1. INVITED SPEAKERS

12 Years impact to health and sport past – presence - future

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Since the European Federation of Sports Medicine was founded in 1997, EFSMA was developing both in the number of member countries and also in different wide spread sport medicine activities. EFSMA at the moment has 41 member countries, has excellent relations to FIMS, IOC, EOC, ECSS and other international federations and has organized through its member countries - including the European Congress in Antalya - up to now 6 successful European Congresses of Sports Medicine. One very important task is the cooperation with UEMS with the final goal to have sports medicine recognized as a specialty within the EU. EFSMA had applied to create e Multidisciplinary Joint Committee (MJC) of sports medicine within the UEMS and was successful. Then a curriculum for the education of sports medicine was worked out, which was recognized by all the sections and the respective board of UEMS. At the moment EFSMA is active to settle up all the necessary preconditions for the training centres and trainees. From the European perspective 20 European countries at the moment have sports medicine recognized as a specialty and 15 as sub-specialty, within the EU the numbers are 11 for specialisation and 7 for sub-specialisation. To be recognized within the EU, we need two fifths of the EU member countries with the specialty of sports medicine.

Following these achievements, challenges and perspectives for the future are discussed with regard to the areas research, practical sports medicine, education and international relations.

Carbohydrate metabolism and performance

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Most studies on carbohydrate metabolism and performance have used constant pace exercise. In contrast there are relatively few studies on the impact of carbohydrate nutrition on performance where the individual sets the pace e.g. time trials that simulate ‘real life’ competition. Therefore, we examined the benefits of ingesting carbohydrate-electrolyte solutions (CHO-E) on self-selected running performance using an automated treadmill that responds to the runner’s change in speed without their intervention. In the first study experienced runners ran as far as possible in 1 h either ingesting a 6.4% CHO-E or the same volume of a taste and colour matched placebo. In the CHO-E trial they selected a slightly faster pace and completed a greater distance than during the placebo trial (Rollo & Williams, 2009). However, when the study was repeated after the runners had a high carbohydrate breakfast there was no difference in the self-selected running speeds between the two trials. It has been suggested that the brain monitors the glycogen stores of skeletal muscle by an as yet an unknown signalling mechanism which in turn influences the selection of exercise intensity (Rauch et al., 2005). To explore this idea we investigated the influence of simply mouth-rinsing a CHO-E on self-selected running speed at an exercise intensity equivalent to a rating of perceived exertion (RPE) of 15 and found that not only did the runners init select a faster pace but that they ‘felt better’ (Rollo et al., 2008). Using the 1 h treadmill running protocol we also showed that mouth-rinsing a 6.4% CHO-E solution improves the distance covered by fasted runners (Rollo et al., 2009). Chambers et al. (2009) recently showed, using functional magnetic resonance imaging (fMRI), that mouth-rinsing a carbohydrate solution not only improved cycling time trial performance but also activated the reward centres of the brain. These studies add to the circumstantial evidence that the brain is actively involved in monitoring the carbohydrate status of the individual during exercise and appears to play a role in the self-selection of running pace.

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Aviation medicine

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The Medicine of Aviation is of physiological origin and, curiously did born almost one century before the Aviation itself. The father of the Aviation Medicine is universally recognized the French physiologist Paul Bert (1870) for his esperiments in balloon on the effects of barometric low pressure on the human body, but the research of the high altitude did start about at the end of the 18th century. Jaques Charles in the 1783, John Jeffries 1784, Robertson 1803, Gay Lussac 1804, Gustav Tissandier 1875 were only few of the many balloonist that did approch the physiology of the extreme altitude, more than 8000 meters over sea level, and the effects of the very low barometric pressure on the human body. The researches in Aviation Medicine did start with the studies on low atmospheric pressure, but about century later were followed by the other fundamental object of research, the variation of the "g" force. This very important field of research is represented by the variation, both in the reduction or in the increase, in some case very intense, of the gravity force. The experiments on the multiple of the ground gravity did start not in ballooning but with the heavier of the air, the aeroplane. The real aspect of the very severe variation in "g" force did not start for scientific reasons, but, for the pilots.... by the need of survive. In fact it was during the first great war 1914-1918, that the aeroplane, few years after his invention (Wrigth brothers 1903), became a very effective weapon. With the increase of the sturdiness of the airplanes did start the aerobatics, very important in the air battles, and with the aerobatics the high number of " g force". One of the relevant aspect of the Aviation Medicine is devoted to the study on the "g" force both to the limit of the human structure, as did the American major Stapp with rocket motorized sledge, or to study and realize the devices to help the anatomy of the pilots to withstand so high forces. And, in the same time of the Aviation Medicine, did start also the Sport Medicine with which there has many points of contact and objectives. Both the scientific disciplines does not are applied to sick people but to an healthy population to verify their capacity to comply with the very specific requirement of both the Sport or Flying activities. Another point of contact between the two science is that they uses more or less the same laboratory equipment. An almost new entry in the field of Aviation Medicine is the Antidoping control, according to the guidelines of the WADA, the ubiquitary World Anti Doping Agency. The application of the rules of the Antidoping Control to the aviation activities not is easy or fully appliable. Just an example: the oxigen supply in the Sport activities are absolutely forbidden. In Aviation the prohibition of oxigen condamn to death some kind of Pilots. This is the case of the gliders pilot that, if the meteo conditions are favorable, during their competitions, climbs very frequently at flight levels in wich, without the oxigen supply and without a pressurized cockpits, they cannot survive.

Bolt´s and Phelp´s performances – the attempt of a physiological explanation

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When looking through the available literature dealing with this topic, it is conspicuous that from an energetic point of view there is no exact knowledge of the stress profile and the energy provision in the various sport events and disciplines.

Based on those physiological coherences a very good assumption and a theoretical frame are given to re-calculate the individual performance of an athlete by computer simulation. The 100m Beijing Olympics sprint of Usain Bolt as well as the 200m swimming record and the other competitive races of Michael Phelps are used to calculate and to remodel the physiological frame of Bolt´s and Phelp´s performance. – Based on video analysis the number, frequency and length of each single step for the 100m distance the Phelp´s muscular power output is calculated by the simulation model written above. Also for Phelps the speed over the distance, the arm frequency and the propulsion per stroke was detected; following also for swimming a calculation was proceeded to explain the individual performance by computer simulation.

Assuming realistic variations of performance ability, the variability of the metabolic pattern will be demonstrated. - There is a relatively favourable result of the special metabolic performance ability at a relative oxygen uptake (VO_2max) or a relatively high glykolytic performance, depending of the event and discipline.

The differences between the reactions of the top-level athlete´s organism show that a physiological performance assessment which is only based on performance, lactate and possibly VO_2max is not very meaningful and can therefore lead to considerable misinterpretations. A sport specific and the metabolism representing simulation of the performance will be shown.

Integration of different technology systems for the development of football training

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Over the last few years, research in the field of Sport Science has incorporated the use of new technologies in order to advance the levels of specific knowledge and to find the most appropriate ways to reach the best performance possible. Within this context, and following the criteria of integration of new technologies for the development of training programmes, Real Madrid CF has launched as a top, strategic priority the development of the world's leading training and performance centre. On the principles of this philosophy Real Madrid TEC-Sanitas, a High Performance Centre focused on innovation in the area of Sport Science using the latest technology and the collaboration of different expertises coming from all over the world, has been implemented with the goal of developing new approaches in the training methodologies area. This advance will produce a modern concept in the control of training with individualized programmes that will develop the performance and the longevity career of all Real Madrid athletes in order to remain competitive in today's football and basketball landscape. The philosophy of TEC is based on the interconnectivity of different systems and the integration of the results produced by them. Real Madrid TEC-Sanitas is a multifunctional structure designed around different operating labs that through cross-platform activity and interchangeable data analysis optimize performance in the field by committing to the following:

- Submission of full cycle of functional evaluation monitoring the physiological characteristics of each athlete;

-Development of individual training programmes following different aspects (physiological parameters, anthropometric, age, player position, minutes played etc.);

-Convergence between scientific research and technological on-field practical application, in order to conduct athlete studies on all Real Madrid players (professional and youth).

Real Madrid TEC-Sanitas is comprised of the following operating laboratories: Biomechanics, Functional Evaluation, Neurophysiology, Image, Vision, Nutrition, Data Analysis Training Methodology and Research & Development. The Biomechanics Lab is composed by different systems of high technology fully integrated and synchronized between that allow a complete analysis of football player movements. It is composed by 12 cameras monitoring movement along 20 meters, and two high resolution cameras. In the Functional Evaluation Lab there are several systems for the evaluation: isocinetic, encoders, stability board, speed and agility system force platforms, wireless EMG and foot scan. The Neurophysiology Lab is based on Bio-feedback and Neuro-feedback systems. The Image Lab use the data collected from the video match analysis and is developing decision making systems. In the Vision Lab the visual skill training is the main priority through the use of different computerized systems. An intelligent data bases allows the Data Analysis Lab to cross-analyze information and to test correlations, and assess predictability among all parameters of performance. The development of cutting-edge instrumentation, end-user products and training methodologies will become the main objective of Research & Development Lab.

Patellofemoral pain: Philosophy behind the problem

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Patellofemoral (PF) disorders are among the most common problems seen by orthopaedists and sport physicians. But there is still no consensus in the literature regarding the terminology for pain in the anterior aspect of the knee. Thence many terms have been used to describe PF pain disorders including anterior knee pain, extensor mechanism dysfunction, medial facet syndrome, lateral facet syndrome, lateral compression syndrome, patellar malalignment syndrome, patellofemoral pain syndrome, patellofemoral stress syndrome, intra-articular patellar chondropathy, patellalgia and chondromalacia patella. Usually the clinical presentation of anterior knee pain is diagnosed as patellofemoral pain syndrome (PFPS). PFPS can be defined as anterior knee pain involving the patella and retinaculum that excludes other intraarticular and peripatellar pathology. PFPS remains a challenging musculoskeletal entity encountered by clinicians. The most frequently reported symptom is a diffuse peripatellar and retropatellar localized pain, typically provoked by ascending or descending stairs and squatting.

The exact cause and pathophysiology of anterior knee pain is not well-understood. Fulkerson described six major anatomic structural sources of PF pain: subchondral bone, synovial lining, retinaculum, skin, muscle, and nerve. It is accepted that PFPS is multifactorial in origin and many theories have been proposed. A combination of variables, including abnormal lower limb biomechanics, soft-tissue tightness, muscle weakness, and excessive exercise (overactivity theory) may alter tracking of the patella within the femoral trochlear notch contributing to increased PF contact pressures that result in pain and dysfunction.

The patellofemoral joint is considered to be one of the highest loaded musculo-skeletal components in the human body. Joint reaction forces that are created within the PF joint in compression and tension with normal activities of daily living are on the order of multiples of body weight. Forces on the patella range from between one third and one half of a person's body weight during walking to three times body weight during stair climbing, to 7 times body weight during squatting, and up to 20 times or more body weight with jumping activities. Therefore the articular cartilage of the patella is the thickest in the body and it can reach 7 mm in the central portion of the patella. However, patellar cartilage is more permeable and more pliable than other cartilage tissues in the body.

Patellofemoral pain has been attributed to excessive stresses associated with abnormal PF joint mechanics. Studies of PF joint biomechanics have focused on force analysis, joint kinematics, and articular contact forces, areas and stresses. Various biomechanical causes of PF pain have been suggested including: increased Q angle, genu valgum, femoral anteversion, external tibial torsion, tenderness of the lateral retinaculum, abnormalities of the shape of the patella, femoral groove morphologic features and forefoot pronation.

In addition, generalized ligamentous laxity, vastus medialis weakness or atrophy and decreased flexibility of the iliotibial band and quadriceps muscles also have been linked with PF pain. The vastus medialis obliquus (VMO) has primary importance, because weakness of the VMO allows the patella to track too far laterally, which increases PF joint stress and subsequent articular cartilage wear. Weakness of hip abductors and external rotators are also recommended to reveal factors contributing to PFPS. These muscles help to maintain pelvic stability by eccentrically controlling femoral internal rotation during weight-bearing activities.

Previously, patients with PF pain often were diagnosed with chondromalacia patellae. Chondromalacia is a degenerative condition of the articular surface of patella. It is not strongly correlated with patellar pain. Studies showed that numerous patients with symptoms consistent with PFPS had no arthroscopic evidence of articular cartilage damage.

Because of the multiple forces affecting the patellofemoral joint, the clinical evaluation and treatment of this disorder still remain the greatest enigma for the sport medical physicians and orthopaedic surgeons. This lecture will address the anatomical and functional biomechanical causes of PF pain.

Patellar dislocations in sportsmen

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Etiology of patellar dislocation is multifactorial. Patella alta, trochlear hypoplasia, lateral patellar tilt, TT-TG distance, generalised ligamentous laxity, tight lateral retinaculum, pes planus, decreased femoral anteversion and wide pelvis are among the most common factors. Hip internal rotation followed by tibial external rotation and knee valgus is the usual mechanism of injury. Diagnosis is very easy if patella is still dislocated. But for reducted dislocations anamnesis, physical examination, direct anteroposterior X-rays but more importantly MR imaging becomes more important. Location of pain especially on medial adductor tubercle or inferior lateral wall of lateral femoral chondyle, presence of hemartrosis, painfull range of motion are among some alerting findings . Whenever suspected primary care consists of immobilization, rest, cold application, elevation followed by removing player from the field. After initial management standart anteroposterior- lateral and Merchant views should be obtained, MR imaging should be completed for further evaluation. As Medial Patellofemoral ligament (MPFL) is primary passive soft tissue restraint to lateral patellar displacement MRI becomes more important for MPFL evaluation. Treatment consists of aspiration of hemartrosis followed by either surgical or conservative treatment. Conservative treatment has high failure rates because of inappropriate patellofemoral positioning it causes patellofemoral arthrosis. Still it can be used for patients with generalised ligamentous laxity. On the other hand surgical treatment is becoming more popular due to low recurrence rates. No standard surgical modality is advocated instead treatment should be individualised according to etiological factor and presence of osteochondral lesions.

Alteration in EMG following angioplasty in a patient with peripheral vascular disease

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INTRODUCTION Peripheral Vascular Disease limits exercise performance due to claudication pain hypothesised to be caused by ischemia and increased blood lactate concentrations. However, no research has investigated the influence of central regulation and more specifically muscle activity on functional capacity. We report on a patient with a single tight stenosis of the femoral artery. We investigated changes in muscle activity, exercise performance and other physiological variables before and 3 days after angioplasty.
METHODS The patient performed maximal voluntary contractions on prior to walking on the treadmill until exhaustion using the Graded Treadmill exercise test (GTET) protocol (walking at a constant speed of 3.2 km·h^{-1} starting at a 2 % gradient which was increased by 2 % every 2 minutes until exhaustion). Electromyography, heart rate, brachial blood pressure, rating of perceived exertion, pain score, oxygen consumption and blood lactate concentrations were measured during both trials.
RESULTS Most of the patients' measured physiological variables improved after angioplasty. Peak force produced during the MVC by the quadriceps and calf muscles increased by 24 Nm and 19 Nm respectively after angioplasty in the diseased leg. Blood lactate concentrations from the 3rd to 5th minute post exercise ranged between 2.00 - 1.75 mmol·l^{-1} in the Pre - A trial and decreased to the range of 1.75 - 1.50 mmol·.l^{-1} in the Post - A trial. Muscle activity in the diseased leg was found to increase after angioplasty and to greater activity extent than the asymptomatic leg after angioplasty. Muscle activity in the diseased leg, increased after angioplasty in VL (85 % - 130% max EMG pre and post angioplasty) and LG (90 % - 180 % max EMG pre and post angioplasty), whereas MG remained similar over the trials.
CONCLUSIONS The alteration in muscle activity after angioplasty is a novel finding. It can be assumed that these changes in muscle activity could be seen as a readjustment of the central drive to the lower limbs and in the diseased state a possible regulatory mechanism to protect the body from harm.

Point-of-care athlete testing, a new approach of sport performance evaluation

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Point-of-care testing is defined as testing performance at or near the sites of training or competitions, in the precise conditions likely to be really experienced. In sport science, usually such tests are not as reliable as laboratory tests, but often have greater validity because of their greater specificity. This is invariably difficult to achieve as there are numerous factors experienced in competition which are near to impossible to replicate in training or testing environment. A combination of regular field based testing (because of the practical, easy and immediate nature of the testing) together with occasional laboratory testing (because of accuracy, reliability and quality) is a good option for most sports.

