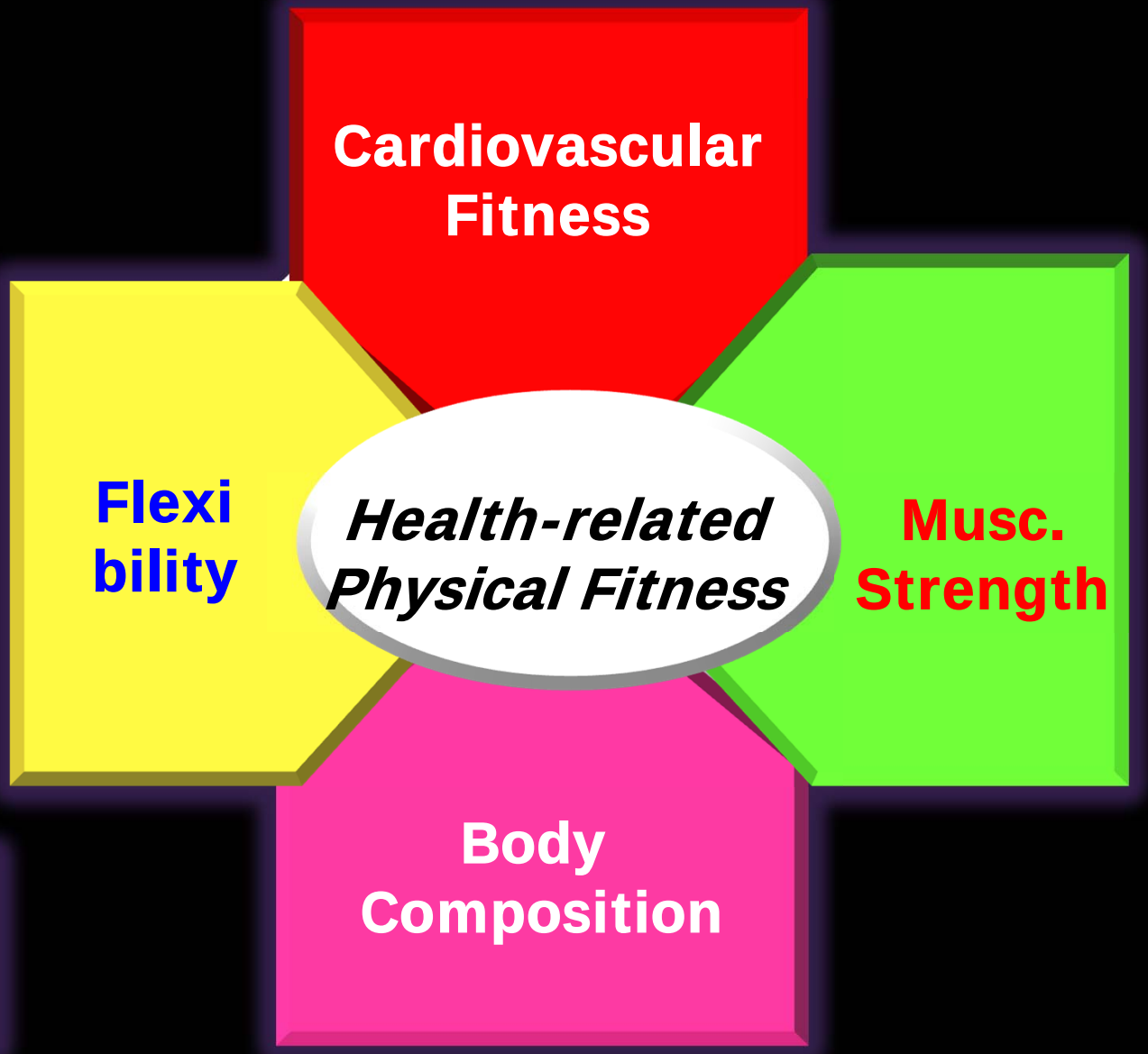
- *Stretching immediately before exercise is different from stretching at other times*
- *Stretching immediately before exercise does not appear in prevent injuries*
- *Regular stretching that is not done immediately before exercise may prevent injury*

