SPORTS RELATED INJURIES AND PREVENTION

Patricia Thoreux[1, 2]

Assistance Publique-Hôpitaux de Paris, Université Paris13, Sorbonne Paris Cité, France[1]
Institut de Biomécanique Humaine Georges Charpak, Arts et Métiers ParisTech, Paris, France[2]

The purpose of this applied session is to illustrate the importance of the collaboration between physicians (both sports doctors and/or orthopaedic surgeons) and biomecanichal researchers to improve the performance of our athletes while reducing sports related injuries.

KEY WORDS: prevention, sports injuries, biomechanics, individual modeling, optimization.

SPORTS INJURIES: Whatever you consider competitive practice or physical activity as part of treatment for chronic diseases, injury represents a major problem in sports and physical activities given the consequences for the athlete him-self at short, middle or long-term, for his entourage (coaches, leaders, family, physicians…), for society (financial, economical, absence at work, media…). From athlete's point of view, sports injury can of course lead to bad sport-performance, but also to stop the season and maybe to stop the career. Moreover injury can lead to long-term consequences and/or disability. From a clinical practice point of view, sports injury represents an important part of sports medicine physicians and/or health professionnals work. Sports medicine staffs play (and have to play) an important role in management of sports injury from the acute management and the diagnosis to the rehabilitation and the return to sports for athlete. In case of injury, athlete asks to be treated as soon as possible to quickly return to sports, with greater performance! The management of sports injury (as primary prevention, treatment and secondary prevention) is one of the main role of sport physicians to protect the health of athletes[1] (Ljungqvist, 2008, Ljungqvist et al. 2009, Mountjoy & Junge, 2013, Rogge, 2009). From scientific research point of view, injury is also of interest since 31824 articles were found on the Pubmed database with "*sports injury*" keywords (at the 24/03/15).
In addition, some major injuries lead to socio-economic impacts, for example knee injuries (especially during ski season or football practice) or ankle sprains. Sport-related or physical activity-related injuries lead to non-negligible direct and indirect costs which are difficult to evaluate. This later consequence is important, since it reinforces the importance of prevention, and include as active partners the financial stakeholders.
In order to go ahead in sports injury prevention, it is of interest to better understand sports injury and their general and individual mechanisms. There are basically two modes of onset of injuries: sudden injuries and gradual injuries. A sudden onset incident refers to an episode where the experienced distress or disability developed during minutes, seconds or less, while a gradual onset incident refers to an episode that developed during hours, days or more (Timpka et al., 2014). In addition, there is, also basically two causes of injuries: traumatic (macro-trauma) and overuse (micro-trauma). Traumatic injuries are mainly acute with a sudden mode of onset, and caused by an identifiable single external transfer of energy (a single traumatic event). Common examples include shoulder dislocations, wrist fractures, ankle sprains, Achilles rupture, and hamstring muscle strains. Overuse injuries referring to a condition to which no identifiable single external transfer of energy can be associated; multiple accumulative bouts of energy transfer could result in this kind of injury (Timpka et al., 2014). Overuse injuries can occur with sudden onset injuries (e.g. tendon tears). Overuse injuries with gradual onset are more subtle and usually occur over time. They are the result of repetitive micro-trauma to every anatomical structure of neuro-musculo-squeletal system as bone,

[1] International Olympic Committee. Olympic Movement Medical Code. In force as from 1 October 2009 http://www.olympic.org/PageFiles/61597/Olympic_Movement_Medical_Code_eng.pdf (accessed 15 Dec 2014).

tendon, joint or muscle. Common examples include tennis elbow (lateral epicondylitis), swimmer's shoulder (rotator cuff tendinitis and impingement with or without hyperlaxity), runner's knee, jumper's knee (infrapatellar tendinitis), Achilles tendinitis, shin splints, stress fractures in runners or dancers… Overuse injuries occur when tissue adaptation fails: the human body and all the anatomical structures as bone, tendon, joint, muscle has a physiological capacity to adapt its properties with a remodelling process depending on constraints or stresses (gravity, activity, loads…). This remodelling process is an association of breaking down and building up (as the osseous callus, for example). But sometimes, in certain circumstances, the process is exceeded; this can happen with the change in physical activity, when you have just started practicing a physical activity, and/or if you increase your training workload in volume and/or intensity. Some favourable circumstances can usually be found and can be divided into intrinsic (as anatomical malalignment like genu valgum or varum, abnormalities of plantar sole) and extrinsic factors (as training errors, modification of surfaces or footwear).

PREVENTION: The prevention of these different kind of injuries requires to know perfectly all the biomechanical aspects of the specific "gestures" or mechanical contraints of the concerned sport and to know the general (extrinsic) and individual (intrinsic) favorable circumstances for each sport and each athlete (Edouard et al, 2011). When this knowledge is obtained, the cooperation between physicians, coaches and biomechanical researchers speaking the same language lead to an improvement of a "personalized risk map".
This applied session will illustrate this with 5 examples: climber's hand injuries, dancer's hip chronic pathology, skiier's knee injuries, rugby's cervical spine injuries and lumbar spine pain and golf practice. These 5 topics will be presented by a "duo" with a physician and a biomechanics researcher will first explain the epidemiological data and clinical aspects of the pathology, then some aspects of biomechanical research to prevent those injuries and then they will consider the development of their collaboration.

REFERENCES:

Edouard, P., Morel, N., Serra, J.-M., Pruvost, J., Oullion, R. & Depiesse, F. (2011). Prevention of musculoskeletal injuries in track and field. Review of epidemiological data. *Science & Sports*, 26, 307-315.

Ljungqvist, A. (2008). Sports injury prevention: a key mandate for the IOC. *British Journal of Sports Medicine*, 42(6):391.

Ljungqvist, A., Jenoure, P., Engebretsen, L., et al. (2009). The International Olympic Committee (IOC) Consensus Statement on periodic health evaluation of elite athletes March 2009. *British Journal of Sports Medicine,* 43(9), 631-643.

Mountjoy, M. & Junge, A. (2013). The role of International Sport Federations in the protection of the athlete's health and promotion of sport for health of the general population. *British Journal of Sports Medicine,* 47(16), 1023-1027.

Rogge J. (2009). An ounce of prevention? *British Journal of Sports Medicine,* 43(9), 627.

Timpka, T., Amonso, J.-M., Jacobsson, J., et al. (2014). Injury and illness definitions and data collection procedures for use in epidemiological studies in Athletics (track and field): Consensus statement. *British Journal of Sports Medicine,* 48(7), 483-490.

Acknowledgement

This applied session was organised under the aegis of the international Society of Biomechanics in Sports and the Société de Biomécanique. The Société de Biomécanique is an international society of Biomechanics which regroups scientists from all over the world for which French is the spoken language. This applied session was organised with the kind support of Natural Grass.