From many parameters used to monitor trainings we chose acid-base status, for the relevance in reflecting in or post-exercise homeostatic changes. In sport performance, excessive efforts to maintain internal homeostasis in normal limits may have limiting even negative effects on performance capacities. It is possible to appreciate sport energetic requirements (energetic pathways contribution and efficiency in sustaining exercise), functional status in basal / rest conditions and exercise, exercise metabolic costs, post-exercise recovery evolution, using calculated functional indexes. Using an ABL microlab (Radiometer, Copenhagen) the following acid-base status parameters are determined: hemoglobin (Hb), acidity / basicity (pH), partial pressure of carbon dioxide in blood (pCO2), partial pressure of oxygen in blood (pO2), oxygen saturation (sO2), bicarbonate (HCO3), actual base excess (ABE), standard base excess (SBE), standard bicarbonate (SBC), alveolar-arterial oxygen tension difference (AaDpO2). Blood lactate values are also determined. Based on specific acid-base disturbances, we can appreciate performance capacity, reveal the metabolic costs, and also recovery drive.

The possibility (or ability) of point-of-care testing to be done in various conditions has demonstrated an significant potential to change the way of monitoring training and recovery. However, the lab cannot exactly reproduce the external environmental factors: run and bike – road conditions, weather, hills, wind resistance; rowing, canoeing – water conditions, current, weather, wind, boat friction / water resistance, that athletes experience in training and playing or training locations (even altitude campus). Based on these results, valuable coaching decisions could be taken. It is essential that the coach identifies a reliable, experienced support team of professionals that can manage the details of competition based testing leaving the coach free to coach. In trainings, competition or during rest periods, point-of-care testing can provide the coach and athlete informations about areas of weakness or limitation, about developing and improving performance. These kind of testing respect sport specificity and environmental factors, experience and training status, age and sex. Based on the testing results, it is possible to create the athlete's profile, for training to performance.

Understanding the structure and the biological properties of the articular cartilage

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The structure of mobile interosseal junctions mandatorily includes the articular cartilage (cartilago articulare). The latter has been marked off as an obligatory element in the human body descriptions by anatomists as early as Antiquity and Middle Ages. According to notions adopted at that time, it was described as avascular, inert and bradytrophic tissue incapable of recovery after being exposed to the effect of external factors with ensuing damage. During the current century, the ever increasing interest in researches into the articular cartilage is linked first and foremost to practical medicine – orthopaedics, sports medicine and rheumatology. Over the last decade, it has been constantly subject of unrelenting attention by morphologists, molecular biologists, biochemists, specialists in biomechanics and bionics. Such interest is further stirred up by the fact that it is a matter of structure fulfilling its functions, having an essential practical bearing on joint movements, without being endowed with a number of advantages, characterizing other tissues: e.g. it lacks innervation, blood vessels and lymphatic system. Its properties are based not on the peculiarities of individual cells, but rather on their production; on a complex network of giant molecules situated around the cells proper and building up the extracellular matrix, incorporating some of the longest protein chains produced by cells in nature.

The cartilage covering articular surfaces is mainly, but not exclusively of hyaline type. Its thickness varies depending on the topography, and diminishes with aging. In the small joints it measures about 1 - 2 mm, and in large ones – 4 – 7 mm. Articular cartilage is thicker in the zones of surfaces where the compression forces are strongest, usually in the central portions. In younger individuals, continuous movements result in cartilage thickening. It is avascular except for the deeper layers closer to bones; devoid of nerve branches; not covered by perichondrium or synovial membrane (except for the lateral portions). Normally, it never undergoes ossification, and is built up of cells (chondroblassts) situated within small cavities of varying size (lacunae), surrounded by intercellular substance – intercellular matrix. The intercellular matrix determines the mechanical properties of articular cartilage. During study with conventional light microscope it is homogeneous in appearance. The existence of collagen fibers has been definitely confirmed after the introduction of electron microscopy which contributes to differentiate two types of fibers – thick (with transverse diameter 600 nm) presenting transverse striation at periodicity 690 nm, and fine fibrils thick 400nm in diameter.

Current state of the art and future directions in cartilage injuries

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Although cartilage defects smaller than 2.5 cm_2 can be treated with conventional methods such as microfracture or mosaicplasty, larger defects require a more sophisticated approach. Autologous chondrocyte implantation and the utilization of mesenchymal stem cells are two avenues of treatment that have become increasingly popular. Although these treatment modalities are indicated for traumatic or osteochondiritic defects in young adults, several centers have used these technologies in the treatment of early osteoarthritis. First generation autologous chondrocyte implantation (ACI) entails the transplantation of the patient's cultured chondrocytes in a suspension under a periosteal patch. 15 to 20 year data show a success rate of 73% in isolated chondral defects, most successful being in the femoral condyles, followed by the patella and tibia. Ankle, shoulder and elbow joint applications have been reported. The use of ACI in adolescents and patients with previously unsuccessful cartilage surgeries has also produced satisfactory outcomes. Problems of hypertrophy and delamination of the transplant occur in about 15-42% of the cases and may necessitate secondary surgeries. Second generation ACI utilizes a 3 dimensional resorbable matrix seeded with chondrocytes that can be shaped to fit the chondral defect. Although clinical results are similar, less secondary surgery, more evenly distributed cells, possibility of arthroscopic implantation and easier surgical handling are advantages of second generation ACI. 5-10 year results of second generation ACI are promising. The most frequently reported techniques have been MACI, Hyalograft C and CARES with around 85% good clinical results. Many improvements, mostly experimental, are being made in ACI to achieve better outcomes. These so called 3rd and 4th generation ACI techniques include selective culturing of cells, the addition of growth factors to matrices, use of hydrostatic pressure to improve cell quality, the use of fetal allogenic chondrocytes or mesenchymal stem cells in a matrix for a single stage surgery. The use of chondroinductive matrices to augment microfracture is also promising. The field of cartilage regeneration is evolving at a breathtaking speed and new technologies are constantly being introduced. The merits of each will become clear with increasing clinical follow-up with possible extension of indications to osteoarthritic joints.

Polypharmacy in sport

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Sport performance primarily depends on genetic characteristic of the athlete, but as well as morphological, physiological, psychological and metabolic sport specific characteristics. Optimal training can improve physical power, enhance mental strength and make competitive advantage. However athletes very often use different substances in order to achieve better physical fitness and sport performance. Implementation of Anti-doping rules decreases use of prohibited substances, but increases use of different dietary supplements. If we add irrational usage of medications, first of all analgetics, we can resume that polypharmacy is present in sport.

We analyzed data collected from athletes from competitions as well as from out-competition testing from 2005 to 2008. Among 912 athletes (age 23.9±6 years, 72 % male), 1.5% (14) of them (64.3% male (9) and 35.7% female (5) have used ten or more supplements and/or drugs.

These 14 athletes used between 10 to 17 products or 162 different products. Of that number 76.5% (124) were supplements and 23.5% (38) were drugs. In average 8.9 supplements and 2.7 drugs were used. Between 12 -59 single substances have been in products taken by athletes, in average 33.4 per athlete. Vitamins are the most presented substances, in some cases in dosage about 250 times greater than recommended. Most of these athletes took vitamins in 2 or more different products. Minerals, aminoacids and other substances were taken in dosages less then recommended.

Overuse of vitamins and suboptimal dosages of other supplements without clear indications and recommendation show us ignorance of athletes, coaches and medical stuff involved in sport. Education, in first place of doctors, then coaches and athletes is a primary goal. But first step should be cooperation of medicine, pharmacy and sport science in order to make strategy and recommendations for use of supplements and drugs in sport.

Nutritional supplements and medications in sport

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Australian Institute of Sport (AIS) categorized nutritional supplements (NS) in four groups: group A - approved NS, group B - NS under consideration, group C - no clear proof of beneficial effects and group D - banned NS. There are many studies with aim to describe qualitatively and quantitatively NS and medications used by elite athletes. Our group did it in several big competitions, like FIBA Europe, University games, as well as in main international competitions in three years period. In that largest study we have analyzed data collected from athletes (n = 912; age 23,9 ± 6 yrs; 72% male) from national, international competitions and out-of-competition done by ADAS from 2005 - 2008. Among 2535 reported substances 69,7% (1767) were NS and 28,9% (734) medications. NS have taken by 74,6% (3,17 per athlete) and medications by 40,6% of athletes (1.98 per athlete). Almost 21,2 % of all users reported use of 6 or more different products and one athlete took 17 different products at the same time. In group A of AIS classification was 56,3% and from group B, C and D, 14,4%, 32,7%, 2,2%, respectively. Majority of athletes who reported use of medication used NSAID (n = 225, 66%; 24,7% of all examined athletes). More than one NSAID was taken by 22% (50) users. In addition, more frequent use of NS among younger athletes was observed ($p < 0.05$). Our studies confirmed overuse of supplements and drugs by elite athletes. Fact that large number of athletes used supplements with no evident performance or health benefits, demonstrated the need for specific educational initiatives. Amount, quantity and combination of reported products raised concern about risk of potential side events.

Submaximal muscle activity at exhaustion during incremental cycling

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INTRODUCTION It is often assumed that all available motor units in exercising muscle are active at exhaustion, regardless of nature and duration of exercise activity. The aim of this study was to measure skeletal muscle activity during progressive cycling to exhaustion in 15 male trained cyclists during a peak power output (PPO) test.
METHODS Muscle activity was compared to that performed during 'maximum' sprint cycling. A further aim of this

study was to determine if muscle activity at the point of exhaustion is repeatable.
RESULTS Skeletal muscle activity at exhaustion was submaximal as compared to EMG activity during a maximal sprint cycle. All six muscles measured in the study achieved peak activation of between 44 % - 65 % of that achieved during a 10 second all-out sprint (all $P<0.05$), Vastus Medialis (VM; 59 % - 65%), Vastus Lateralis (VL; 54 % - 60%), Rectus Femoris (RF; 44 % - 51%), Biceps Femoris (BF; 42 % - 45%), Medial Gastroc (MC; 40 % - 46%) and Lateral Gastroc (36 % - 44%). The intra-subject variability showed that only a few muscles had coefficient of variation (CV) values less than 12 % at exhaustion. Out of 15 subjects the number of subjects displaying CV <12 %; VM showed only 6 subjects, VL and MG only 5 subjects, RF, BF and LG only 4 subjects. This is an indication that muscle activity at exhaustion varies from day-to-day.
CONCLUSİONS These data suggest that muscle activity at exhaustion has a significant day-to-day variation. Furthermore, skeletal muscle activity is sub-maximal at exhaustion during PPO cycling. The findings support the hypothesis of a central regulation of maximal exercise and confirm that only a certain percentage of the limb muscle mass is active during maximal exercise. These findings are not compatible with the peripheral model of fatigue, as this model assumes that the total muscle mass is active at exhaustion.

Low back pain in athletes

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Low back pain has been reported to affect approximately 85-90% of the population at least once during their lifetime. The incidence in the athletic population has been reported to be 1-30% and is one of the most common reasons for missed playing time in professional sports. Unfortunately, the specific etiology of the athlete's back pain often remains elusive. Muscle strain is the most common etiology of low back pain in adolescent, collegiate, and adult athletes. It is also the most common diagnosis in both acute and chronic low back pain.

Many conditions may lead to low back pain. Causes of low back pain include lomber strains, sciatica, non-mechanical back and/or leg pain, mechanical back and/or leg pain, lumbar spine fractures, abnormalities of the hip joint, damage of nociceptive (pain generating) structures (nucleus pulposus,annulus fibrosus, facet joints, ligaments, muscles, nerve, synovium), intervertebral disk injuries, stres fracture of the pars interarticularis, sacroiliac joint injury/inflammation, lumbar instability, mainly. Malignancy, severe osteoporosis, gynecological and genitourinary conditions should not be missed.

The basic mechanism of injury causing low back pain produces a combined vector of force that may be difficult to analyze in a force diagram. The three basic mechanisms of injury to consider are (1) compression or weight loading to the spine; (2) torque or rotation, which may result in various shear forces in a more horizontal plane; (3) tensile stress produced through excessive motion of the spine.The compressive type of stress is more common in sports that require high body weight and massive strengthening such as football and weight lifting. Torsional stresses occur in throwing athletes such as baseball players and golfers. Motion sports that put tremendous tensile stresses on the spine include gymnastics, ballet, dance, pole vault, and high jump.

The lumbar spine is a highly vulnerable area for injury in a number of different sports. The reported incidence varies from 7% to 27%. Lumbar pain is a big part of many sports, but an organized diagnostic and therapeutic plan can prevent permanent injury and allow full function and maximum performance. With reference to lumbar spine injuries, gymnastics is probably the most commonly mentioned sport. We mostly face lumbar injuries in sports like ballet, water sports, pole vaulting, weight lifting, football, running. In addition, there is a high risk of spine injuries in rotational and torsional sports like golf, tennis and baseball.

Back pain is a common symptomatic complaint in the active and athletic population. An understanding of differential diagnosis, careful history and physical examination is obligatory to pinpoint the back problem. Prevention is very important. Applying this knowledge and experience to a preventative setting such as preparticipation evaluations may allow the clinician to positively impact the development of these often debilitating injuries through prevention.

Sport and male sexual function

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The possible links between male sexual function and physical training or sport have mainly been evaluated in terms of exercise-related modifications of the hypothalamus-pituitary-gonadal (HPG) axis and in terms of the possible effects of life style on sexuality.

In fact, the main relationships between exercise training, sport and male sexual function that should be discussed are:

- the role of sexual hormones in the adaptation to exercise-related stress;
- the effects of physical training or sport on HPG axis;
- the effects of physical training or sport on sexual health;
- the effects of sexual intercourse on sport performance;
- the effects of prohibited substances (i.e. doping) on sexual health;
- the sport eligibility in male athletes with andrological diseases (e.g. hypogonadism, etc);
- the sport participation and gender modifications;
- the sexually transmitted diseases in athletes;
- the role of sport medicine in the prevention of male sexual disorders in athletes.

It is known that the endocrine system is highly involved in the physiological adaptation to exercise-related stress. Depending on the characteristics of performed exercise and on individual responsiveness, many hormones mediate the adaptive response to exercise-stress (e.g. CRH, ACTH, cortisol, catecholamines, GH, PRL, β-endorphins, and so forth). Many of these also influence the HPG axis.

Whereas it is still not clear if a sexual intercourse can influence sport performance in male athletes, it has been fully established that a moderate training is useful in the prevention and treatment of sexual disorders in general population. Furthermore, increasing evidence points to high intensity endurance training (e.g. running) or specific sports (e.g. cycling) as having detrimental effects on the HPG axis and on male sexual function (e.g. reduced sexual desire, erectile dysfunction). Males chronically exposed to exercise-related stress may exhibit reduced serum testosterone, due to increased peripheral catabolism and/or to decreased production. Such an “exercise-hypogonadal male condition” is characterized by stable, reduced, serum free and total testosterone without concurrent LH elevation, and is reported as being detrimental to both health and performance. The reduced serum testosterone levels (e.g. male hypogonadism) can be associated to sexual and not-sexual symptoms in athletes (e.g. reduced sexual desire, erectile dysfunction, anaemia, osteoporosis fractures, depression, and so forth).

Apart from being a symptom of hypogonadism, an inhibited sexual behavior (e.g decreased libido, loss of erection) in eugonadal athletes could be also considered as a physiological mechanism of adaptation to exercise-related stress and might represent one of the biological effects of stress hormone mediators involved in the endocrine response to training-related stress. Besides the exercise-stress related “physiological inhibition” of sexual arousal, the neuro-endocrine and metabolic modifications induced by intense exercise training, the effects of the type of sport on male reproductive axis (e.g. cycling on genitalia) and many prohibited substances (e.g. androgenic anabolic steroids, amphetamines , diuretics, beta-blockers, and so forth) can induce male sexual disorders in athletes (e.g. altered sexual desire, erectile dysfunction).

Tendon plasticity

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Tendons that provide movement by transferring the contraction force that have been emerged by muscle contractions, are consist of a systematic packed organization of connective tissue primarily by collagens type I foremost, type III and IV and extracellular matrix protein. While tendon is completely different from the muscle in terms of physiological and histological, it can not be considered as independent from the muscle and when it is evaluated they are assessed together with musculo-tendinous unite.