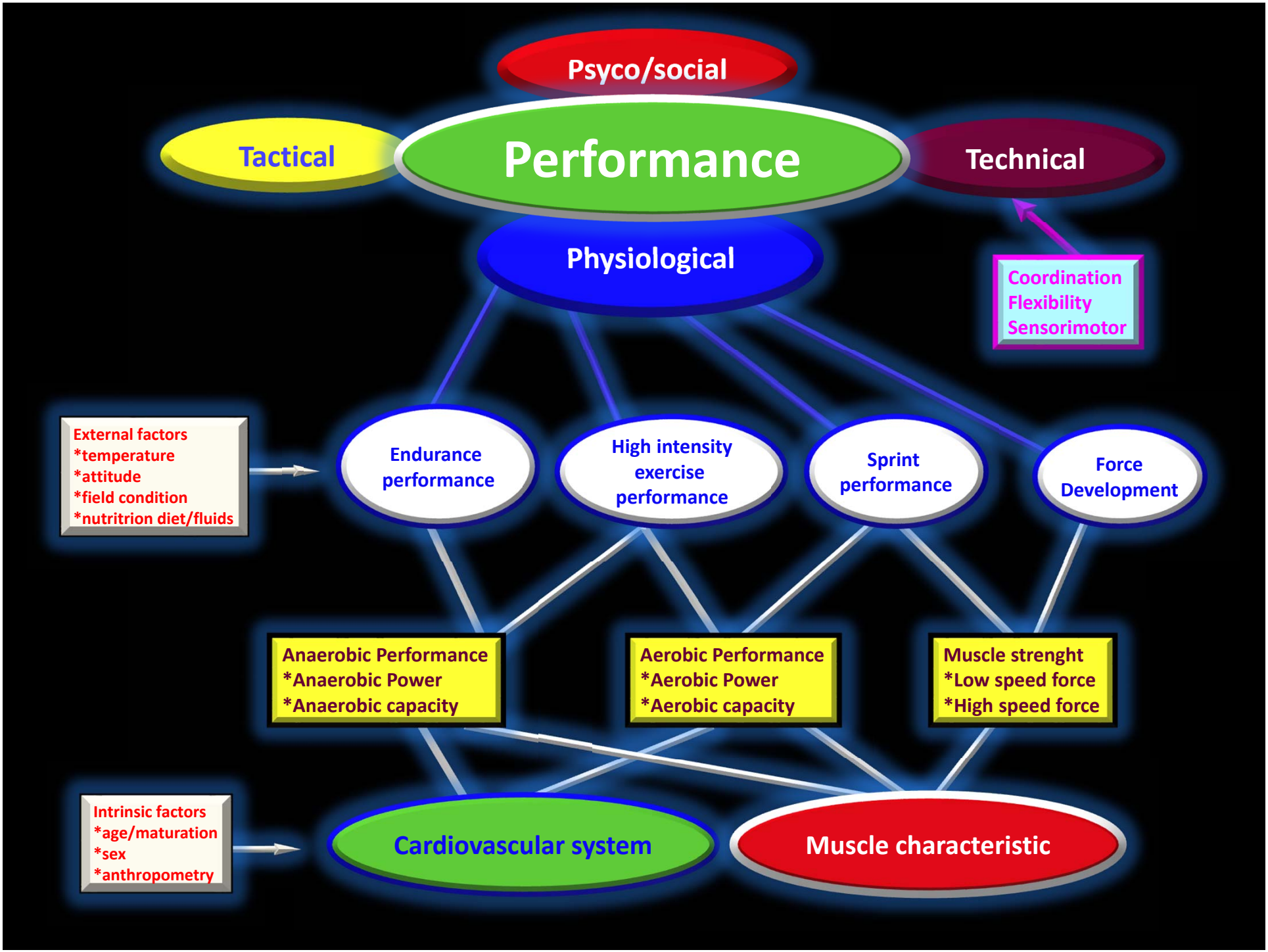
MacAuley-Best BMJ August 2007

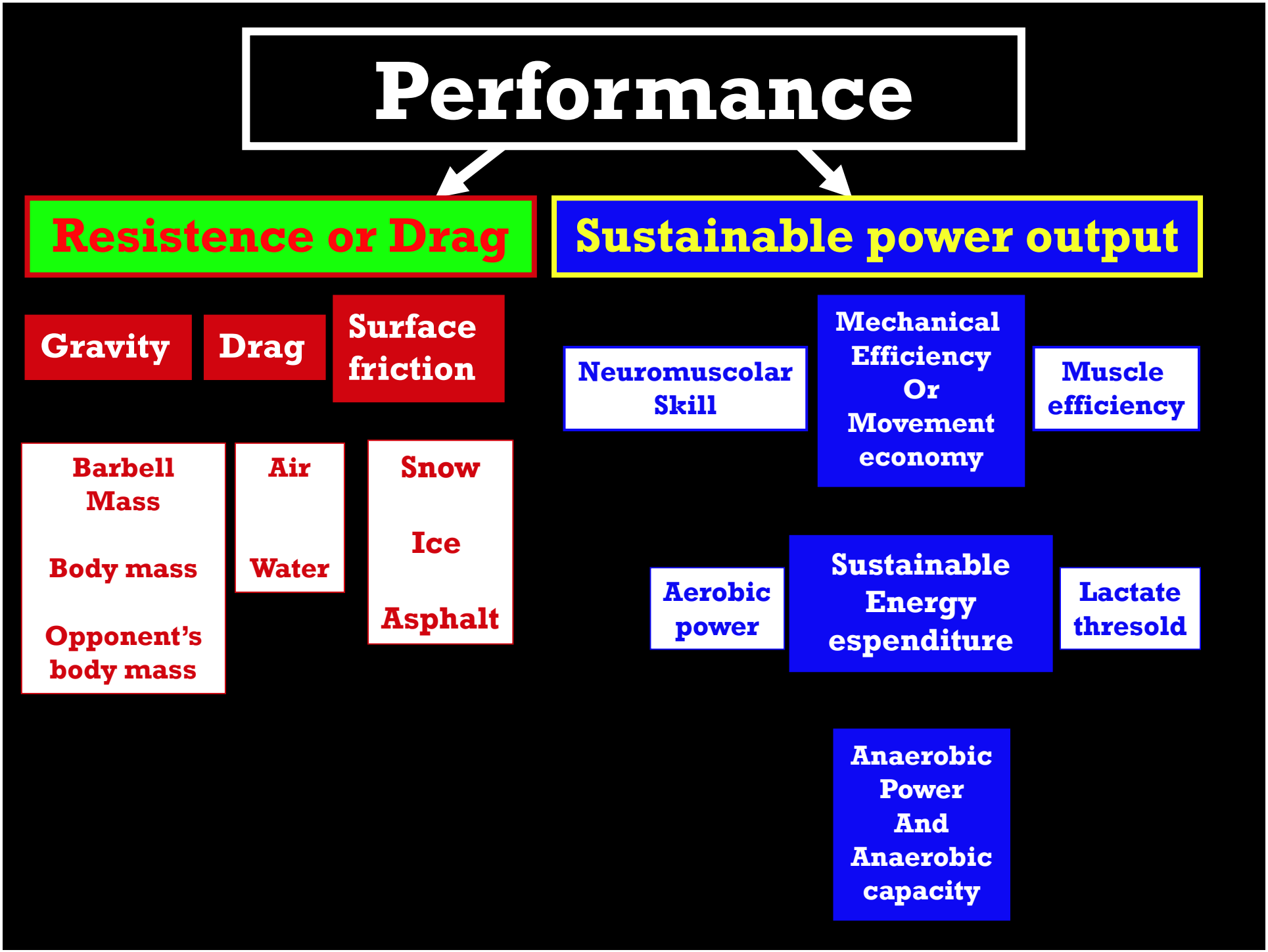
" ATHLETIC FITNESS"

A SETS OF CARDIORESPIRATORY, NEUROMUSCULAR AND PSYCHOLOGICAL CHARACTERISTICS-NATURAL OR ACQUIRED- WHICH ALLOW ATHLETE TO CARRY OUT THE SPORTS ACTIVITY WITH HIGHEST EFFICIENCY AND LOWEST INJURY HAZARD.