From the past to the current date, intensive studies were performed upon the physiology of the muscle and introduced how the muscle changes depend on mechanical loading, disuse and ageing. However, the data accumulation regarding tendon was extremely limited until the last 10-20 years and their results were in contradiction with each other intensively. The reasons that have been placed under this issue are, the studies were made usually in vitro and structural, mechanical and chemical features of tendon were evaluated one by one.

As a matter of fact, while very fast and specific responses exist in the muscle, which is the part of musculo-tendinous unite, to mechanical loading and unloading; it is impossible that tendon can stay without responding against this situation. Tendons do not have an inflexible structure like steel, and thanks to the included elastin they can stretch in specific measurements. Recently, evaluations, which were performed by ultrasonography (USG) and magnetic resonance imaging (MRI) as in vivo, introduce that some changes existed in tendons, similar to the muscles as response to the physiological changing.

Tendon morphology and compatibility have been studied as in vivo techniques (USG, MRI), recent years. These studies have increased in parallel to the development of space technology, and thanks to these studies it has been introduced that tendons are not stabile against exercise and zero gravity environment, and on the contrary they react.

Although tendons react against these situations by changing their interior structure, especially suffering to exercise especially during the growth era, introduced that they could display hypertrophy. Under the lights of these studies, we have been realized;

1. Mechanic features, stiffness and Young modulus of tendon decrease by the affect of ageing, in other words tendon becomes more compliant,
2. These changes that have been caused by ageing are prevented partially by performing exercises (up to 70%),
3. Disuse and spinal cord injuries cause reducing of the mechanical features of tendon,
4. Right after performing of acute exercise, synthesis of tendon collagen speed and collapsing increase. While this increasing is characteristic in males, it is limited in females.
5. Estrogen hormone in females is the most important factor that pressurizes production speed increasing depends on exercise. Increasing of tendon diameter after menopause and decreasing of collagen production speed in females taking birth control pills, are the important indicators that support this situation.
6. While tendon diameters are larger in males that perform regular exercise in comparison with the males, who do not perform regular exercise, the same situation can not be discussed in females.

Immunological responses to exercise

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The evidence of the changes in immune system with exercise is generally derived from two sources: laboratory based investigations and epidemiological studies.

For some years there is considerable evidence that exercise of high intensity and long duration is associated with adverse effects in immune function, and low intensity exercise appears to be beneficial for immune system.

Those observations were based in the results of laboratory evaluation of the number and qualities of the cells of the immune system, that appear to be enhanced by the exercise. That is to say, that the number of natural killer cells and circulating lymphocytes are augmented in low intensity exercise, and the high intensity exercise makes a decrease in circulating immune cells.

For a long time we have tried to explain the changes with other another view keeping in investigation the plasma glutamine and cytokines considering the exercise as a kind of inflammation, without all the deleterious effects of this particular aspect of our metabolic pathways.

The other face of exercise has to deal with mind and emotional changes we can see in our athletes through the seasons of training and competition and along the years as they grow, and somewhat, grow older too.

This makes us understand that sports are much more than muscles, bones it takes a lot from brain also.

Molecular basis of muscle hypertrophy and repair

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It has been appreciated for some time that skeletal muscle is a very adaptable tissue and that exercise training can be designed to produce greater muscle mass and strength and/or fatigue resistance. With the emergence of molecular biology methods it has been possible investigate the genes responsible for physiological changes when muscles are subjected to different types of activities. Shortly after the start of resistance type exercise the IGF-I gene is spliced to MGF (IGF-IEc in the human) and this involves a “reading frame shift” which results in a different C terminal peptide to other types of IGF-I but all have the main globular part of IGF-I. This unique MGF peptide acts as a separate growth factor which initially activates the muscle satellite (stem) cells to replicate. These are important because after embryological development there is no further increase in nuclei by mitotic division once the muscle fibres have formed. The extra nuclei required for muscle growth, adaptation and repair comes from the fusion of activated muscle satellite (stem/progenitor) cells with the muscle fibres. Following the initial splicing to MGF the IGF-I gene is later switched to IGF-IEa which is the main anabolic agent and initiates this fusion and the expression of myogenic genes. As well as replenishing the muscle stem cell pool the unique C terminal peptide of MGF has also been found have a role in limiting tissue damage including protective against oxygen free radical damage in non muscle tissues including the CNS. Unfortunately, as we grow older we become less able to produce MGF. Also in diseases such as muscular dystrophy and ALS there is impairment that results in the ability to produce MGF and to replenish the muscle satellite (stem cell) pool and maintain muscle and motor neurons. From a physiological point of view this is interesting as the initiation of the activation of the IGF-I gene and the switch in splicing to produce MGF must involve a mechano transduction system. The detection of mechanical strain is thought to involve focal adhesion kinases (FAKs). It seems that as we grow older that this system becomes less sensitive because of the decreased compliance of the tissue due to cross-linking in the connective tissues. In some animal experiments we showed that regular exercise improved muscle compliance during ageing but it was still not as good as in young mouse muscles. However there are good prospects for its use as a therapeutic compound for treating age-related muscle loss muscle as well as muscle cachexia in a range of diseases. Unfortunately, there seems to be more interest in its use as a doping agent as it is available over the internet and it is now being produced using recombinant E coli methods and therefore it will become relatively inexpensive.

Entrainment with bio-informative time patterns to optimize tissue regeneration and performance

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In the field of life sciences, the interaction of time and space pattern in living cells and its rhythmic order from macro scale to nano scale are in the focus since years. Inspired even by Albert Einstein "Life without rhythm does not exist." we asked from the clinical side:

1. How far tissue function is in general and especially tissue regeneration and performance dependent from the organisation of biological, body intrinsic time patterns (brain rhythms, breathing rhythms, heart-rhythm muscle rhythms, cell rhythms etc.)?
2. Are there specific rhythms in the body ordering and organising these 50 trillion cells of a human organism the whole life span.
3. Is it possible to entrain time pattern from outside the body for therapeutic reasons?

Regarding body rhythms as a result of coherent single cell function, we analyzed especially those of the skeletal muscle because it is with 45% mass the hugest organ of the body. Oscillating in the range of 8 -12 Hz (alpha-rhythm of the brain) the whole life span, we studied the physiological and pathophysiological meaning of pulsations and rhythms for muscle function down to the level of the environment of the cells, the Extracellular Matrix. [1, 2, 3, 4]

We found, that symptoms are correlated to a loss of order in time (rhythm) and space (morphological structure) pattern and can be seen as mismanagement of the "logistic processes" on the level of cells.

In consequence the idea was born, to construct an apparatus, to synchronize and to readapt harmonically the cellular processes to its normal from outside the body, similar to starter of a cars engine.

How tissue regeneration even in worst surgical cases as well as performance in sports increases by using this entrainment-method will be presented.

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Fatique during exercise: Possible mechanisms and recovery strategies

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Training in its simplest form represents acute challenges to the body intended to optimize chronic improvements in physiological capabilities. Today athletes in many sports carried out intense training 2-3 times per day. These trainings lead to fatique and stress. Limited time for recovery between games and training can have a negative effect on performance. The repetitive and intense trainings, the hassle and stress of travel increase the risk of ‘‘over-reaching’’ or ‘‘burn-out’’, whereby athletes lose ‘‘form’’ and enter an underperformance spiral.

Although athletes spend a much greater proportion of their time recovering than they do in training, recovery is one of the least understood and most underresearched constituents of exercise-adaptation cycle. Strategies that optimize recovery after physically intense competitions and trainings are essential to enhance, or at least maintain, performance in subsequent sporting events (training and competition). Different recovery strategies such as hydrotherapy, compression garments, exercise, massage, diet and ergogenics, and combined methods are investigated and now routinely implemented by teams and athletes after competition and training. Restoring of body fluids, minerals and energy sources via diet and ergogenics can aid recovery. Some relief from muscle soreness may be achieved by means of a warm-down or exercise. But there are studies that active and passive recovery yielded similar effects on performance too. Massage, cryotherapy and alternative therapies have not been shown to be consistently effective, but the potential psychological benefit of massage on recovery should not be discounted. Contrast water immersion has become one of the most common recovery modalities among elite athletes. Thus hydrotherapy regimens can replace conventional physical training in the days after competition or training.

Although recovery from training is one of the most important aspects of improving athletic performance effective training recovery strategies have not been fully elucidated, and may prove to be spesific to the individual athlete and to the point in the competitive season. It can be concluded that optimizing recovery post-exercise depends on a combination of factors that incorporate consideration of individual differences and lifestyle factors.

Vibration and performance

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In this paper the effects of vibration as an exercise and training method on human body will be evaluated. For this purpose responses of muscle spindles and motor units to vibration, effects of acute and chronic application of local and whole-body vibration on neuromuscular performance, flexibility and balance will be examined.

Vibrations are mechanical oscillations that is produced either by regular or irregular periodic movements of a body about its resting position. The extent of the oscillation determines the amplitude of the vibration which is the peak-to-peak displacement in millimeters (mm) and the repetition rate of the cycles of oscillation determines the frequency of the vibration in Hertz (Hz). Vibration applied to a muscle belly or tendon elicits a reflex muscle contraction named as the Tonic Vibration Reflex (TVR). When muscles are exposed to vibration, they exhibit TVR in the form of a gradually increasing involuntary contraction. A few seconds after the application of vibration, the involuntary contraction begins, increases gradually and stays at a relatively constant level until the vibration ends. TVR results mainly from the vibration induced activity of the muscle spindle Ia fibers.

There are two methods of applying vibration to the human body during exercises. In the first method which is called local vibration, vibration is applied directly to the muscle belly or tendon or the muscle being trained by a vibration unit. In the second method which is called whole-body vibration (WBV), vibration is applied indirectly to the muscle being trained. That is vibration is transmitted from a vibrating source away from the target muscle through part of the body to the target muscle. This method usually requires vibrating platforms for the transmission of the vibration.

In recent years, vibration has attracted a great deal of interest in the field of sport and exercise science as a special method of exercise or training. Some studies in the literature indicate that vibration exercise or training resulted in improved neuromuscular performance while others found no effect. The reasons for discrepancies between studies will be discussed with respect to different methods of vibration application (local vs WBV), vibration characteristics (amplitude and frequency) and duration of vibration (short vs long; acute vs chronic) within this presentation.

Biochemical parameters in performance testing: Validity and limitations

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Most research in sports medicine involves the analysis of biochemical parameters in a laboratory or field test setting. No consensus exists regarding the standardization of such tests. To further complicate the outcome, the variation in biochemical analyses is appreciable. Systematic causes of error will be discussed in this short presentation, with emphasis being given to lactate testing, overtraining assessment, and measurement of main metabolic parameters. A review of genetic markers is beyond the scope of the present analysis.

In general, the analytical processes are influenced at the biological material collection, storage, transport, and preparation stages. The sport biochemist should be aware of pitfalls in this phase, for parameters used in following training, diet, and performances of athletes, to avoid data misinterpretation. The right choice of anticoagulants, the preparation of specimens for hormone testing, and for labile molecules such as cardiac markers, lactate, cytokines, micronutrients and antioxidants is crucial. Influence of physical exercise, biological rhythm, overtraining and infection on biochemical parameters should be taken into account.

Plasma volume changes during and after exposure to severe exercise and environmental conditions might result in haemodilution or haemoconcentration. Thus, it becomes important to consider the level of these changes in assessing plasma constituents' levels as indicators of training adaptation. Acute long distance running, bicycle ergometry, and swimming exercises are known to cause haemoconcentration at the end. Endurance training has been shown to cause long term expansion of plasma volume. To further confound the issue, plasma volume changes are associated with heat acclimatisation, hydration state and physical training changes. It appears sensible to monitor blood haemoglobin, haematocrit, and plasma protein levels.

VO_2max, LT, OBLA and VT correlate with endurance performance, and are used to prescribe training loads, and monitor adaptation. Tests differ in terms of starting and subsequent work rates, increments and duration of each stage. LT concepts are integrated within the 'aerobic-anaerobic transition' framework. They fall into three categories: use of a fixed BLa, detecting the first rise in BLa above baseline, and threshold concepts detecting either the MLSS or a clear change in the BLa curve. The analysis of BLa response to incremental exercise may vary due to the nature of blood sample and the treatment of data graphs. Peak power output is reduced in longer staged tests, whereas VT or LT occur at higher absolute work rates with shorter staged tests. Sports scientists should consider these factors, and use protocols mimicking the actual competition.

Over-trained athletes usually present an impaired anaerobic lactacid performance and a reduced time-to-exhaustion in high-intensity endurance exercise testing. Lactate levels are slightly lowered during submaximal performance, resulting in an increased AnT. Although measurements of resting blood urea, uric acid, ammonia, CK, and serum free testosterone to cortisol ratio may serve to reveal circumstances which impair exercise performance, they are not useful in the diagnosis of established overtraining. Chronic myocyte alterations may cause plasma myoglobin, troponin I and CK increases. Monitoring reactive oxygen species' activity might be a good tool for skeletal muscle metabolic stress level evaluation.

Metabolic schemes studied in relation to overtraining are linked to CHOs, BCAAs, glutamine, polyunsaturated fatty acids (PUFA), leptin, and proteins. A higher BCAA oxidation might favour free tryptophan's entry into the cerebral area, enhancing serotonin synthesis. BCAA supplementation before and after exercise decreases exercise-induced muscle damage and promotes protein synthesis. Higher circulating glutamine oxidation might cause immunosuppression. The amount of TAG produced is monitored by controlling the composition of fatty acids via stearoyl-CoA desaturase action, the control of this enzyme and lipogenesis by the inhibitory effect of dietary PUFA, and the interaction of PUFAs with specific transcription factors, which maintain the balance between oxidation and storage of lipids. There is some evidence that plasma leptin is more sensitive to training volume changes than specific stress hormones.

Exercise anaemia might also predispose the tired athlete to overtraining by lower inflammation reactivity of hepatic/muscular proteins. Iron in the body can be used as a marker of both adaptation to training and as an indicator of acute inflammatory response to exercise. Clinical measurements of serum iron, transferrin, ferritin and the acute inflammatory protein alpha 1-antitrypsin can be used to differentiate between an inflammatory response to tissue damage and infection.

Do mouth guards have negative effects on athletic performance of athletes?

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Many types of sports activities put participants at risk of orofacial injury and concussion. Epidemiological studies have reported sports activities as one of the main etiological factors for the dental trauma. Furthermore, the highest risk of dental trauma appears to occur to professional athletes. Maxillofacial injuries do not occur only during competition. Up to 25–30% of these accidents occur during training sessions.

Mouth guards have been determined to be the most effective way of preventing dental injuries. Three types of mouth guards are available: (i) stock mouth guards, which are prefabricated in different sizes; (ii) boil and bite mouth guards made from a thermoplastic material, and immersed in hot water and formed in the mouth of the athlete; (iii) custom made (CM) mouth guards made by dentists on a model of the patient's mouth.

The American Dental Association and the International Academy of Sports Dentistry currently recommends that mouth guards be used in 29 sport or exercise activities. These include acrobatics, basketball, bicycling, boxing, equestrian events, extreme sports, field events, field hockey, football, gymnastics, handball, ice hockey, inline skating, lacrosse, martial arts, racquetball, rugby, shot putting, skateboarding, skiing, skydiving, soccer, softball, squash, surfing, volleyball, water polo, weightlifting and wrestling.

Although mouth guards have been shown to protect against orofacial injury, many players do not wear them during training and competition. The major reasons cited by the athletes for this are discomfort and difficulty in verbal communication and breathing. Another worry is that mouth guards will interfere with their athletic performance.

From a psychological point of view, any protective device should not negatively affect maximum exercise capacity, i.e., the athletic performance. Effects of mouth guards on performance of athletes measured in various studies included muscle strength, visual reaction time; sprint and jumping ability, VO_2 max and arterial lactate etc... Most of the current studies about physiological effects of wearing mouth guards interested in effect of mouth guards to airflow dynamics and ventilation and oxygen consumption in low and high intensity exercise.

Published research consistently shows that wearing a CM mouth guard does not affect the main performance parameters generally associated with performance of athletes. It can be concluded that athletes can use CM mouth guards without any negative effects on their strength and aerobic/anaerobic athletic performance.

Treatment options of ACL injury at the medical center

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ACL is an important stabilising structure of the knee, preventing anterior translation of the tibia in relation to the femur. Rupture of the ACL is one of the most common sports injuries in active young people. Besides providing mechanical support, ligaments give dynamic reinforcement to the joint via their mechanoreceptors. Therefore, ACL injuries result in not only mechanical deficits, but also proprioceptive defects. But do not forget; there is no only ACL in the knee as a functional stabilizer.

Reconstructive ligament surgery is a common treatment method in the acute and chronic ruptures of the ACL. The major goals is to restore ligamentous functional stability, decrease the risk of articular cartilage deterioration, preserve menisci, and return patients to active lifestyles and sportive activities.

Various types of grafts and fixation methods have been employed in such surgeries. Current treatment options in ACL reconstruction include autografts, allografts, and synthetic grafts. Multiple allograft tissues are available including bone-tendon-bone patella tendon (BPTB), anterior and posterior tibialis, Achilles tendon, fascia lata, and hamstring tendons. BPTB graft (allograft or autograft) is the most frequently used graft for reconstruction of the ACL and provides bone to bone fixation options with flexibility in tunnel selection sizing. Studies have shown greater fixation strength, superior mechanical properties, and good long-term results with this technique. On the other hand many concerns have arisen with regard to donor- site pathology. These includ; anterior knee pain, patellar fracture, patellofemoral pain/crepitus, kneeling pain, quadriceps weakness, loss of joint motion, and patellar tendonitis, tendinozis in a long term period or rupture.

Reconstruction using autogenous tissue as a primary reconstruction has emerged as the most popular method for reconstruction and has produced good clinical results. The use of allogenic tissues from cadavers has risen tremendously over the past decade because of their advantages of less donor-site morbidity, shorter operative time, availability of larger grafts, lower incidence of postoperative arthrofibrosis, and potential improvements in physical functioning and overall health-related quality of life. The disadvantages of allografts are; graft incorporation and functional ligamentization are slower for allografts when compared with autografts. However, several studies have shown that allograft ACL reconstruction is a sound alternative to autografts with no significant difference in postoperative symptoms, activity level, functional outcomes, or physical examination measures. In ACL reconstruction surgery, it is also important to fix the graft at the most convenient position with an adequate tension and soundness.

Finally treatment of the ACL injuries should be individualized because the patient's age, occupation, sports activities, and some knee-related and medical factors affect the surgical decision. Because in an elite competetive athlete torned ACL cannot heal (not demonstrated yet) with only conservative management. On the other hand, today there were %20 athletes w/o ACL, make a sports at the moderate level w/o any surgical treatment. Functional knee braces have been proposed to improve outcomes after ACL reconstruction especially by decreasing the strain on the reconstructed ligament and also by enhancing aspects of neuromuscular control.

Early inpatient physiotherapy

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Rehabilitation following ACL reconstruction is generally divided into four phases: • early postoperative , • subacute strengthening, • functional progression, • return to sports.

Early postoperative rehabilitation after anterior cruciate ligament (ACL) reconstruction plays an important role in the functional outcome of the knee. The main goal of immediate postoperative phase is to alleviate inflammatory reaction that takes place following surgical intervention. The orthopaedic surgeon and physical therapist are both concerned about controlling acute pain. Another goal of this early phase is to enhance range of motion (ROM) and progress to full weight bearing. The exercise program should be tailored according to the patient's needs. It is important to control external forces and protect the healing ligament during this stage. However, contolled motion should be allowed to nourish cartilage, decrease fibrosis, prevent stiffness and, stimulate collagen healing. Controlled loading may enhance ligament and tendon healing, while excessive loading can be harmful to the healing graft and lead to anterior-posterior knee laxity.

Rehabilitation of the patient should begin on the day of surgery . ACL reconstruction can cause severe postoperative pain. Improved control of postoperative pain facilitates more rapid achievement of functional outcomes. Postopertive pain can be contolled by using multiple techniques of analgesia. However, simultaneous application of cold and compression is still a valuable tool in postoperative pain alleviation. An increase in swelling causes a restriction in motion and exerts more pressure on nerve endings, which leads to additional pain . Cryotherapy also helps reduce swelling as well as pain in 48 hours following the surgery.

During the postoperative inflammatory phase, potential loss of function may result in scar formation which can restrict normal ROM of the knee joint. The knee should not be immobilized except during ambulation after the reconstruction. It is especially important to gain full knee extenson in this stage. Early passive extention is important after every ACL repair so that the intra-articular notch is not allowed to fill in with scar tissue, thereby preventing full knee extension. Continuous passive motion (CPM) machines can restore mobility, also decrease postoperative hemarthrosis and edema. Besides CPM, patients should be encouraged to perform active-assisted range of motion exercises every hour that they are awake. Physiotherapists especially should on reflex guarding and spasm as well as inhibition of quadriceps muscle, because both of them results in the loss of function.

When using an ipsilateral patellar tendon graft, early patellar mobilization is necessary to prevent potential patellofemoral complaints. Quadriceps muscle contractions during weight bearing also pull the patella proximally and stretch the tendon. Quadriceps muscle strengthening is another important goal of ealy rehabilitation in ACL reconstructions.

To sum up, clinical milestons of early rehabilitation are reduction in pain and effusion, full knee hyperextension, 110 degrees of knee flexion, patellar mobility, ability to perform straight leg rises, partial weight bearing with at least 70% of body weight.

Out-Patient physiotherapy and returning to sports

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Rehabilitation after surgery for an ACL tear is a lengthy process. Return to sports and activities takes months. Twenty years ago, rehabilitation programs included immobilization of the leg for 6 weeks or longer after an ACL reconstruction procedure while inflammation diminished and the graft healed. Biomechanical studies performed on animals have documented the adverse effects of immobilization of the knee on the articular cartilage, ligaments, capsular structures, leg musculature, and periarticular bone. This has led some authors to advocate early-motion rehabilitation programs that included guarded motion in a knee brace or continuous passive knee motion immediately after ACL reconstruction. Other studies revealed that early mobilization of healing ACL grafts, including immediate full weight-bearing activities such as walking, is possible without endangering the healing tissues. It is clear that immobilization after ACL reconstruction results in undesired effects; however, little is known about how much activity will promote adequate rehabilitation of an injured knee without permanently elongating the graft, producing graft failure, or creating damage to articular cartilage. This lack of knowledge may be explained, at least in part, by the fact that there is little information that derives from prospective, randomized, controlled studies of rehabilitation after ACL reconstruction.

Specific rehabilitation must focus on each individual athlete, and you must adhere to your own protocol. It is also important to note that timelines are a guide -- progression depends on completion of one step, before advancing to the next step.

Late Phases: The knee, and its range of movement, should now be essentially normal during everyday activities. This should be maintained during the late stage. Strengthening and proprioception exercises should be progressed and, once the operated knee has achieved 90% of the normal leg in these aspects, functional activities can be undertaken. In a sporting individual, these activities consist of sport-specific drills and movements, the intensity, frequency and duration of which should be gradually increased until normal function is achieved. Early sports activities can be started and patients can often begin light jogging, cycling outdoors, and pool workouts. Side-to-side, pivoting sports -- such as basketball, soccer and football -- must be avoided. Toward the end of this phase, some athletes can begin shuttle runs, lateral shuttles and jumping rope.

Functional Phases: Emphasis of rehabilitation should be on sport simulating activities. These will include figure-of-eight drills and plyometrics, and over time will include sport drills. For example, a tennis player may start light hitting, a soccer player some controlled dribbling, etc. The progression to functional activities can begin once the player can jog without pain and is comfortable doing plyometric drills. The idea of this stage is to take the player from gentle exercise to the high intensity activity at which games are played. All exercises are preceded by a warm up. As each exercise is a progression, they should be completed at least one day apart.

Return to Sports:

Deciding when to return to unrestricted sports activities depends on a number of factors:

- Functional Progression
  The decision to return to sports must be based on each individual's progression through their therapy.
- Graft Type
  Surgeons may delay return to sports if the graft used to reconstruct the ACL came from a donor. Because these grafts are sterilized and frozen, there is a belief that they take longer to heal well inside the patient.

Health benefit of activity of daily living (ADL) in children

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Physical activity is essential for a balanced and healthy development in children. The structured days of children in western civilization gives only small room for free and spontaneous activities. In the international literature complains the decline in physical activity and the decline in physical fitness. The consequences for health are obvious, there in increase in overweight and obesity in children. Physical activity is regarded as one mechanism of compensation and should be promoted especially in schools and sport clubs. Unfortunately whether the sport activities neither in schools, nor in sport clubs and even not in leisure time are sufficient to compensate the extent of inactivity. All day activities have to be taken into account.

New techniques in the registration of activity of daily living for example accelerometers allow a different inside view in physical activity in different settings. This allows the analysis of current status and the detection of strategies to promote physical activity. The Münster All-day Activity Study (MAAS) Project examined 1325 school children from the 1th to the 11th grade of school in the area of Münster in Germany. ADL was registered for one week by using the Step Activity Monitor (SAM).

The total amount of steps per day declined with age. International Guidelines demand 7500 steps per day or more than 600 steps per hour to be regarded as good for health. This amount was reached only in the 1th and 3th grade of school. The activity level in girls was always below the level of boys. The time in school is structured very strong. There are only few opportunities to be physically active. But even on this low level there a decline with age. The activity level in the 9th and 11th grade of school must be regarded as low active or even sedentary. If schooldays are divided into small portions there are some elements to be found which contain a high potential for improving physical activity. Physical education has to be mentioned on the first place, but also the breaks between the lessons and the way to school are important sources of physical activities. The attractiveness of these opportunities for being physically active shows no decline even in higher grades of school.

Obesity in childhood: Therapeutic options

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Obesity is a chronic disease involving interaction between genetic and environmental factors. Considering the limited financial resources of our health care system, priority should be given to prevention, early identification and the treatment of risk groups (selective prevention), as well as early disease management in groups known to be particularly at risk. Considering the increase and degree of overweight and obesity, as well as the decrease in physical activity of today's children and adolescents, we must design new methods of treatment for a variety of risk groups and establish a network of appropriately trained physicians in clinics and universities. The degrees of overweight (overweight < 90th. percentile, overweight between the 90th and the 97th percentile and obesity > the 97 th percentile or adipositas permagna > the 99.5 th percentile) correspond to preventive or therapeutic intervention levels. Patients should be treated according to the guidelines of the German "Konsensuspapier 2004". An increase in central obesity combined with elements of the metabolic syndrome underline the quality of the disease. A network of outpatient and inpatient therapy centers should treat the individual needs of obese children. The Freiburg Intervention Trial for Obese Children (FITOC) consists of regular physical exercise (three times a week) plus comprehensive dietary and behavioral education. At four- to six-week intervals during the eight month program, seven information sessions with parents and seven with their children were held. At these meetings, staff members gave parents theoretical and practical information on obesity and nutrition, answered individual questions and work in behaviour training. Children were separately given the same basic information. Questionnaires concerning nutrition (food frequencies) and behaviour were regularly completed. Anthropometrical, biochemical and fitness data were collected. Measurements of body height and weight, fasting total-cholesterol, LDL-cholesterol, HDL-cholesterol and physical performance followed identical, standardized guidelines. Initial examinations of all 496 children (boys n=229; girls n= 267) were conducted. At the beginning of the program, boys were 10.6± 1.5 and girls 10.5 ± 1.6 years of age. Follow-up examinations after the intensive program were carried out 8.5 ± 1.2 months later. Results of the FITOC therapy programs (www.fitoc.de), which strictly follow the AGA's guidelines, have sufficiently demonstrated that those affected do not recognize obesity as a chronic disease despite a growing interest in this syndrome in society. A focus on sports during therapy and the counselling of daily activities appear to be key to the achievement of success. From the very beginning, one must obtain a clear statement of commitment from all participants (parents and physicians, as well as directors and teachers in kindergarten, day care centers and schools). If this strategy is then supported by public and private health insurance companies, it can successfully fight the obesity epidemic.

Platelet rich plasma treatment in sports medicine

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It is a fundamental fact that every athlete with a muscle, tendon or ligament injury wants to regain physical fitness as soon as possible. More and more attempts are being made to replace faster 'tissue repair' by faster 'tissue regeneration' to minimize sports disability and to allow early rehabilitation. The aim is to accelerate the natural processes without damaging the body. Platelet Rich Plasma (PRP) is obtained by centrifugation of autologous blood. Platelets are a source of growth factors, such as transforming growth factor beta, vascular endothelial growth factor , and platelet-derived growth factor, which are responsible for tissue repair and regeneration. Growth factors are biologically active polypeptide molecules that interact with specific cell surface receptors, leading to responses that are dictated by the receptor-mediated signal transduction pathways of the target cells. Growth factors are unique because they stimulate the growth or proliferation of these target cells. Chronic or acute tendinopathies, tendon ruptures, muscle ruptures, ligament ruptures, nonunions and stress fractures are the most important indications for PRP treatment. At our department many pilot studies have been performed. Importantly no patient was worse after treatment. After three weeks we observed marked pain relief and less swelling (in chronic tendinopathies). More controlled research has been planned and will be started soon.

Local administration of growth factors and anti-doping aspects

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The repair response of the musculoskeletal tissues generally starts with the formation of a blood clot and the following degranulation of platelets, which releases locally growth factors (GFs) and cytokines. This microenvironment results in chemotaxis of inflammatory cells as well as the activation and proliferation of local progenitor cells. Alpha granules are storage units within platelets, which contain pre-packaged GFs in an inactive form. The main GFs contained in these granules are: PDGF (Platelet Derived Growth Factor), TGF-β (Transforming Growth Factor-beta), FGF (Fibroblast Growth Factor), IGF (Insulin Like Growth Factor), VEGF (Vascular Endothelial Growth Factor) and EGF (Epidermic Growth Factor). It is widely accepted that GFs play a central role in the healing process and tissue regeneration being able of modulating the recruitment, duplication, activation and differentiation of cells involved in bone- and soft-tissue healing and the efficacy of those GFs should be, in theory, directly proportional to their local concentration. This observation is at the base of the use of preparation rich in growth factor (PRGF) in several circumstances, all of them characterized by the need of activating, modulating, speeding up or ameliorating the process of tissue repair. In this setting PRGF should be considered as highly safe autologous haemocomponents for non-transfusional use. With regard to sport medicine, doping related issues are still matter of debate when considering this therapeutic approach for the treatment of sport-related injuries, in particular because of the IGF-1 content in the platelets alpha granules. Indeed, the recent version of the World Anti-Doping Agency code prohibits all use of growth factor therapies in elite sport. Theoretically, there are two reasons that eliminate anti-doping concern from the therapeutic use of PRGF: 1) the PRGF content of IGF-1 is sub-therapeutic in terms of systemic anabolic actions by a factor of between 500 and 1000; 2) the availability of most IGF-1 is modulated by the IGFBP3 binding protein. Only 1% of the total IGF-1 released from the PRGF is unbound, and therefore biologically available. Additionally, the short half-life (10 minutes) of this unbound and active IGF-1 makes an alteration in systemic levels unlikely.

On the contrary, with particular regard to the muscle injection of platelets derived growth factors several issues still need to be clarified. Assuming that this technique, as it has been demonstrated by several studies, is able to ameliorate the muscle tissue repair processes, it is still unclear if the concentrated amount of growth factors injected into the skeletal muscles may affect the performances of the treated tissues.

Actually, in Italy, this technique may be used for the treatment of elite athletes following the approval of the appropriate therapeutic use exemption but other countries apply different approaches. Therefore, the author believe that it is necessary to clarify anti-doping regulatory guidelines and prohibited lists in order to avoid confusion and to promote an uniform approach given the awareness of the current clinical utility of these therapeutic approach.

Visualisation techniques in athlete's early recovery after trauma and training

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The need for quicker recovery after injuries or the pressure to obtain ever better results leads to the use of less frequently utilized methods such as visualization. Visualization is a natural process that allows a person to see pictures in their mind; the pictures can represent actual things in a person's waking life or things that are not actually present, things that a person would like to achieve. Most of the sport medicine literature presents the results in how to use visualization in mental training. However, visualization can also be used in early recovery after trauma. Visualization can reduce the recovery period by up to a third, depending on the number of sessions, their length and the personality type of the athlete. During the workshop the participants will be introduced to the concept of visualization, why, when and where it is used, the methods of building good imagery, the reason why sometimes visualization doesn't work, the most frequent mistakes that the author has met in her practice. The workshop is built in three parts: a very short initial one – with several theoretical concepts, a second part, with practical exercises, and a third one reserved for discussions and conclusions. The theoretical part of the workshop presents the author's experience with 48 athletes (male and female) from different sports, of different ages (from 8 to 49 years old); visualization is used in each case during early recovery after musculoskeletal trauma. The experience of other 97 athletes is also presented on whom mental training is used to prepare a competition. In the practical part, the focus is on the most successful techniques and methods that give results in real life. Finally, it is also important to present the limits of the method and the future possibility for future research: the type of imagery that can be used, the time when the method can be applied, and the type of the personalities on which it can be applied.