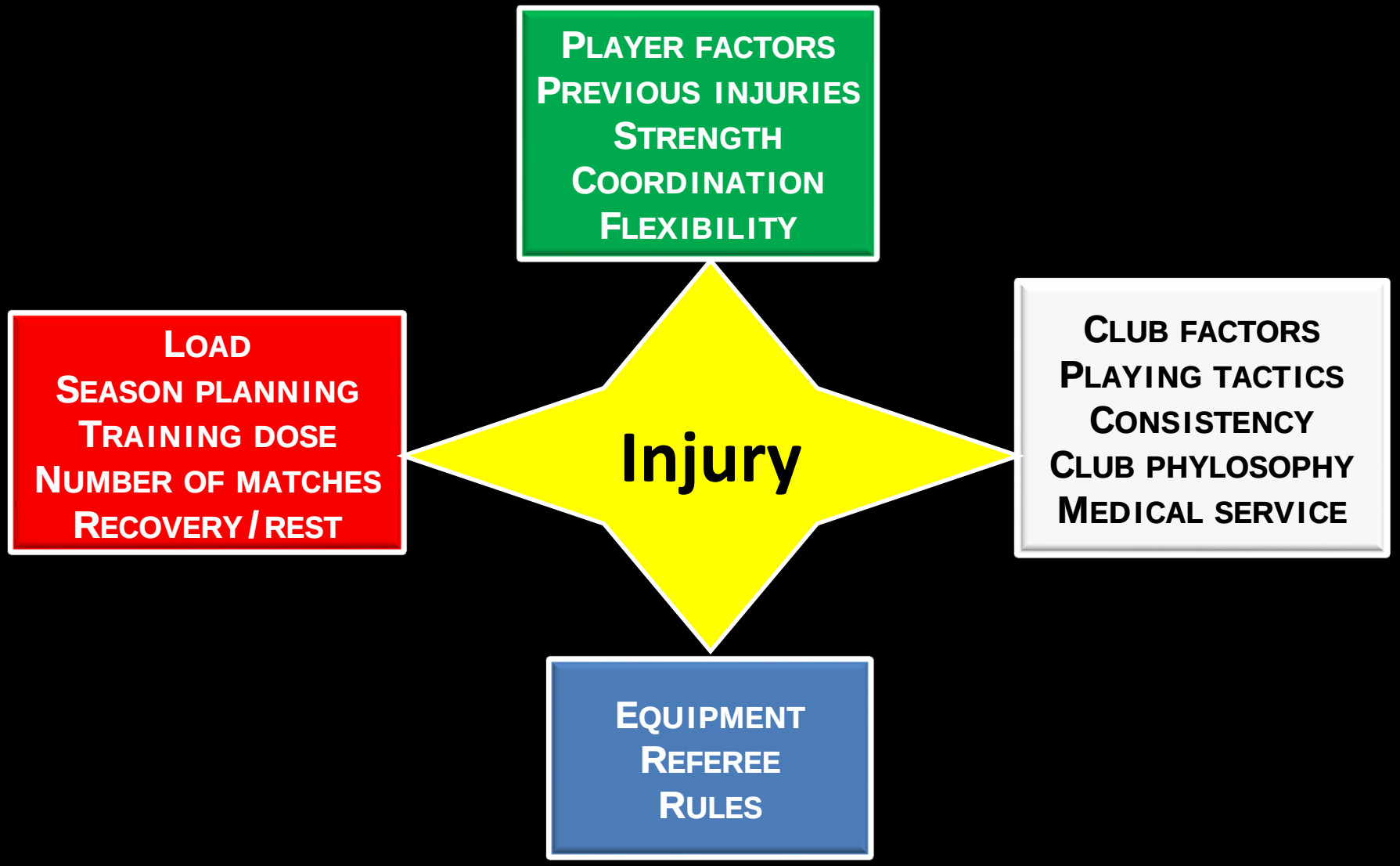
Health related physical fitness components



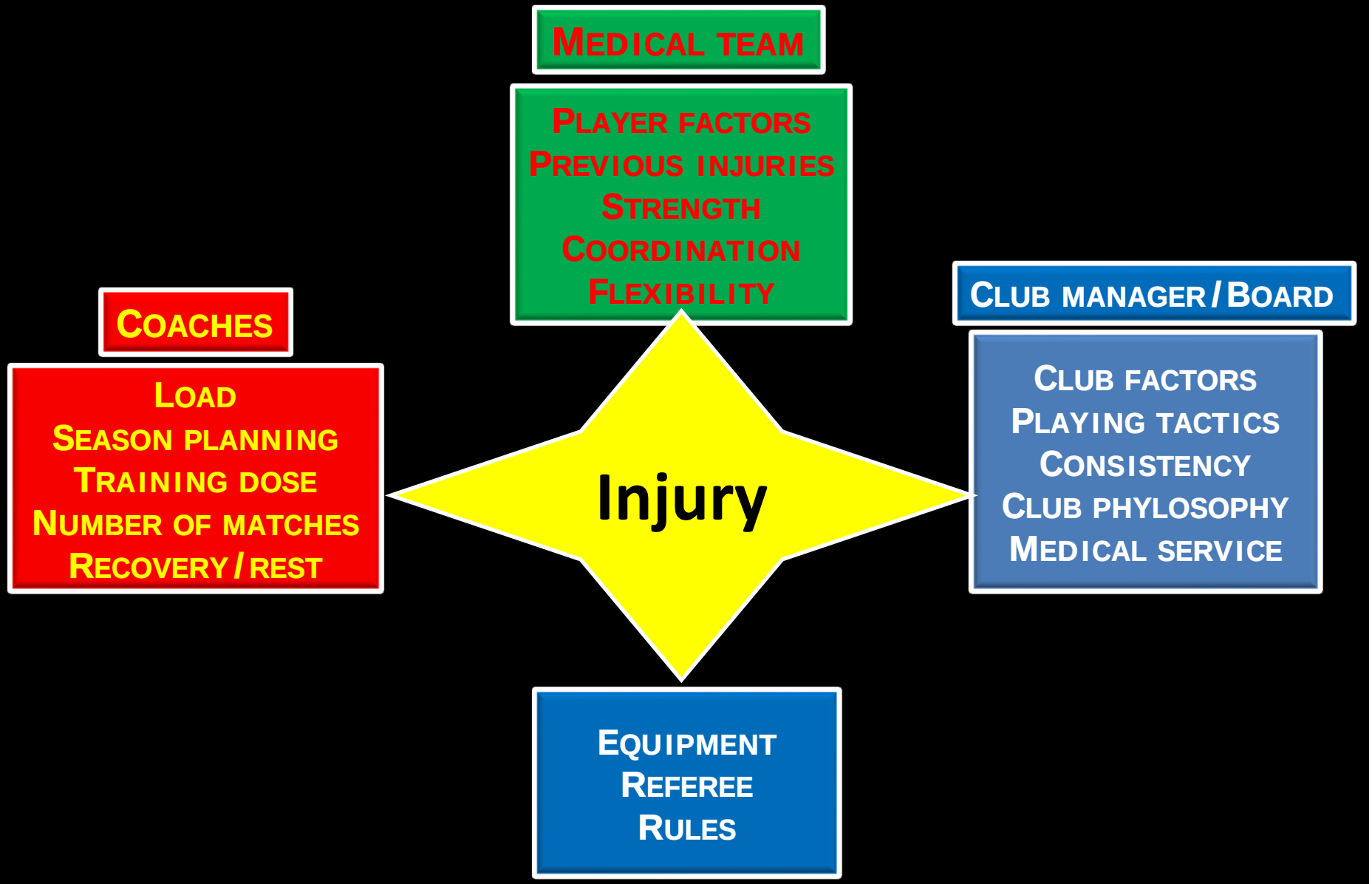

Psyco/social
Tactical
Performance
Technical
Physiological
Coordination
Flexibility
Sensorimotor
External factors
*temperature
*attitude
*field condition
*nutritrion diet/fluids
Endurance performance
High intensity exercise performance
Sprint performance
Force Development
Anaerobic Performance
*Anaerobic Power
*Anaerobic capacity
Aerobic Performance
*Aerobic Power
*Aerobic capacity
Muscle strenght
*Low speed force
*High speed force
Intrinsic factors
*age/maturation
*sex
*anthropometry
Cardiovascular system
Muscle characteristic


Performance
Resistence or Drag
Sustainable power output
Gravity
Drag
Surface friction
Barbell Mass
Body mass
Opponent's body mass
Air
Water
Snow
Ice
Asphalt
Neuromuscolar Skill
Mechanical Efficiency Or Movement economy
Muscle efficiency
Aerobic power
Sustainable Energy espenditure
Lactate thresold
Anaerobic Power And Anaerobic capacity

What factors influence the risk of injuries?