Achilles tendinopathy: Diagnostic and treatment algorithm

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Achilles tendinopathy is characterised by pain, impaired performance, and swelling in and around the tendon. It can be categorized as insertional and non insertional, two distinct disorders with different underlying pathophysiologies and management options. Other terms used as synonymous of non insertional tendinopathy include tendinopathy of the main body of the Achilles tendon (AT) and mid-portion achilles tendinopathy. The terms tendinitis, tendinosis, and paratenonitis, or an association of them, should be reserved to specific histopathological features of tendon conditions. We suggested that terms such as 'partial ruptures of' a given tendon not to be used to indicate intratendinous lesions of the tendon under study. We advocated the term tendinopathy as a generic descriptor of the clinical conditions in and around tendons arising from overuse. We challenged the common wisdom, intrinsic in the suffix -itis, that overuse tendinopathies are due to inflammation.

Although sound epidemiological data are lacking, Achilles tendinopathy is common in athletes, accounting for 6-17% of all running injuries, possibly because of the continuous prolonged intense functional demands imposed on the

AT . However, it does presents in middle aged overweight non-athletic patients without history of increased physical activity. To date, no data are available to establish the incidence and prevalence of Achilles tendinopathy in other populations, even though the conditions has been correlated with seronegative arthropathies (e.g. ankylosing spondylitis).

The essence of tendinopathy is a failed healing response, with haphazard proliferation of tenocytes, some evidence of degeneration in tendon cells and disruption of collagen fibres, and subsequent increase in non-collagenous matrix. Tendinopathic lesions affect both collagen matrix and tenocytes. The parallel orientation of collagen fibres is lost, there is a decrease in collagen fibre diameter and in the overall density of collagen. Collagen microtears may also occur, and may be surrounded by erythrocytes, fibrin and fibronectin deposits. Normally, collagen fibres in tendons are tightly bundled in a parallel fashion. In tendinopathic samples, there is unequal and irregular crimping, loosening and increased waviness of collagen fibres, with an increase in Type III (reparative) collagen.

At electron microscopy, various types of degeneration have been described, namely (a) hypoxic degeneration, (b) hyaline degeneration, (c) mucoid or myxoid degeneration, (d) fibrinoid degeneration, (e) lipoid degeneration, (f) calcification, (g) fibrocartilaginous and bony metaplasia. All can coexist, depending on the anatomical site and the nature of their causal insult. Therefore, tendinopathy can be considered the end result of a number of etiologic processes with a relatively narrow spectrum of histopathological features.

In tendinopathic tendons, tenocytes are abnormally plentiful in some areas. They have rounded nuclei, and there is ultrastructural evidence of increased production of proteoglycan and protein which gives them a chondroid appearance. Other areas may contain fewer tenocytes than normal with small, pyknotic nuclei, with occasional infiltration of lymphocytes and macrophage type cells, possibly part of a healing process associated with proliferation of capillaries and arterioles. Degeneration of the AT is usually either ‘mucoid’ or ‘lipoid’. Collagen fibres that are thinner than normal, and large interfibrillar mucoid patches and vacuoles are seen. There is an increase in the Alcian-blue-staining ground substance. The characteristic hierarchical structure of collagen arrangement is also lost. Vascularity is typically increased, and blood vessels are randomly oriented, sometimes perpendicular to collagen fibres. Inflammatory lesions and granulation tissue are infrequent, and, when found, are associated with partial ruptures. Inflammatory cells and acellular necrotic areas are exceptional, and probably not typical of the tendinopathic process. On the other hand, mucoid degeneration, fibrosis and vascular proliferation with an inflammatory infiltrate may be found in the paratenon. Using common staining techniques, light microscopic degeneration was not a feature of tendons from healthy, older persons. Type I collagen is the main collagen in tendons; type III collagen is present in small amounts.

The diagnosis of Achilles tendinopathy is mainly based on history and clinical examination. Pain is the pivotal symptom. A common symptom is morning stiffness or stiffness after a period of inactivity, and a gradual onset of pain during activity. In athletes it occurs at the beginning and end of a training session, with a period of diminished discomfort in between. As the condition progresses, pain may occur during exercise, and it may interfere with activities of daily living. In severe cases, pain occurs at rest. In the acute phase, the tendon is diffusely swollen and edematous, and tenderness is usually greatest 2 to 6 cm proximal to the tendon insertion. A tender, nodular swelling is usually present in chronic cases.

Clinical examination is the best diagnostic tool. Both legs are exposed from above the knees, and the patient examined while standing and prone. The AT should be palpated for tenderness, heat, thickening, nodule and crepitation. The “painful arc” sign helps to distinguish between tendon and paratenon lesions. In paratendinopathy, the area of maximum thickening and tenderness remains fixed in relation to the malleoli from full dorsi- to plantar-flexion; lesions within the tendon move with ankle motion. There is often a discrete nodule, whose tenderness markedly decreases or disappears when the tendon is put under tension.

The management of Achilles tendinopathy lacks evidence-based support, and tendinopathy sufferers are at risk of long-term morbidity with unpredictable clinical outcome. The appropriate moment to switch from conservative to operative therapy remains unknown, as no solid data exist on the natural course of recovery. Non-operative care should be in general a minimum of three to six months prior to considering surgery since this condition usually resolves. However, each patient should be evaluated independently. Surgery is generally recommended to patients in whom conservative management has proved ineffective for three to six months.

Many common therapeutic options lack hard scientific background [64]. Rest, cryotherapy, pharmaceutical agents such as non-steroidal anti-inflammatory drugs and various peri-tendinous injections, training modifications, splintage, taping, electrotherapy, shock wave therapy, hyperthermia are used. Modalities tested using randomised controlled trials include nonsteroidal anti-inflammatory medication, eccentric exercise, glyceryl trinitrate patches, electrotherapy (microcurrent and microwave), sclerosing injections, and shock wave treatment.

In 24 – 45.5% of patients with Achilles tendinopathy, conservative management is unsuccessful, and surgery is recommended after exhausting conservative methods of management, often tried for at least six months. There is a the lack of trials on surgical management of Achilles tendinopathy, and therefore the high success rate needs to be interpreted with caution. Surgical options range from simple percutaneous tenotomy (possibly ultrasound-guided, to minimally invasive stripping of the tendon, to open procedures.

The classical aim of open surgery is to excise fibrotic adhesions, remove areas of failed healing and make multiple longitudinal incisions in the tendon to detect intratendinous lesions and to restore vascularity and possibly stimulate the remaining viable cells to initiate cell matrix response and healing. However, there is no level I evidence that fibrotic adhesions should be removed, and the areas of failed healing should be excised, at least if the pathology does not involve the paratenon. Multiple longitudinal tenotomies trigger well ordered neoangiogenesis of the AT. This would result in improved nutrition and a more favourable environment for healing.

A more recent approach targets not the tendinous lesion itself, but the neo-innervation which accompanies the neovessels. New minimally invasive stripping techniques of neovessels from the Kager's triangle of the AT for patients with tendinopathy allow to achieve safe and secure disruption of neo-vessels and the accompanying nerve supply, producing a denervation effect. During open procedure, if more than 50% of the tendon is debridement, consideration could be given to a tendon augmentation or transfer.

In conclusion, Achilles tendinopathy gives rise to significant morbidity, and, at present, only limited scientifically-proven management modalities exist. The management of this condition remains a challenge, especially in athletes, in whom the physician often tries to be innovative. In many instances, this carries with it an unquantifiable risk. A better understanding of tendon function and healing will allow specific management strategies to be developed. Many interesting techniques are being pioneered. Although these emerging technologies may develop into substantial clinical management options, their full impact needs to be evaluated critically in a scientific fashion. Future trials should use validated functional and clinical outcomes, adequate methodology, and be sufficiently powered. Clearly, studies of high levels of evidence, for instance large randomized trials, should be conducted to help answer many of the unsolved questions in this field.

Metabolic definition of the physiological background of high performance middle distance runners

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When looking through the available literature dealing with this topic, it is conspicuous that from an energetic point of view there is no exact knowledge of the running performance profile and the energy provision. Therefore in the last 50 years basic and applied physiology have provided substantial knowledge, which allows to establish systems of equations describing the steady state and dynamic behaviour of the mentioned basic energy delivering processes for the purpose of mathematical simulation of the muscular energy metabolism as a function of power output and time. The differences in the simulation patterns are due to the difference of 3 components of ATP supplying reactions in the working muscle mass: 1. The concentration of creatine phosphate ([PCr]) (~alactic work capacity), 2. the content of mitochondria which determines the maximum of aerobic ATP production rate (aerobic power (~VO_2max (ml/min*kg))) and 3. the maximal glycolytic ATP-production rate (lactic power (~VLamax (mmol/s*l))). To apply to the human body the active muscle mass (25% to 35% of body mass) and the lactate distribution space (35% to 45% of body volume) have to be considered. As it is for practical purpose too complicated to re-simulate experimental results of the individual pattern of test results simplifying of the mathematical approach is needed, without a loss of accuracy. This seems to be possible regarding two principles: First: Efficiency of ATP-production is nearly constant at all levels of intensities which means 1.0 mmol [ATP] ≅ [PCr] ≅ 4.3 ml O2.

That means also that 1.0 mmol LA ≅ 1.35 mmol [PCr] ≅ 5.8 ml O2 at muscular level. This is a typical value for top athletes. As the lactate oxygen equivalent is constant at the ATP production level according to principle 1: the resulting oxygen equivalent related to BW varies according to the relation of active and passive lactate distribution space between 2.4 up to 3.0 ml O2. - 2: The rise of oxygen uptake in case of an escalating load is approximately mono exponential. VO_2max in skeletal muscle is direct proportional to mitochondria content (Mit.Vol.) and 1.0 ml Mit.Vol. can consume 4,3 up to 4,5 ml O2/min. A normal 3% Mit.Vol. results in a VO_2max = 4.5 * 30 = 135ml O2/min*kg muscle. – A sportspecific simulation will be presented.

Chronobiologic factors of performance

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With pleasure we present you an overview of the work done on chronobiology/circadian rhythms in the laboratory of the university of Caen. In general biological rhythms are well known to follow the rhythm initiated by two internal clocks located in the pineal gland and the suprachiasmatic nuclei.

Both are subject to the influence of external synchronizer in order to stay within a 24h period. The physical performances follow also the pace of these clocks. This explains why alactic anaerobic muscle performance is always superior at 18h compared to those made at 6 o'clock, regardless isometric, concentric or eccentric contraction. The same is true for performances realized during the Wingate's test. For the anaerobic lactic processus, superior performance is found (e.g. 11%) at 18h versus 6h for environmental actions.

With regard to forced gestures (repeated contractions), the difference goes beyond the 40th second. This difference between the two types of movement is probably related to the principles and mechanisms underlying muscle mechanics, for example nerve conduction. In other words, the spontaneous frequency of cycling is higher in the evening than in the morning. The other parameters (maximal oxygen consumption, maximal power output) remain the same during the day. However, up to 85% of maximal aerobic power, ventilation for a given power is greater at night as compared to morning. The rectangular test at 100% of maximal aerobic power exhibits a higher time limit in the evening with a gain of 16% during the day. The best performances are realized late in the day. Therefore the athlete needs to regulate him or herself and start warming-ups in time if top performances can be scheduled in the evening. For mental performance, we found a rhythm for vigilance with two peaks, one around 10 a.m. and another at 06 p.m. Variations are the same for the first stage of action, namely the identification. In contrast, no differences were noted for the decision stage.The third stage, or the programming, implements and improves executing motor tasks throughout the day. For these reasons, amongst others, the late morning (good psychomotor performance, poorer physical performance) should be dedicated to learning strategies and analyzing competition. Finally, in support of these results, we showed that the wake-up time and breakfast did not influence the data acquisition in the morning.

Asthma and sport: Where did we come from and where are we now?

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Where have we come from

- 1999 The 3 IOC, MC premises highlighted
- 2001 WADA aTUE for asthma
- 2002 International panel at an Olympic Games

PFT are now manitory in asthma diagnosis. This clinical syndrome must have the clinical diagnosis of asthma supplemented with the addition of Pulmonary Function Tests (to ERS and / or ATS standards). The percentage changes in PFT are as follows:

- resting pulmonary function tests, (12% bronchodilation above the predicted or the athletes resting FEV-1)
- non-pharmacological challenge (10% bronchoconstriction) Exercise or Eucapnic Voluntary Hyperventilation tests
- pharmacological stimulation tests
  (20% bronchoconstriction at a Methacholine dose of < 4 mg/ml)
  (15% bronchoconstriction to a Mannitol test)
  (15% bronchoconstriction to a 4.5% saline challenge)

Where are we going with asthma

2008 Publish in 8.2008 IOC, MC consensus statement American JACI
2008/9 WADA scrapping a TUE
2008/9 WADA insisting on only the athletes on the registered testing pool of each IF having a full TUE for asthma
2012 Review the criteriae now in place
2010 Possible GINA consensus of asthma in high performance sport
2014 New advances in our understanding of asthma in 5 years

Imaging of osteochondral lesions of the talus and anterolateral impingement

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Both anterolateral impingement and osteochondral lesions of the talus are related to repeated inversion mechanism of ankle sprains. They are frequently encountered in soccer players. Radiological imaging has a role in the detection and staging of anterolateral impingement and osteochondral lesions of the talus especially in a preoperative phase. Anterolateral impingement is already described in the 1950 by Wolin as a meniscoid lesion of massive hyalinised and vascularised, connective tissue extending into the joint from the anterior inferior portion of the talofibular ligament

Impingement during dorsiflexion can occur at the anterior inferior tibiofibular ligament, the lateral gutter and the anterior talofibular ligament. Four grades of anterolateral impingment are recognised depending on the association of the meniscoid tissue with bone and cartilage abnormalities. Both MRI and ultrasound can be used to detect the meniscoid tissue. Dynamic ultrasound examination is able to demonstrate the impingment during dorsiflexion of the talocrural joint. The purpose of this presentation is to illustrate the findings and grading system on US and MRI examinations. Osteochondral lesions of the talus are detected and staged by plain CT and or plain MRI. Four stages are recognised depending on the grade of detachment of the bone fragment. In all but stage 3 with an in situ fragment these plain techniques are sufficient. In stage 3 the differentiation of a loose or atached in situ fragment is only possible by CT-arthrography or MR-arthrography as the contrast infiltration in between the fragment and roof of the bony defect is proof of a loose in situ fragment. Preoperative MR imaging and/or CT-arthrogram can help to determine whether the lesion is loose or not.

Persistent pain following lateral ankle sprains

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Persistent pain following ankle sprain may be due to one or more of the following conditions: a) Misdiagnosis (importance of differential diagnosis), b) Lesions developing at or following sprain, c) Chronic instability.

Acute inversion sprain is the most common sports injury (45% in basketball,31% in football).Differential diagnosis is of great importance:Syndesmosis injury,rupture or dislocation of the peroneal tendons,fracture of the lateral malleolus,lateral talar process,anterior calcaneal process and base of the 5th.metatarsal.Tarsal coalition and osteoid osteoma should be ruled out in every chronic sprain pain.

Most common lesions developing during or following ankle sprain are osteochondral lesions,osseous and soft tissue impingement syndromes,sinus tarsi syndrome and reflex sympathetic distrophy. Lesions due to insufficient healing are chronic lateral instability (mechanical or functional), avulsion fractures or symptomatic ossicles,subtalar instability,and neural injuries.

In summary, a good knowledge of differential diagnosis is the key to lessen persisting symptoms following acute ankle sprain.Additional lesions that develop at the time or after the injury are treated properly.

Cardiac emergencies in sports

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Cardiac emergencies and sudden death during physical activity remain a challenge in the general population and in athletes as well. Definition and epidemiology of sudden death will be given. Cardiac emergencies are mainly due to acute arrhythmias, myocardial ischemia or syncope. Causes of sudden death are complex ventricular arrhythmias due to structural heart disease. Coronary artery disease predominates in people over 35 years. In younger subjects (below 35 ys), especially in athletes, “electrical” abnormalities i.e. ion channel diseases such as Brugada- Syndrom, cardiomyopathy (ARVD,ALVD) , WPW-Syndrom or long or short QT-syndrom predispose to threatening circulatory collaps. Diagnosis is based on history, including sports and family history, clinical examination, resting ECG (consensus recommendation). It is strongly recommended that expertise from sports medicine and cardiology as well is need for correctly interpretating resting ECG in athletes.Stepwise increasing diagnostic procedures include stress testing, echocardiography and analysis of autonomic function, MRI and invasive procedures, with MRI as the key diagnostic tool for analysis of structural heart disease even in myocarditis. Molecular autopsy is now the standard approach in sudden athlete’s death of unknown origin. Possible diagnostics and treatments for survivors include: Cardiac catheterization, electrophysiological testing, bypass surgery or ballon dilatation (PCI), catheter ablation in special diseases (HOCM,WPW - Syndrom), drug therapy, and implantable cardioverter-defibrillator. In athletes, restriction to physical activity is sometimes recommended depending on the underlying disease (e.g. myocarditis). Prevention is the best approach using thorough history and clinical examination and ECG as a pre-participation screening. Recommendations from the German Society of Sports Medicine will be presented.

Gray zone in athlete's heart

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There is little doubt that vigorous physical exertion increases the risk of cardiac events in athletes with cardiovascular abnormalities. The increased risk of exertion has been documented in athletes in whom the risk of sudden death. Although hypertrophic cardiomyopathy is a major complex cardiac disease with a heterogeneous genetic, morphologic and clinical spectrum and it is the most important cause of sudden cardiac death among young athletes. The diagnostic criteria for hypertrophic cardiomyopathy includes a hypertrophic, but not dilated, left ventricle, in the absence of systemic disease or left ventricular hypertrophy due to left-sided obstruction. Some athletes develop substantial excessive left ventricular hypertrophy (13-15 mm) during intense physical training. In this situation, the differentiation between physiological and pathologic hypertrophy may be difficult, and this evaluation is important in determining the presence or absence of cardiac disease in athletes in order to prevent exercise- related sudden cardiac death.

At present, routine genetic testing is not a practicalmethod for differentiating physiologic from pathologic left ventricular hypertrophy. Several echocardiographic and electrocardiographic features can help to distinguish between hypertrophic cardiomyopathy and physiologic left ventricular hypertrophy in athletes, but, inevitably, a small number of individuals fall into a gray zone where differentiation between the two entities, athlete heart and hypertrophic cardiomyopathy. Although the presence of septal thickness more than the ranges suggests the diagnosis of hypertrophic cardiomyopathy, some patients with the disease have mild hypertrophy within the same range as that observed in highly trained athletes. Approximately, 2% of elite athletes have a septal thickness of 13-15 mm. A number of clinical, electrocardiographic, echocardiographic and new imaging methods can assist in the identification of hypertrophic cardiomyopathy in an athlete in these circumstances. Hypertrophic cardiomyopathy is more likely in the presence of a positive family history of hypertrophic cardiomyopathy in a first degree relative, echocardiographic demonstration of a small left ventricular cavity dimension, large left atrial diameter, abnormal diastolic filling patterns and the presence of abnormalities on the electrocardiography. Echocardiography is a valuable non-invasive and frequently using method for differentiating cardiac pathologies than athlete's heart; however, it is accepted that the method is not cost-effective for screening. Although there are several limitations of echocardiography, it helps for the accurate diagnosis of hypertrophic cardiomyopathy and facilitates risk stratification. Furthermore, some scanning and imagine methods may facilitate for differentiating of two entities, hypertrophic cardiomyopathy and athlete's heart.

Preparticipation medical screening of athletes: The Italian experience

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Sudden cardiac death in athletes is an event that dramatically occurs more and more often. Up to 90% of these deaths are due to cardiovascular diseases, therefore referred to sudden cardiac death (SDC). The causes of athletic-field SCD are strongly related to the athlete's age. In young athletes (<35 years) the main causes are represented by congenital cardiac diseases, particularly hypertrophic cardiomyopathy, arrhythmogenic right ventricular cardiomyopathy and coronary artery anomalies. Conversely, in older athletes (>35 years) the high percentage of deaths is due to coronary artery disease.

Death is a natural and ineluctable event. However, when it occurs suddenly and unexpectedly in a trained athlete who represents in our minds the image of health, strength and invulnerability, is difficult to accept. Indeed, the sudden death of an athlete, while training or competing, is an infrequent but devastating event to all involved (patient, family, friends, team, and staff). The great interest of the mass media for this tragic event, especially when young or well-known athletes are involved, contributes to increase their shocking impact on the public.

Over the past two decades ample medical literature on the causes and the mechanisms of sport-related sudden death as well as on the screening strategies and disqualification criteria for competitive athletes, has been collected. Nevertheless, such catastrophes continue to occur. Sudden death is defined as a witnessed or un-witnessed natural death occurring unexpectedly within 6 hours of a previously normal state of health.

Though non-traumatic athletic-field deaths may recognize non-cardiac causes - cerebral aneurysm, heat-stroke, sickle cell trait, bronchial asthma, drug abuse -, more than 90% of these events occur in subjects with pre-existing, and usually clinically silent, cardiac abnormalities. For this reason, sport-related sudden death should be distinguished in sudden cardiac death (SCD) and death due to non-cardiac causes.

A primary goal for prevention should be to identify cardiac pathology through PPS . Recently, interest has been focused on the strategies and results of PPS in athletes as a valuable instrument of investigation for:

a) early identification of structural cardiac disease associated with sudden death

b) reduction of the risk of disease progression associated with athletic training and competition.

Recommendations regarding eligibility to sport should be on precise guidelines, such as the ones set by the Bethesda Conference or the Italian Guidelines (COCIS).

Update on strategic plan on IOC scientific activities
Strategies in Sports Medicine - Contribution from IOC Medical and Science Department. An ounce of prevention?

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At a time when there is of an abundance of medical meetings, journals and papers, some might argue that the last thing we need is yet another field of research. What would justify such an emphasis on a new and developing research field in medicine such as prevention of injuries and diseases in high level athletes (1)? First, it must ask important questions not answered by others. Second, the new research field should have the potential to create truly new knowledge, lead to new ways of thinking and lay the foundation for improved health for our patients. Third, research results from the new field should be publishable in respected journals, recognized and cited by peers, presentable at high quality meetings and fundable on competitive grant review.

Challenges and opportunities: First, is injury prevention important? Epidemiological studies show that of injuries seen by a physician in Scandinavia, every sixth is sustained during sporting activity(2). Among children, every third hospital-treated injury is the result of sports participation. A research group within the English Football Association found that the overall risk to professional athletes is unacceptably high—approximately 1,000 times higher among professional football players than for high-risk industrial occupations (3).

The second issue relates to the potential for new ideas and improved health. When we started the Oslo Sports Trauma Research Center in May 2000, a PubMed search revealed that out of 10,691 papers on athletic injury, there were only 6 randomized controlled trials on sports injury prevention. However, a similar search of the literature now reveals that sports injury prevention research is emerging as a new field in medicine. While the number of papers on athletic injuries has increased by 26% over the last five years, clinical studies and RCTs related to sports injury prevention has doubled.

Sports participation is also important from a public health perspective. There is no longer any doubt that regular physical activity reduces the risk of premature mortality in general, and of coronary heart disease, hypertension, colon cancer, obesity, and diabetes mellitus in particular. The question is whether the health benefits of sports participation outweigh the risk of injury and long-term disability, especially in high-level athletes? Sarna et al. (4) have studied the incidence of chronic disease and life expectancy of former male world-class athletes from Finland in endurance sports, power sports and team sports. The overall life expectancy was longer in the high-level athlete compared to a reference group (75.6 versus 69.9 years). The same group also showed that the rate of hospitalization was lower for endurance sports and power sports compared to the reference group (5,6). This resulted from a lower rate of hospital care for heart disease, respiratory disease and cancer. However, the athletes were more likely to have been hospitalized for musculoskeletal disorders. Thus, the evidence suggests that although sports participation is beneficial, injuries are a significant side effect. To promote physical activity effectively, we have to deal professionally with the health problems of the active patient. This does not only involve providing effective care for the injured patient, but also developing and promoting injury prevention measures actively.

Possible solutions: Since 2007 the IOC is developing various programs for prevention of injuries and diseases in high level and recreational sports. This development is occurring with the cooperation of IFs such as FIFA, IHF, IAAF and FINA as well as with renowned research institutions world wide. The Medical and Science Department of the IOC is currently developing research in the prevention field with several major institutions to focus on research, education and implementation of the new knowledge to all NOCs around the world. Furthermore, special issues of the British Journal of Sports Medicine under the IOC leadership will disperse new knowledge to the scientific community which again will help IFs and NOCs to implement new knowledge to the practical athlete. The IOC will have yearly Advanced Team Physician Meetings to educate our colleagues and a major conference every third year where researchers from around the world will meet to discuss challenges and new results in the field of prevention of injuries and diseases. The IOC will continue the extensive publication of the Olympic Encyclopaedia and the more practical and very popular Olympic Hand Book in Sports Medicine. Every year at least two consensus conferences will be held - in 2009 one on Pre Participation Exams and on Age Determination in young athletes. The results from these conferences are spread to all NOCs and IFs. Finally, the IOC will develop an injury and disease surveillance system for the Olympic Games- the first successfully conducted in Beijing.

Through these initiatives, The International Olympic Committee (IOC) will increasingly emphasize the protection of the athletes' health and the prevention of injuries.

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Assessment of balance: From theoretical background to practical applications

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Unlike a solid object in stable balance position, the human body maintains a dynamic balance by oscillating center of mass (COM) in all horizontal directions around a virtual central verticular line. In order to prevent toppling, vertical projection of COM, representing center of gravity (COG) must remain within the base of support. This is achieved by perpetual shifting of the body in horizontal direction by muscle contraction in the ankle and hip area. Such corrective movements, controlled by the central nervous system, are based on sensory feedback information from the muscle proprioceptors, vestibular apparatus, visual organ, and to some extent also from the skin receptor in the plantar area. Tightness of this feedback control reflects the quality of balance. Generally, poor balance is characterised by rather large excursions of COM and vice versa. The analysis of COM horizontal movements is utilised for the assessment of balance. COM projection on the supporting ground is defined as center of gravity (COG). Recording of its movements is usually based on the distribution of the gravitational force among the sensors in the corners of the force platform sampled at the rate of 100 Hz. Such an approach, in fact, does not display COG exactly. As it does not take into account only simple projection of COM on the horizontal plane of the platform, but also momentum forces resulting from corrective horizontal movements, parameter calculated is in fact center of pressure (COP). However, as the differences between COP and GOG are rather minor, COP is utilised for the assessment of balance. The methods of analysis of COP movements under various conditions, their reliability and practical application will complement the presentation.

Genetic risk factors for musculoskeletal soft tissue injuries

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Acute and overuse tendon and ligament injuries are common as a result of participating in specific physical or workplace activities. Although the exact causes of these injuries are unknown, various intrinsic and extrinsic risk factors, including genetic factors, have been identified. Common musculoskeletal soft tissue injuries for which a genetic contribution has been proposed include the Achilles and rotator cuff tendons, as well as, the cruciate ligaments. Sequence variants within genes that encode for several collagens (COL1A1, COL5A1 and COL12A1) and glycoproteins (TNC), which are structural components of the basic building block of tendons and ligaments – the collagen fibril, have been shown to be associated with specific acute and chronic musculoskeletal soft tissues injuries. Recently variants within the enzymes (MMP3) that degrade the fibril have also been shown to be associated with chronic Achilles tendinopathy. Whether these variants are directly involved in the development of these musculoskeletal soft tissue abnormalities or linked with the actual disease causing variants remains to be established. The results of these initial case-control genetic association studies suggest that these injuries, like other more extensively investigated complex disorders, such as obesity, and type 2 diabetes, are caused by a complex interaction of multiple genetic and environmental factors. Developments in the identification of genetic risk factors for tendon and ligament injuries will be reviewed. It is proposed that eventually these and other specific genetic risk factors could be included in multifactorial models that will identify ‘high-risk’ athletes. It is conceivable that these models could in the future also be used by clinicians to develop personalised training programmes to reduce the risk of injury, as well as, personalised treatment and rehabilitation regimens for injured athletes. The ethical framework however in which this is done is not straightforward, need to be discussed and guidelines developed.

Genes and performance

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Human physical performance is determined by a variety of environmental and also genetic factors. Several studies have revealed, that heritability is a strong component of endurance and strength phenotypes, but it is important to note, that beside the athletic performance capacity a lot of genes in the same way are responsible for the normal functioning of metabolic pathways and processes which are necessary for a healthy state of an organism. With regard to athletic performance, today more than 200 gene entries and quantitative trait loci have shown some associations of linkages with exercise related phenotypes. Some of these associations seem to be rather weak or need to be improved in larger populations, on the other hand, the impact of the R577X-single-nucleotid-polymorphism of the α-actinin 3 (ACTN3) gene on elite performance has been confirmed in a series of studies. Similar results were found for the polymorphism of the Angiotensin converting enzyme (ACE), the Myostatin (GDF-8) and the Peroxisome proliferator activated receptor-γ coactivator 1, α (PPARGC1A) and other genes. However, it is very likely, that more than one genetic variant will be responsible for a complex trait such as athletic performance as well as for its components endurance capacity and strength, which also per se are polygenic. Therefore it seems to be necessary to look after optimum or favourable polygenic profiles, but taking into account that other polymorphisms yet are undiscovered as well as several other environmental factors may explain, why some individuals reach or don't reach the upper end of special performance capacity.

Genetic variability and training responses

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The HERITAGE (HEalth, RIsk factors, exercise Training And GEnetics) family study documents the role of the genotype in cardiovascular, metabolic, and hormonal responses to a tightly controlled 20 weeks aerobic exercise training program. One of the most interesting findings was that the training-induced changes in the outcome measures such as the maximal oxygen consumption varied widely, dividing the study participants in non-responders, medium-responders and high-responders (Skinner et al., 2001). Of course environmental factors such as age, gender and diet might have had an impact on the outcome variables. However, the variability within families was lower than the overall variability suggesting a genetic influence. At the latest since then numerous case-control, association or linkage studies tried to relate the individuals' genetic make-up with the adaptation to endurance or resistance training programs (Bray et al., 2009). When looking on muscle mass or strength genetic variants in the a-actinin 3 (ACTN3), myostatin (GDF-8), ciliary neurotrophic factor (CNTF) genes seem to influence the response to resistance training (Gordon et al., 2005). The ability to enhance endurance capacity is modulated by polymorphisms in the angiotensin convering enzyme (ACE), peroxisome proliferator-activated receptor alpha (PPARA) and nitric oxide synthetase 3 (NOS3) genes. Even though this list is highly incomplete it seems to be clear that more than one polymorphism contribute to a complex phenotype such as the training response making it necessary to develop a polygenic profile rather than single associations (Ruiz et al., 2009). Although we are just at the beginning of understanding the impact of genetic variability future research on this topic should help us to develop personalized training programs by identifying personal strengths and weaknesses and therefore finding the "optimal" exercise.

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Meniscal preservation: Current state of the art and future directions

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The menisci have important functions of load bearing and load sharing in the human knee joint. They also contribute to joint lubrication and act as secondary stabilizers in the event of ACL insufficiency. Loss of menisci leads to significant biomechanical and biochemical changes that ultimately lead to loss of cartilage and early onset osteoarthritis. Preservation of meniscal functions is an important goal in knee injuries especially in adolescents and young adults. As arthroscopic techniques have evolved, rim preserving partial meniscectomy has become the gold standard for irreparable meniscal tears. However, osteoarthitic changes still occur after partial meniscectomy depending on the amount of meniscal tissue removed and the disruption of circumferential collagen fibers. Meniscal repair is indicated for vertical longitudinal tears in the vascular 1/3 of the meniscus. These are usually acute tears in conjunction with an ACL injury and have the greatest chance of healing. Isolated tears have about 75% healing rate in stable knees. Recently the indications for meniscal repair have been extended to radial tears, tears in the avascular zone and more complex tears especially for the lateral meniscus. Enhancement of healing with a variety of techniques such as the fibrin clot, synovial abrasion, vascular access channels and microfracturing the notch may improve healing rates. Two options are available for younger patients with total meniscal loss; meniscal allografting and meniscal substitution with a scaffold. Meniscal allografts have shown pain relief and preservation of function in about 70-80% of the patients at 5-10 year follow-up. It is not clear whether the allografts can halt the progression of osteoarthritis at long term follow-up. Problems with sizing, logistics and the risk of disease transmission have prevented the widespread use of this technique. A variety of natural and synthetic materials have been tried to replace the meniscus. Most of them have been unsuccessful or have not reached clinical phase. A collagen meniscus implant acting as a scaffold has been used in a small number of patients with moderate success; however this implant is indicated for segmental meniscal defects and not total loss of meniscus. In conclusion, meniscal repair seems the best way to preserve meniscal function. Although suture techniques offer the strongest fixation, recent meniscal fixators offer the chance of an easier surgical technique. Prevention of meniscal injury and early treatment of ACL injuries before meniscal tearing, especially in adolescents are also important.