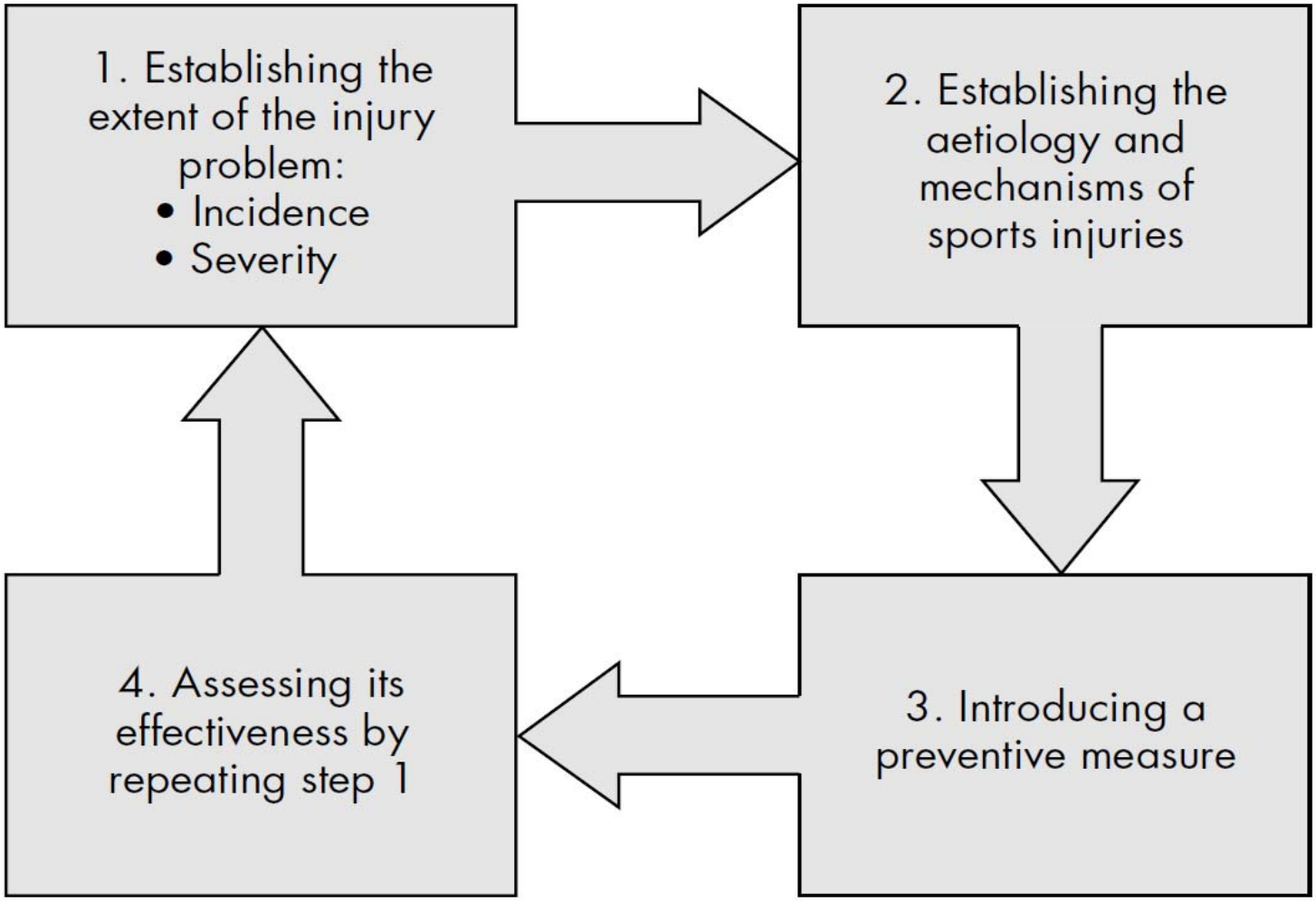
WHO CONTROLS THE INJURY FACTORS?



Take home message

- A professional soccer team with 25 players can expect about 50 injuries for season, 8-9 of them severe
- The injury risk has not increased during recent years
- Likely Climate affects injury risk
- Hamstring strain the most common injury
- The key to prevention at elite level is monitoring,communication and cooperation among medical team, coaches and club manager
- Injury studies and research are the base of prevention

Step sequence of injury prevention research



UNIVERSITA’ DEGLI STUDI FIRENZE

NEW TRENDS IN THERAPY

Dott. Salvatore Caruso-Dott. Andrea Moretti

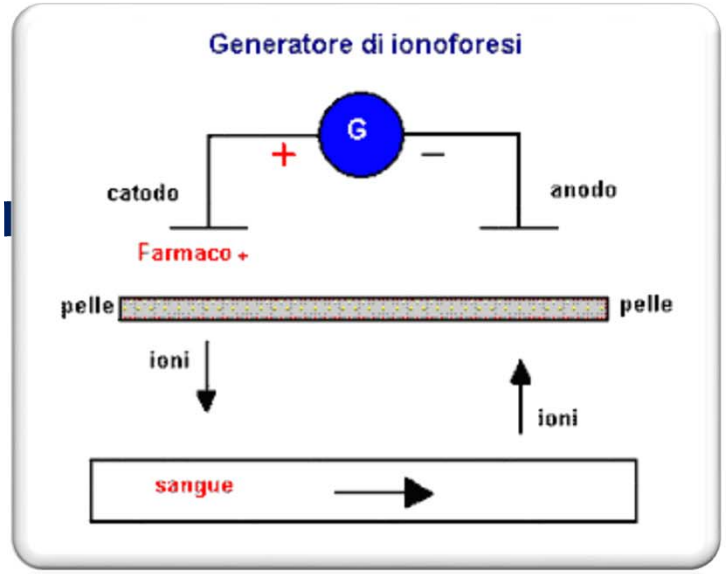
Scuola di Specializzazione in
Medicina dello Sport
A.O.U.C