Sport therapy in patents with COPD

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OBJECTIVE The incidence of COPD in Germany is estimated between 8-15%. Improvement in pharmacologi-cal therapy as well as in non pharmacological therapies has lead to an augmentation in quality of life. One of the non pharmacological tasks is sports-therapy. Question arise can physical excises in a ambulatory group improve physical capacity in the amount of activity of daily living (ADL).

In a prospective controlled longitudinal study we included 29 COPD patients – 14 patients in a excercise group mean age 67 ±7 FEV 1 40-60%; 15 patients in a training group mean age 61 ± 8 age FEV 1 > 60%. The patients where compared to 17 healthy controls mean age 63 ± 9. Before and after a six months trainings period spiroergometrie on a bicycle ergometer, 6-minute-walking-test, postural balance testing, sit-to-stand-test and dynamic valance test where performed. All this activities where measured by step watch activity monitor (SAM) for seven days. Quality of life was measured with special questionnaires.

METHODS VO_2max was 18 ± 3 ml/kg in the excise group and 20 ± 4 ml/kg in the training group. There was no difference between pre- and post-test. The distance in the 6-minute walking-test in patients of the exercise group was 439 ± 9 m and 491 ± 26 m in training group. This was 67% respectively 75% of the distance in controls. In the pos-test the level was augmented between three to five percent in both groups. After the training program there was a slide augmentation in force- and balance test to be found. The ADL level of the controls was 6500 steps per day and must be regarded as low active. The training group was 400 steps per day and the excise group 1000 steps per day below the level of the controls. The training program improved ADL level of excise group to the level of the controls and the level of the excise group was augmented 2000 steps and reached a level above that of controls. The quality of life was improved in all interven-tion groups.

CONCLUSION COPD patients, and especially the patients with low capacity, seem to achieve bene-fit from intervention in ambulatory COPD training groups.

Biomechanical modelling in sports medicine

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OBJECTIVE Sports biomechanics suffers from one very serious limitation; in general it is impossible to measure forces inside the human body for technical and ethical reasons. In order to measure the force inside a human body requires an operation to implement a force transducer. In addition to technical complications and calibration problems of force transducer, the subject would also be at risk of surgical infections. Therefore, modelling in biomechanics works as an interface between the body and measurement settings.

In recent years biomechanical modelling has become very popular in the area of sports medicine. Recent developments in software and hardware in the computer technology can be the key explanation of this popularity. Developing a biomechanical model itself improves the understanding of the mechanical system's dynamics and the structure. On the other hand, most of the real-world biomechanical systems are so complicated that a satisfying modelling seems extremely difficult. One standard consequence is that the complexity can be reduced by cutting down the some part of the system to be modelled. A well prepared model is simple but also adequately detailed to precisely represent the system.

Considering the system components (i.e. limbs of the human body) as a rigid body, rather than deformable body is also helps to reduce the complexity of the model. Although, in reality, there is no body is absolutely rigid, deformation of limbs in sports movement can be ignored, when compared to the gross motion of the system.

METHODS Basically, there are two types of approaches in biomechanical modelling. The first one is inverse dynamics and the second one is forward dynamics or direct dynamics. Inverse dynamics calculation is used to determine joint forces and torques based on the physical properties of the system being modelled and a time history of displacements from experimental kinematic data, including velocities and accelerations. Ground reaction forces, mass and inertial characteristics of segments are also required in this method. In a forward dynamical analysis the joint torques are the inputs and the body motion is the output. It is critical to understand what generate this joint torques. Joint torques are the addition of internal body forces such as ligaments, joint constraints, and of course, muscle forces. Muscles are the actuator in this method. Therefore the correct input into the model is definitely neural input, which drives the muscles.

Whichever approach is used for modelling, first of all, the equation of motion has to be derived. The dynamics of biomechanical systems is based on classical mechanics. The simplest element of a multi-body biomechanical system is a free particle which can be treated by Newton's equations. The rigid body that is a key element in the modelling was introduced in 1775 by Euler. Thus the equations obtained are known in human-body dynamics as Newton–Euler equations.

CONCLUSION As indicated above the modelling is widely used in all fields of sports medicine from kinematics to dynamics. In fact, advanced biomechanical modelling requires sophisticated simulation tools which can model accurately enough the physical world at sufficient speed and allow user interaction.

Modeling of soft tissue mechanical behavior on computer

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INTRODUCTIONNearly all mechanical interactions of human body with the surrounding take place through soft tissues. Therefore, experimental determination of soft tissue mechanical properties and computer simulation of various mechanical interactions of human body with the environment received attention in biomechanics. There are different test equipment and protocols, each having its own advantages and disadvantages, that have been utilized till now to uncover soft tissue mechanical behavior for the purpose of constructing a material law that would model the mechanical behavior of soft tissues.

METHODS Because the aim is to model mechanical interaction with the surrounding, it is preferred to use in vivo experiments so that the tissue of interest would be in its natural environment with proper interaction with the surrounding tissues.

A soft tissue indenter, which is a noninvasive device, is utilized for the experiments. Although the primary mode of operation of the indenter is displacement controlled, with a closed loop control algorithm force control can also be achieved. The indenter tip that deforms the soft tissue has an ellipsoid shape to detect in-plane anisotropy. The indenter system collects simultaneous data of tissue reaction force, tissue displacement and time. With the utilization of inverse finite element method, this data is converted into stress-strain-time data which can directly be used to establish the

material law (constitutive equation).
RESULTS Lower arm bulk soft tissues were tested using three different test protocols: cyclic loading, relaxation and creep. The results indicate that soft tissue behavior is nonlinear with stiffening behavior in increasing strain, considerably anisotropic, not fully elastic with considerable mechanical energy dissipation, relaxation is observed under constant displacement and creep is observed under constant load. There is preconditioning in maximum reaction force and in hysteresis magnitude in the first few loading cycles. It was further observed that the soft tissue mechanical behavior is personal, local in the body and even at the same location mechanical response changes in time.
CONCLUSION The experimental results reveal that unlike many engineering materials, soft biological tissues exhibit relatively complex mechanical material behavior. Computer simulation of mechanical interaction of human body with its surroundings requires the material model to reach a maturity for success.

Classification methods in biomechanical analysis

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OBJECTIVE Classification of human motion plays an important role in many application areas, such as surveillance, films, biomechanics, biometric person identification or the analysis of gait abnormalities in medicine. Most of the existing systems, description of human movement depends on variables that represent the kinetics and/or kinematics of the body segments. Increasing amounts of three-dimensional kinetics and kinematics data are available from commercial motion-capture systems. However the problem is not technological since recent advances have made data collection fast and efficient with sufficient resolution to provide meaningful measurements. A significant barrier to use of kinetics and kinematics information is the successful reduction and classification of this large data set.
METHODS Large data sets have orientated the researches to use different methods. Using multivariate statistical methods has become widely accepted technique among the many different approaches. Since the availability of statistical software packages to do the calculations has developed the use of linear techniques to describe human motion data has been employed in a number of studies. Principal Component Analysis (PCA) which is one of these linear techniques has been used as an evaluation and classification tool for kinematics and kinetics data of normal vs. pathological movement patterns. This approach allows one to identify components of low power that may be removed from the data set without significantly affecting the data, thus producing a dimensionally reduced form of the original data.
CONCLUSION Using linear techniques as a classification tool have become common within the animation and computer vision community. However there exist only few studies for biomechanical analysis in sport medicine. PCA can be used to classify the entire temporal movement pattern and can detect differences due to disease, gender and age as well as psychological attributes such as personality traits and emotions.

Gait analysis in healthy and operated subjects

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Quantitative gait analysis is an objective clinical tool to differentiate gait deviations, to measure and document neuromusculoskeletal functions in numbers and graphs, and to obtain accurate and precise measurements of human movement. It serves not only as a useful tool in planning treatment, but also a measure of treatment outcome. Although observational gait analysis has been used for many years in our daily practice, there are multiple reasons why it may not be adequate for the identification of more complex gait parameters. A more scientific evaluation can be provided by the use of three-dimensional (3D) quantitative gait analysis. The advance of 3D quantitative gait analysis, which includes kinematic, kinetic, and dynamic electromyographic assessment, has enabled clinicians to differentiate gait deviations objectively and understand the primary problem behind a complex disorder more accurately than can be done with observational analysis. A detailed history and physical examination of the patient combined with the gait data and the expertise of the team help in clinical decision-making in terms of antispastic drugs, orthotics and surgery.

A typical 3D quantitative gait analysis session starts with subject preparation and followed by data recording and data analysis. During subject preparation anthropometric data including height, weight, leg length and joint width of the knee and ankle are collected. After the subjects are instrumented with retroreflective markers, they walk barefoot or with shoes together with walking aids (if they need), at a self-selected pace, a number of times, over a 10-meter-long walkway during which time data collection was completed. Three to nine cameras record the quantitative spatial location of each marker as the subject walked. The trial in which all the markers were automatically and clearly identified by the system is determined the best data. Some laboratories average the trials they collected. Three components of the ground reaction force are collected by forceplates as the subject steps on them. Ground reaction forces (GRF) and kinematic data were combined with inverse dynamics to predict joint moments and powers of hip, knee and ankle joints in three dimensions. The recorded data is then processed for interpretation. The clinically validated biomechanical model combines the movement, force plate and EMG data with patient specific measurements to calculate the joint center locations, segment orientations, three dimensional joint angles and moments.

Three-dimensional quantitative gait analysis has advanced our understanding of normal gait, identified and quantified the biomechanical and motor control abnormalities of pathologic gait, and documented the usefulness of various therapeutic interventions. Further research are needed to show how gait analysis can improve patient care, evidences that 3D quantitative gait analysis studies can aid in the diagnosis and determination of the pathomechanics of some gait abnormalities.

Skeletal muscle adaptation to increased activity level

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Skeletal muscle is a plastic tissue capable of changing the type and the amount of protein under increased activity level. Increased activity induced adaptation in skeletal muscle involves a various of signalling mechanisms resulting in new protein synthesis. Endurance training especially targets to mitochondrial protein synthesis. On the other hand resistance training primarily stimulates the rate of myofibrillar protein synthesis and results in muscle hypertrophy. Hyperplasia has also been shown in some experimental conditions in animal subjects. Exercise training induced various metabolic and morpholocigal changes are specific to the type of exercise. One of the important feature of the exercise training is transformation of the muscle fiber types. Although increased activity level results in fast to slow shift in myosin isoform, training duration, intensity and frequency play critical role in this transformation.

Exercise-induced muscle damage and neutrophils

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Trauma, mechanical stretch, exercise may cause muscle damage. All forms of exercise, if carried out vigourously enough, can lead to ultrastructural damage of muscle fibers but eccentric exercie, leaves stiff and sore the day afterwards. Muscle damage is characterized by ultrastructural changes to muscle architecture, damage-increased muscle proteins and enzymes in the bloodstream, loss of muscular strength and range of motion and muscle soreness.

The primary sequence of events leading to exercise-induced muscle damage is believed to involve initial mechanical disruption of sarcomeres, followed by impaired excitation-contraction coupling, disturbances in Ca^{2+} homeostasis. The activation of calcium–sensitive degradation pathways and inflammatory reactions are the subsequent steps and responsible for the delayed-onset muscular soreness (DOMS).

Inflammatory reactions within damaged muscle involves leucocyte infiltration and increase in proinflammatory cytokine production, systemic release of leucocytes and cytokines. Neutrophyls and macrophages play dominant role in inflamatory responses. Neutrophyl infiltration leads greater damage in muscles. Neutrophyl activation cause increase in oxygen consumption. The “respiratory burst” result in release of reactive oxygen species (ROS). ROS are suggested to be responsible subsequent muscle damage. The neutrohyl response to the exercise is dependent on the intensity and type of exercise, age and gender. There are limited data about hte effect of antiinflammatory drugs and antioxidant supplements.

Evaluation and diagnosis of isolated and combined knee ligament injuries

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Recent interest in the anatomy and biomechanics of the knee joint, combined with the increased incidence of high energy knee injuries has led to an increased awareness and diagnosis of knee ligament injuries. Most isolated knee ligament injuries involve the medial collateral ligament (MCL) and/or the anterior cruciate ligament (ACL). They usually occur as a non-contact, low energy trauma during sports. Meniscal and chondral injuries usually accompany the ligamentous lesions. Diagnosis is usually straightforward with the typical history of sudden rotational trauma, followed by a pop and hemarthrosis. Tenderness along the MCL, frequently on the femoral insertion on the epicondyle, and a positive valgus stress test are the hallmarks of MCL injury. A positive Lachman test immediately after trauma is helpful in ACL injuries. As the swelling reduces and pain subsides a positive pivot-shift test clearly denotes the injury. Partial ligament injuries may occur. A positive Lachman test without a positive pivot shift test implies injury to the antero-medial bundle of the ACL, while the reverse denotes an injury to the postero-lateral bundle of the ACL.

Isolated injuries to the posterior-cruciate ligament (PCL) or the postero-lateral corner (PLC) are rare. These ligaments are usually injured during a high energy, contact trauma such as a motor vehicle or industrial accident and involve multiple ligaments. Associated injuries to the popliteal artery, peroneal nerve, impression fractures of the contra-lateral femoral condyles, tibial rim fractures, meniscal injuries and rupture of the patellar tendon may occur. Emergency evaluation of the soft tissue coverage and neuro-vascular status of the extremity should be carried out. Gentle examination of the knee reveals the magnitude of ligament injury. The posterior drawer, external rotation-recurvatum, dial and varus stress tests aid in the diagnosis. X-rays may reveal frank knee dislocation or avulsion fractures. MRI is the gold standard in the evaluation and surgical decision making of these complex injuries. Routine angiography is not mandatory if careful clinical and ultra-sound evaluation is available. Since surgery in the first three weeks after injury is results in the best clinical outcomes, a treatment strategy should be formed early after injury. Combined ACL + MCL injuries may be addressed with a conservative treatment of MCL followed by reconstruction of ACL after adequate healing of MCL has occurred and knee range of motion has been restored. All other combined ligament injuries involving more than two ligaments should be treated surgically in the first 3 weeks following injury. Boney avulsions of ligaments can be internally fixed. Mid-substance cruciate ligament injuries are reconstructed with autologous or allogenic grafts. Primary repair of the collateral ligaments and capsular structures are performed if the tissues of are good quality. Chronic cases require reconstruction of all injured ligaments.

Topographic and functional anatomy of the knee joint

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The knee is the largest joint of human body. It is separated in two joints, the tibiofemoral and patellofemoral joints. The femoral condyles (FC) roll and slide on the tibial plateau. During flexion they slide anteriorly and roll posteriorly, while during extension they slide posteriorly and roll anteriorly. During lateral rotation, lateral FC moves anteriorly and medial FC moves posteriorly. During medial rotation, lateral FC moves posteriorly and medial FC moves anteriorly.

Concerning the tibial condyles (TC), during flexion they roll posteriorly and during extension they roll anteriorly. When the knee is rotated laterally medial TC moves posteriorly and lateral TC moves anteriorly. When the knee is rotated medially lateral TC moves posteriorly and medial TC moves anteriorly.

In the patellofemoral joint, as the patella moves vertically, along the trochlea during flexion. During knee flexion the patella and FC come closer, while during extension the patella and FC separate. During medial rotation, the patella moves medially and during lateral rotation it moves laterally.

The lateral meniscus (LM) covers about 80% of the lateral tibial plateau, while the medial meniscus (MM) covers about 60% of the medial tibial plateau. However not all knees are the same. When the knee is extended the menisci move anteriorly unequally, while when the knee is flexed they move posteriorly unequally. During lateral rotation LM moves anteriorly and MM posteriorly, while during medial rotation MM moves anteriorly and LM posteriorly.