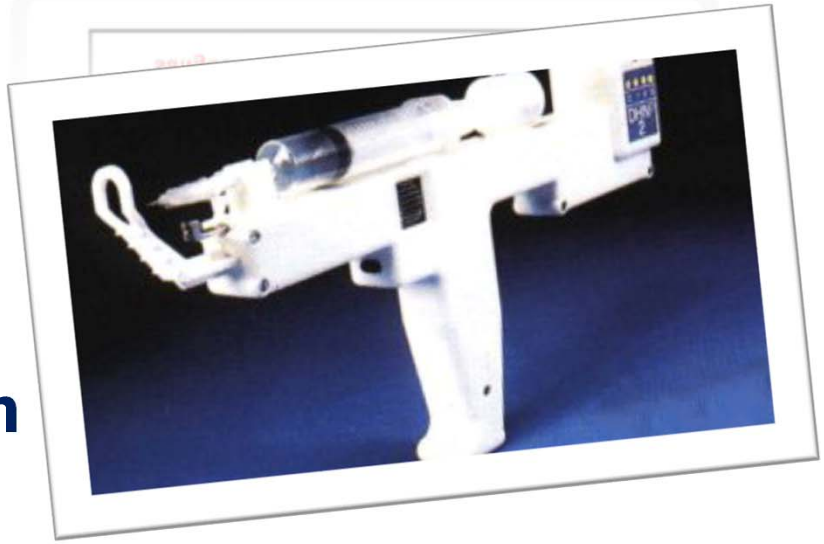
Introduction

- In traditional medicine, the drugs injected through a syringe are absorbed according to the flow circulation
- This may affect the final outcome, due to the impossibility to concentrate drugs in the area of clinical interest
- Many researchers have attempted to find alternative ways, less traumatizing than the injection of drugs

Medical devices

- Among the alternative ways to the use of the needle for the drugs administration, for example, we can mention the iontophoresis, mesotherapy, electroporation
- The research in this direction has been a very important task and it was very useful in medicine, but with the limitations due to the low depth of penetration of the drug



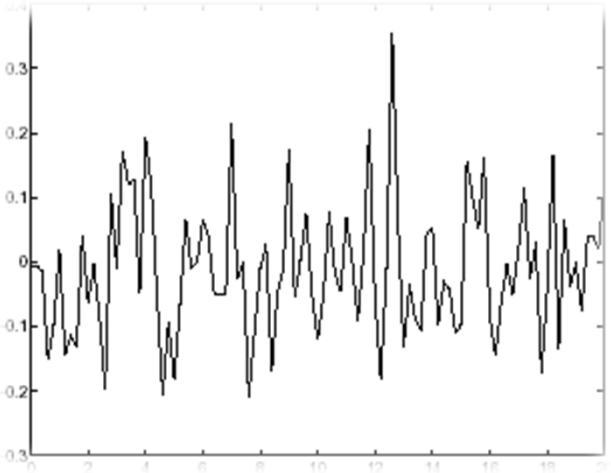


In particular:

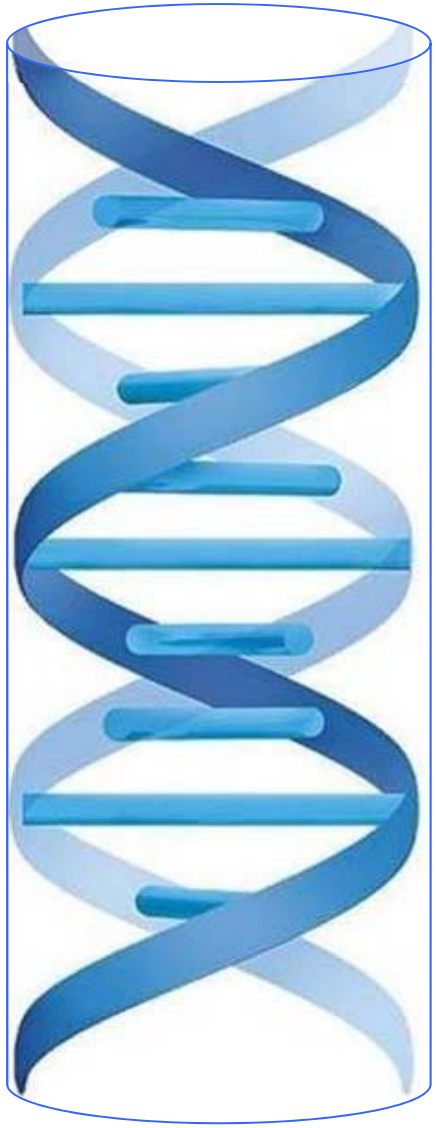
the Iontophoresis allows to transport active substances within the tissues, it's however necessary that the substance is ionizable and with a low molecular weight. Furthermore, the transport takes place exclusively in the superficial areas of tissue

The equipment "FarmaT.E.B. Trans Epidermal Barrier "is a medical device for the subcutaneous vehiculation of drugs, studied for the treatment of various loco-regional diseases.

The device FarmaT.E.B. is the latest innovation in terms of procedures of transdermal vehiculation.



This system operates as a "virtual syringe", which replaces the needle with an electric wave suitable for the transport of the active principles

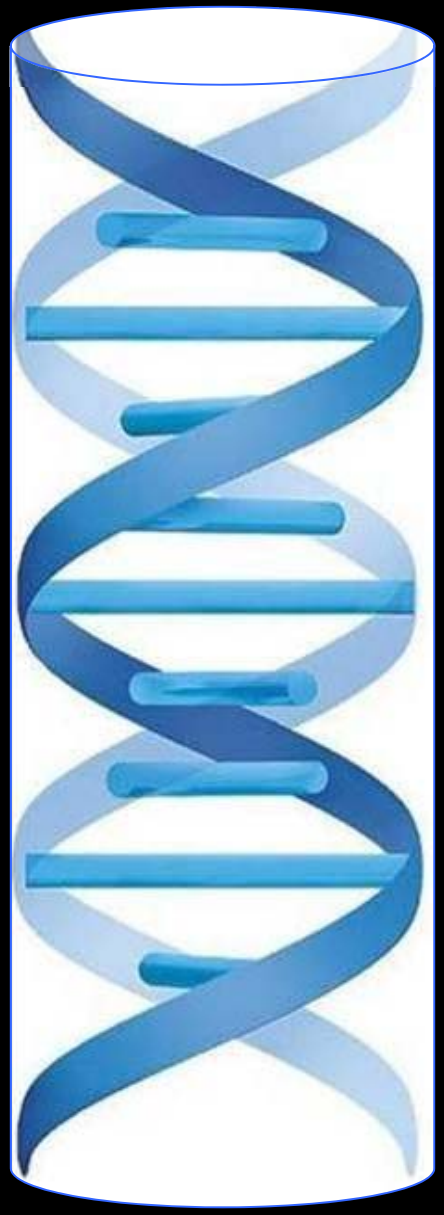


“Bio-electrodic reptation”®

allows the transport of medications, also not ionizable, through the skin, overcoming the epidermal barrier thanks to the action of electric pulses

Ad Biomedical Innotech S.r.l.

- **To enhance and optimize the vehiculation of the active principle through the epidermal barrier, the medical device Farma TEB associates the action of electromagnetic waves with the action of a mechanical massage performed with the use of an applicator tool**
- **The noninvasive system concentrates in a targeted manner a high quantity of molecules, that interacts with specific receptors available in situ, realizing the maximum of its therapeutic restorative potential towards the injured tissues**
- **Vehiculating a small dose of active principle in correspondence with the lesion to be treated, it interacts exclusively with local receptors with a therapeutic activity much more effective**

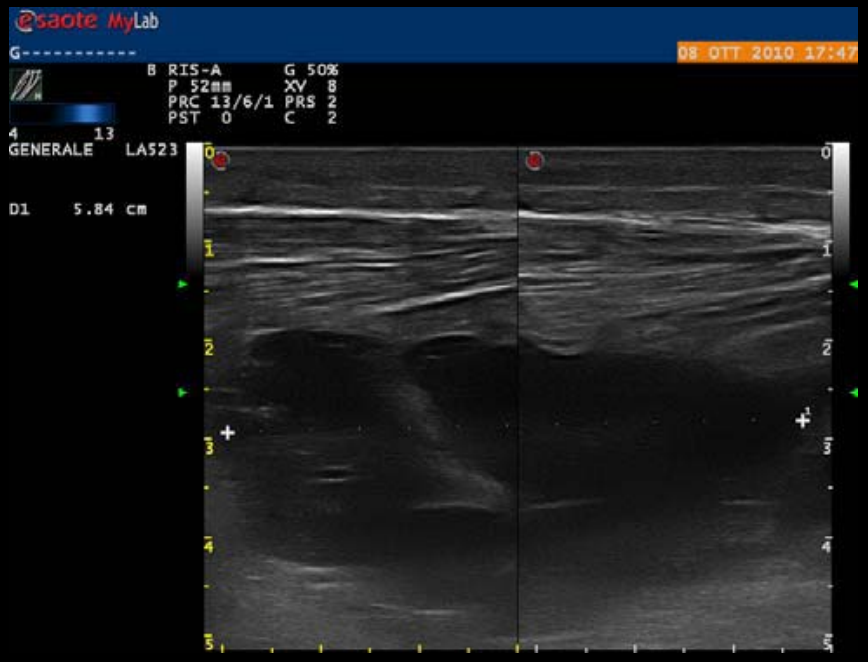


In sports

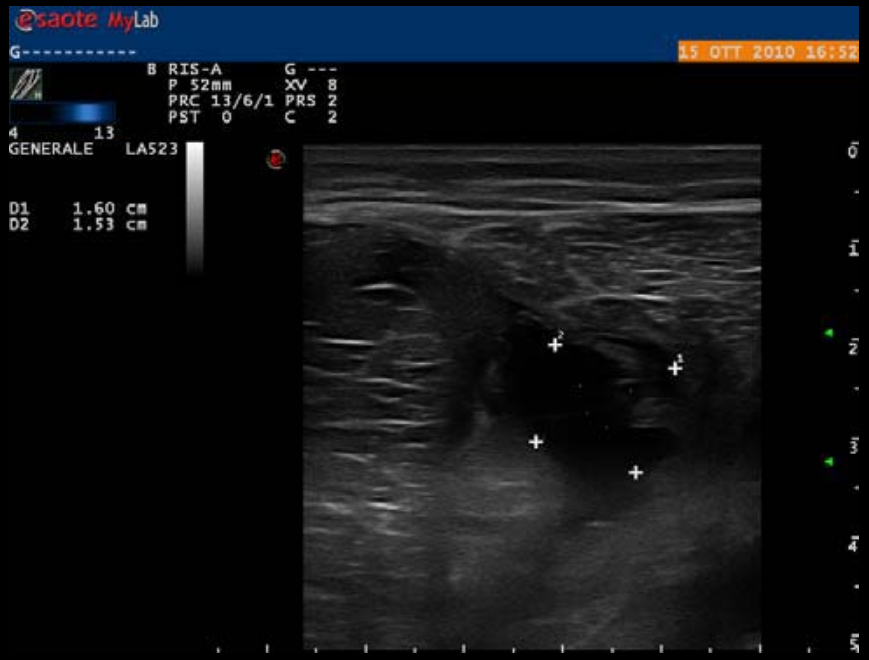
Ad Biomedical Innotech S.r.l.

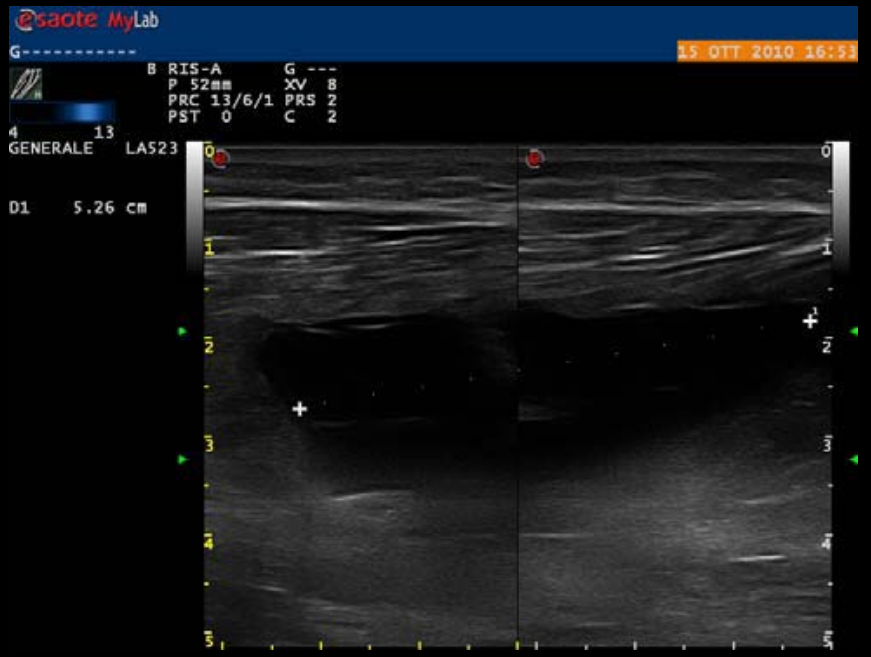
CASE 1

-Martial arts athlete, 27 years old, during a fight has suffered an injury to his right leg.
- Ultrasound report (date 08/10/2010): "second-degree injury at the m. semitendinosus: hematoma size 5.8 cm x 3.2 cm diameter and 1.3 cm in transverse diameter"

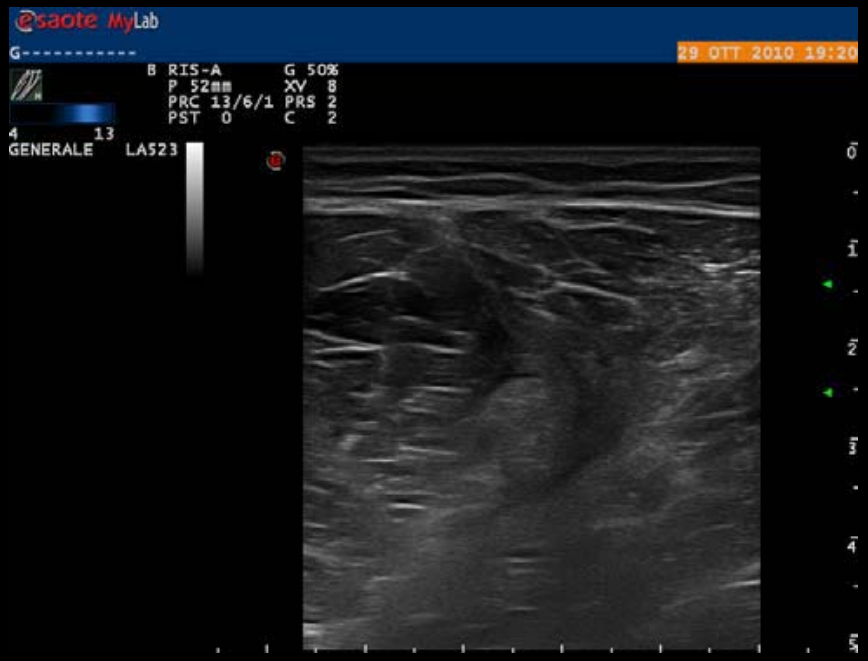


- At the first control at 7 days (date 15/10/2010) The lesion has an hematoma's size of 5.26 cm in diameter and 1.6 cm x 1.5 cm in transverse diameter.
- At the classic therapy of hot humid wrap and tecar we have combined 3 sessions with Farma TEB using a vial of 5,000 IU dalteparin sodium in a period of one week (application program: muscle injury)





- At the second control to 21 days (date 29/10/2010): “the muscolar lesion shows a scarring process in place with hematoma almost completely reabsorbed”



CASE 2

- Sedentary patient, 76 years old. Hypertension treatedwith ACE inhibitors

- He came to our Institute for a teno-synovitis of extensors digitorum of the right foot of labeled grade with diffuse lymphedema. The patient reported pain and impossibility on extension of the fingers of the right foot, with consequent difficulty in walking

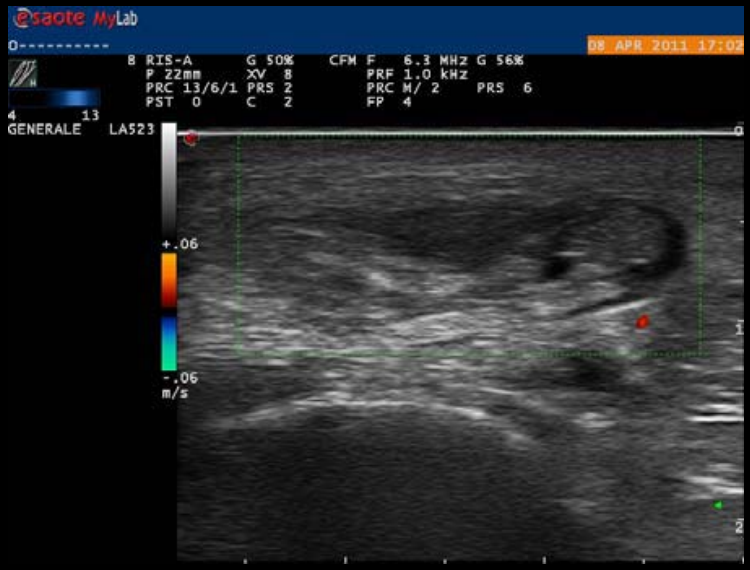
- At the Inspection the back of his right foot appeared swollen

- Ultrasound report of the dorsal right foot region: "The tendons of the extensors of the fingers and, to a lesser extent, of extensor of the first finger are surrounded by **abundant partially corpuscular fluid collection**. During dynamic maneuvers the scrolling of the tendon is also preserved. In the foot and in the ankle it's appreciated marked thickening of the subcutaneous tissue due to diffused lymphedema

- According protocol, we conducted a first session with Farma TEB with diclofenac 75mg and Triancinolone acetonide 40mg, then 3 sessions with diclofenac 75mg, accompanied by cryotherapy at home

- The symptoms and, at the physical inspection, the edema are regressed already after two sessions. At the end of treatment the patient has regained a normal gait

- Ultrasound report after treatment : "the extensors tendons of the fingers are surrounded by a minimum, partially corpuscolar fluidcollection. The scrolling is preserved. At level of the distal third of the right leg remains mild lymphedema



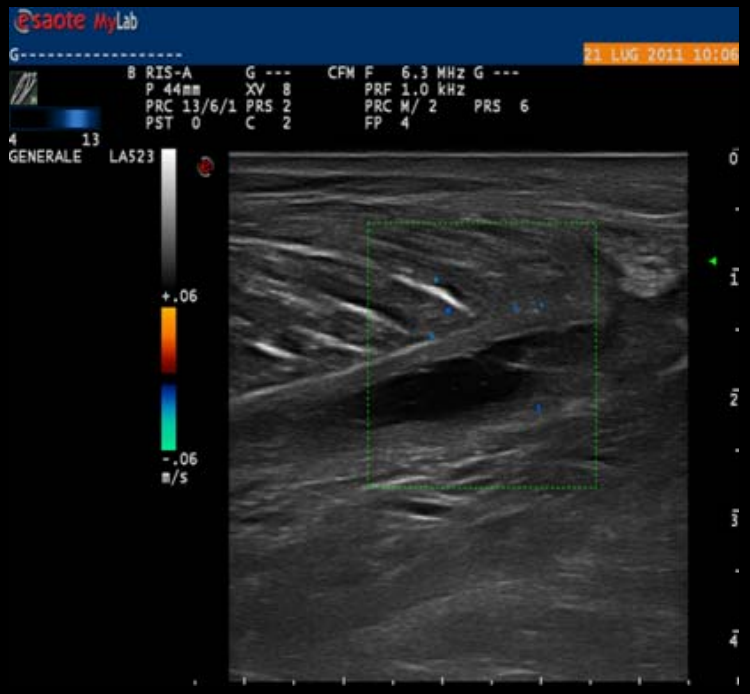
CASE 3

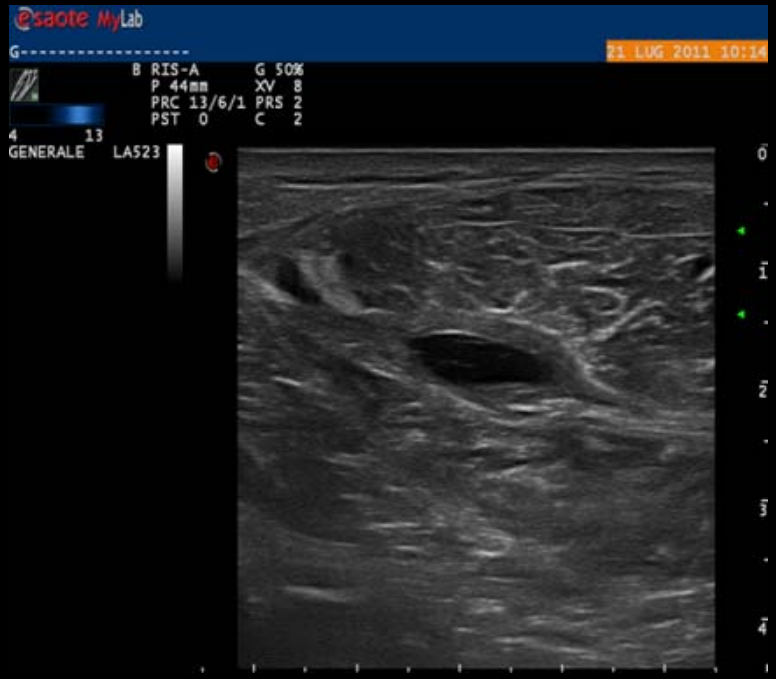
- Golf player, 50 years old

- He came to our institute for **a tear at level of medial gastrocnemius muscle of the right leg**

- Ultrasound report performed on 14/07/2011 by another institute: "to the lower third of the medial gastrocnemius muscle, in subfascial intramuscular seat is currently detectable an hypoechoic oblong area that extends from the top down for about 3cm, transversely for 2 cm and in deep 0.5 cm, of finely corpusculate liquid contents"

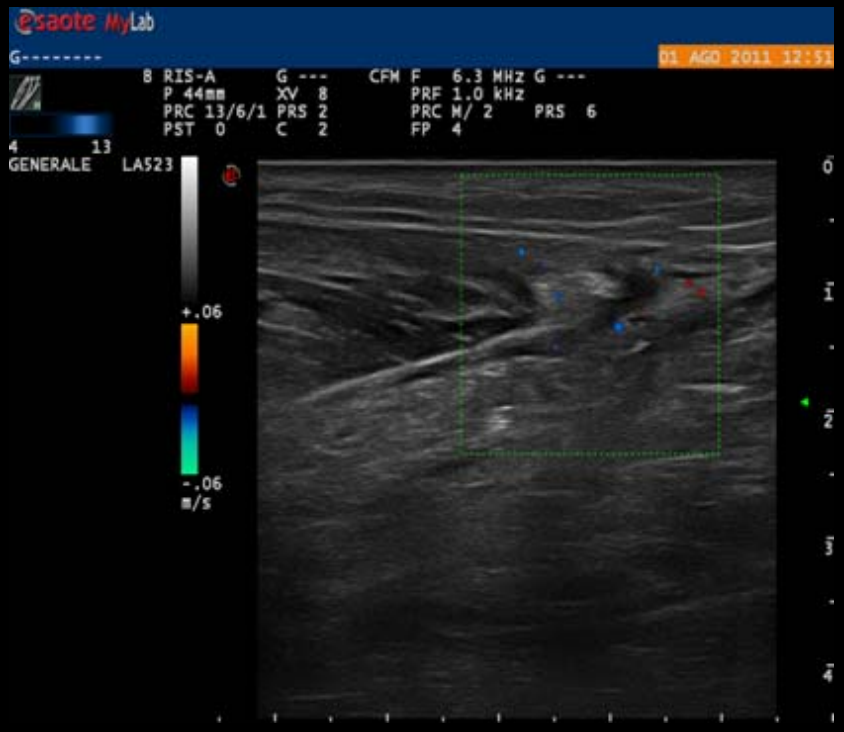
- Ultrasound report performed at our instituteon 21/07/2011 after an other accident at the same leg. "The distal portion of the medial gastrocnemius muscle shows globular morphology and is moderately retracted cranially, in seat deep intramuscular subfascial is present fluid collection that extends skull-caudally for about 4.30 cm and with cross-sectional diameter of about 2.20 cm. Changes of the remaining musclebundles or Achille's tendon aren't appreciated. "

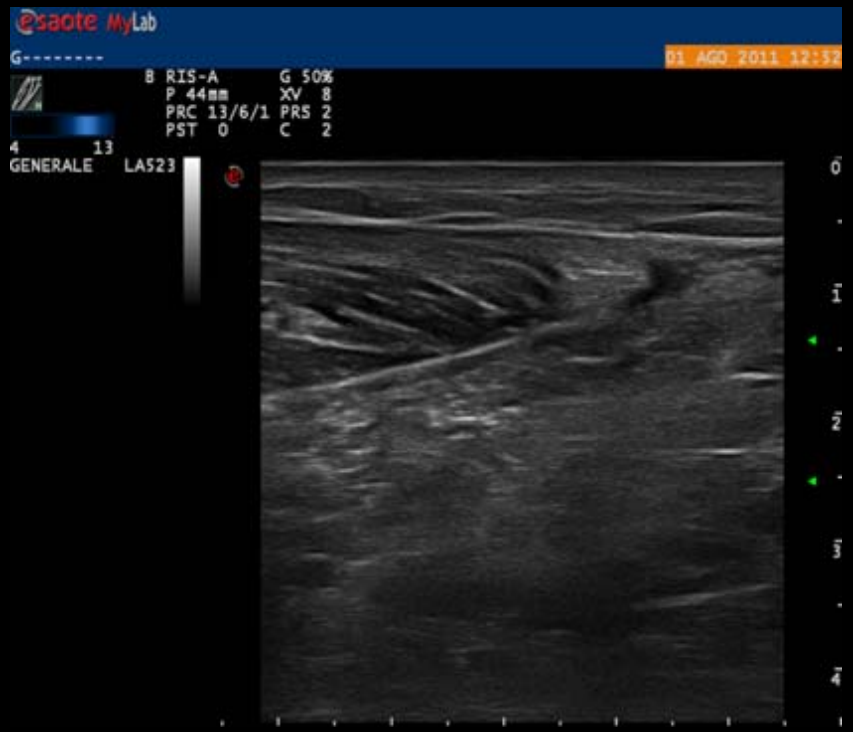




-We made 5 sessions with Farma TEB using a vial of dalteparin sodium 5,000 IU per session in a period of one week .

- Ultrasound control effected on 01/08/2011: "almost complete resorption of fluid collection in the seat deeps ubfascial with initial scarring of the lesion. "





CONCLUSIONS

1. Efficacy in the treatment of musculo-tendon diseases with a non-invasive and extremely localized technique
2. Actual use of various types of drugs, including high molecular weight ones
3. Time of healing of injuries equal, sometimes shorter, than the traditional methods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