The collateral ligaments of the knee, medial (MCL) and lateral (LCL) are responsible for the transverse stability of the knee during extension. According to relatively recent observations the MCL is divided into superficial and deep MCL, while the LCL sometimes may consist of two bundles. Both ligaments are taut during extension and slackened during flexion.

The anterior cruciate ligament (ACL) is divided into two parts, the anteromedial bundle (AMB) and the posterolateral bundle (PLB), while other authors have separated the ACL in three functional bundles (AMB, intermediate band, and PLB). However, the two bundle model has been generally accepted as the best representation to understand ACL function. The fascicles of the AMB originate at the most anterior and proximal aspect of the femoral attachment and insert at the anteromedial aspect of the tibial attachment. Conversely, the fascicles of the PLB originate at the posterodistal aspect of the femoral attachment and insert at the posterolateral aspect of the tibial attachment. When the knee is extended, the PLB is tight and the AMB is moderately lax. As the knee is flexed, the femoral attachment of the ACL becomes more horizontally oriented, causing the AMB to tighten and the PMB to loosen up.

The posterior cruciate ligament (PCL) can be partially separated into an anterolateral and posteromedial bundle. A more detailed subdivision of the PCL bundles separates it in anterior, central, posterior longitudinal and posterior oblique fibers. The anterolateral bundle is seen to be curved in the sagittal plane and therefore is slack in the extended knee. When the knee flexes this bundle becomes tight and also takes a steeper angle away from the tibial plateau. In deep knee flexion the anterolateral bundle comes to rest against the roof of the posterior part of the femoral intercondylar notch. The posteromedial bundle of the PCL is tight and aligned in a proximal-distal direction in the extended knee. The posteromedial fibers slacken as soon as the knee starts to flex. In deep flexion the posteromedial fibers' attachment moves anteriorly and also upwards away from the tibial plateau and as a result the posteromedial fibers then become tight.

In the PCL's complex we describe the anterior and posterior meniscofemoral ligaments (aMFL and pMFL). In brief, the anterior and posterior meniscofemoral ligaments attach respectively distally and proximally to the PCL attachment to the femur. These positions mean that the aMFL is slack in the extended knee and tightens with knee flexion, when it is well-aligned to withstand tibial posterior draw. Conversely the pMFL is tight in the extended knee and slackens with knee flexion, because its femoral attachment moves down towards the tibial plateau.

The major structures of the posterolateral corner (PLC) of the knee include: the iliotibial tract, the lateral collateral ligament, the popliteus complex consisting of both dynamic components (the popliteus muscle-tendon unit) and static components (the popliteofibular ligament, popliteotibial fascicle, meniscofibular ligament and popliteomeniscal fascicles), the middle third of the lateral capsular ligament, the fabellofibular ligament, the posterior horn of the lateral meniscus, the lateral coronary ligament, the arcuate ligament and the posterolateral part of the joint capsule. However, this anatomy can be quite variable.

Actually, all the muscles around the knee have a dynamic stabilizing role in the functional anatomy of the joint. One of the most important dynamic stabilizers, the popliteus muscle-tendon unit, slackens during knee flexion and lateral rotation and stretches during knee extension and medial rotation.

Knowledge of topographic and functional anatomy of the knee is very useful to explain the mechanism of injury and evaluate mainly the ligamentous injuries. To make these injuries understandable, the knee can be divided into sections. According to the traumatic mechanism (varus, valgus, or both), structures in different sections may be injured. Additionally, there may be associated injury of the central pivot. Multiple combinations of injuries can occur.

Structures of the anterolateral portion are the most frequently injured. These injuries are usually associated with damage to the anterior cruciate ligament. The injury is caused by varus force with internal rotation of the tibia. Most commonly, the posterior fibers of the iliotibial tract are damaged. An avulsion fracture of the Gerdy tubercle may also occur.

The mechanism of posterolateral injury is either direct varus force while the tibia is externally rotated or sudden hyperextension of the knee. Clinical signs may be subtle and might remain masked by the more extensive symptoms due to cruciate ligament damage. Practically all tears of the (LCL) are associated with damage to posterolateral knee structures: capsular tears, detachment fracture of the superior rim of the tibia (Segond fracture), biceps femoris tendon tears, popliteus tendon lesions, cruciate ligament tears, and so on. Instead of a (LCL) tear, an avulsion fracture of the fibular insertion of the (LCL) and biceps femoris tendon can occur. The majority of popliteus tears are extraarticular, involving the muscular or myotendinous portion, although they can be intraarticular at the level of the popliteal hiatus and at or near the femoral insertion. Such injuries can also be a mixture of intraarticular and extraarticular. Most popliteus muscle and tendon injuries are associated with damage to other knee structures: injury to other elements of the arcuate ligament complex, cruciate ligament tears, meniscal tears, bone fractures, and so on. Less than 10% of popliteus tears are isolated.

Concerning the stability of medial side of the knee three principal structural elements have been described: the superficial medial collateral ligament (sMCL), the deep MCL (dMCL), and the structures of the posteromedial complex (PMC). Several fibrous bands that form thickenings of the PMC have been described. These attach around the femoral adductor tubercle and pass posterodistally across the joint line, to insert on the rim of the tibial plateau; a central band among these has been called the posterior oblique ligament (POL).

The anterior translation laxity with free tibial rotation does not change significantly when the 3 medial structures are cut at any angle of knee flexion. Only at fixed tibial external rotation isolated cutting of the dMCL causes a small but significant increase in tibial anterior translation.

Posterior tibial translation does not increase significantly when the sMCL, dMCL and PMC are cut. At tibial internal rotation cutting the PMC alone and after cutting the dMCL and PMC, further cutting the sMCL in the extended knee, increases posterior laxity overall. Of course in severe trauma, all the stabilizing structures of the knee may be disrupted. In these serious situations, the common peroneal nerve and gastrocnemius muscle can also be injured.

The Event Physician – Emergency Sports Medicine

David McDonagh

Sports Medicine may have its origins in, yes, India - when the use of therapeutic exercises were described in the fourth Veda book Artharvaveda, written sometime between 900 and 100 B.C.

Due to the popularity of sports and the increase in sports injuries, physicians were asked to attend sports fixtures to offer treatment to injured athletes. Later, the rehabilitation of athletes became a necessary function that has evolved into a large and sophisticated scientific field. The field of sports and exercise medicine has grown exponentially and now has practitioners and researchers from many scientific backgrounds, physiologists, nutritionists, physiotherapists, athletic trainers and physicians. The Federation of Sports Medicine (FIMS) was created in 1928 to assist the athletes at the St. Moritz Olympic Winter Games. Later, sports medical organisations have been established in almost all countries in the world.

But, despite all this development and research, little focus has been placed on the role of the Event Physician and the tasks he or she must confront.

Is it time to go "Back to Basics".

Dr. McDonagh describes where emergency sports care is today. He will elaborate on the exciting new projects that are developing in the education of event physicians, with books, courses and research programs.

Dr. McDonagh is Chair of the International Bobsleigh Federation Medical Committee; the representative of the Olympic Winter Federations on FIMS; was team physician for several Norwegian national teams; was Deputy Chief Medical Officer at the 1994 Winter Olympic Games; has been advisor for 5 other Olympic Games; is a member of the Norwegian Antidoping Tribunal and the ICC (Cricket) Antidoping tribunal. He is an A + E consultant at the University Hospital, Trondheim and senior lecturer at the Norwegian University of Science and Technology, Trondheim, Norway.

Medical coverage in major sports events

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Planning, organizing and carrying out medical assistance / emergency care for a major international sports event means providing adequate medical services to athletes, judges, referees, media, spectators, volunteers and all accredited individuals and groups. To that end, the role of sports medicine is of crucial importance and therefore must be of high quality for the participating athletes since the primary aim of the practice of sport is promoting health habits.

More specifically, health care management has the following aims:

1) Placing medical care units at training and competition venues, lodgings, accreditation and press centers thus providing medical coverage to athletes, managers, staff, media, volunteers, spectators, etc. This service will provide first aid care, basic and advanced cardiopulmonary resuscitation, ambulance transportation, any necessary complementary diagnostic tests, medical treatment or surgery by specialists and, if necessary, hospitalization.
2) Provision of appropriate equipment and adequate facilities for medical and health personnel of the participating teams for the performance of their duties.
3) Implementation of prevention and control measures of Public Health.
4) Implementation of prevention and control measures for veterinary care in equestrian competitions.
5) Implementation of preventive measures, emergency services and medical care for water sports competitions (both offshore and small lakes).
6) Supervision of diet and nutritional quality of meals for the participating athletes, taking account of hygiene and health issues and respecting cultural and religious peculiarities.
7) Managing and carrying out doping controls in accordance with WADA regulations.
8) Producing manuals for medical health care for athletes and delegations (Medical Guide, Drug Formulary Guide, Doping Control Guide)

In terms of structures and responsibilities, every international sports event will be organized into three main areas of health care: Sports Medicine, Public Health and Doping Controls.

These structures strictly depend on the management of health services operations: a person responsible for each area will be appointed to facilitate the work of coordination.

Sports medicine aims to provide responsible medical attention to athletes in accordance with criteria established. Its main areas of action are:

- Management and Administration
- Sports Medicine for competition and training venues
- Polyclinic at the Athlete's Village (outpatient services, trauma services, laboratory analysis, conventional radiology services, CAT, MRI, ultrasound, physiotherapy)
- Sports Nutrition

Public Health covers three distinct areas:

- Primary care and ambulance transport service (competition venues, residential venues, media center, accreditation centers, official events)
- Intensive care units and emergency care service
- Public Health

Doping controls are carried out through the following ways:
- Doping controls are organized at all competition and training venues and at the Polyclinic Medical Center.
- Preparation of sites in compliance with WADA regulations
- Determining and training of DCOs and "chaperones"
- Organizing doping controls and chain of custody with the accredited anti-doping laboratory

At the end of the sports event a report on all health activities should be prepared in order to document the management of the organizational arrangements and report on issues regarding health care services.

Yachting Injuries

Kirill Micallef-Stafrace [1], Andrew Decelis [1], Nicola Micallef-Stafrace [2] and George Buttigieg [3]
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Historically sailing medicine has been mainly undertaken by doctors that were themselves sailors. However, with the increase in popularity of sailing events such as the America's Cup, The Volvo Ocean Race and the Olympics sailing programme, a significant effort is being made to maximise the potential performance of the sailors. Over the last few decades millions, if not billions, of Euros have been poured into the development of the sailing boats , yet little thought had been spent on ensuring the physical and mental performance of the sailors themselves. This has now all changed. Sailors have been recognised as being athletes themselves and ameliorating their performance will automatically lead to better results. This applies to all levels of sailors, across all the classes, even the weekend 'warrior'. Some little attention can ensure injuries are avoided and when they do happen that they are sorted out as soon as possible. Another aspect is how to better ones physical and mental performance, but that will be tackled in another issue.
As we all know, injuries are far from being a rarity in sailing. Sailing is one of the few sporting disciplines that the athlete in question in never in complete control. The elements have a nasty habit of reminding us of this. The type of injury is often related to the class of boat and the function of the sailor within the crew. They can be caused by poor athletic conditioning, overtraining or improper training and the more obvious direct trauma. In sailing all of them are a common occurrence, although this might not be apparent to a non sailor. Sailing involves a series of complex physical manoeuvres which are often repetitive, yet at the same time can be sudden. To compound matters they are often undertaken in awkward positions and on a platform that has the unerring capacity of being unstable. Repetitive powerful movements such as hiking or main sheet handling can lead to back, knee or upper body ailments. Muscle imbalances are often found in sailors due to the often unilateral physical effort imposed on them and if not identified early can cause or aggravate musculoskeletal problems.

Hyperthermia and soccer

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Only about 20-25% of the energy released by muscle metabolism during exercise is used to do work, with the remaining 75-80% appearing as heat. An increase in body temperature is therefore a normal response to exercise. Elevation of body core temperature can be compensated through the evaporation of sweat from the skin surface, but this increase in sweating rate may eventually cause dehydration during prolonged exercise. Therefore, performing physical activities during a sportive event in a hot and humid environment without proper hydration can be a significant threat to health and performance.

In Europe the regular soccer season typically begins in August and in some parts temperature may exceed 30 oC with a relative humidity of 50% (www.bbc.co.uk/weather). Thus, climatic heat stress can be a problem for soccer players. Although reports of serious heat illness are rare and deaths are extremely uncommon in soccer, they do occur. Thermoregulatory responses during exercise in different environmental conditions have been studied extensively. However, because of the unique nature of soccer, the physiological and physical challenges of a soccer game cannot be replicated in a laboratory, though attempts have been made to simulate this activity pattern. Therefore, studies performed during a soccer match played under extreme heat conditions are extremely important to evaluate the physiological strain of the soccer players that they have to cope with. In fact in a match played at 36 °C with a relative humidity of 61% had shown that average body core temperature reaches to values of 39.5 °C with an heart rate value over 180 beats/minute. Moreover the average sweating rate reached nearly to value of 2 liter/hour during the game. The volume of sweat loss, possible changes of plasma electrolyte balance and osmolality together with hyperthermia would seriously impair athletic performance capacity and thermoregulatory mechanisms.

Prophylactic interventions such as acclimatization, different cooling strategies and hydration before, during, and after the sportive event are extremely important to prevent athletic performance capacity. It is also important to remember that together with these interventions, extensive health screening is important to protect soccer players from the undesired occasions related with physical activities.

Effects of a single session of resistance exercise training on specific cardiac and oxidative stress markers

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OBJECTIVE In the past the fear of damage to the cardiovascular system has led exercise specialists to urge against high intensity resistive exercise. Strength training has been associated with an abrupt increase in blood pressute, wall stress, increased myocardial oxygen demand, myocardial ischemia, and left ventricle dysfunction. The present study was designed to investigate wether wheater the stress of a high intensive strength training session can induce myocardial cell incury in trained weightlifters as assessed by post exercise plasma concentrations of cardiac specific and nonspecific biochemical markers. A futher aim of the study was to examine if this intensive training session would result in an elevation of cell-free plasma DNA or an elevation of reactive oxygen intermediates (hypoxanthine, xanthine).

METHODS 12 healthy, national class weightlifters performed 6 sets of 6 lifting exercises at 5 RM each, including isometric stabilization and the Valsalva Maneuver. Blood samples were drawn and urine samples were obtained from each subject 1 hr before the training, as well as immediately after finishing the exercise test and 2 hrs post-exercise. For dedection of myocardial and skeletal muscle damage cardiac troponin I (cTnI), total creatine kinase activity (CK) and myoglobin (Myo) were measured. Serum concentrations of cTnI and myoglobin were measured by immunoassays – CK activity by routin photometric assay. For detection of myocardial overload NT-proBNP was analyzed using electrochemiluminescence immunoassay. The amount of cell free plasma DNA was measured using fluorescence signal detection and oxipurine levels were analysed using HPLC technology. A one-way ANOVA with repeated measures was used to detect changes over time. The Tukey HSD post-hoc test was used to determine the location of differences when significant main effects were detected.

RESULTS Beside cTnI all markers showed significant elevations ($p<0.05$ to $p<0.001$) over the time course of the 3 blood draws and urine measurements respectively. Most laboratory markes were outside the reference ranges. However the sensitive and specific biochemical markers for dedecting myocardial damage (cTnI and NT-proBNP) stayed within the reference ranges and tended to decrease toward baseline levels already 2 hrs after finishing exercise training again. Markers of oxidative stress and cell free plasma DNA showed the same tendency with significant elevations ($p<0.01$) immediately following strength training but no significant differences compared to baseline 2 hrs after finishing the training session.

CONCLUSION From the present study it would appear that heavy resistance exercise is well tolerated by experianced weightlifters without showing any evidence that lifting tasks damages the myocardium. The elevention of non-specific markes (CK and Myo) may reflect a mild tissue trauma of the skeletal muscles. The transient elevation of cell free plasma DNA and of the oxipurenes might be caused by short episodes of ischemia of the skeletal muscles resulting in an elevation of reactive oxygen intermediates.

Phosphodiesterase’s inhibitors and physical activity

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Phosphodiesterases (PDEs) catalyze the hydrolysis of cyclic adenosine monophosphate (cAMP) and cyclic guanosine monophosphate (cGMP), to the corresponding 5’ nucleotide monophosphate (19). Currently, eleven different PDEs families have been found throughout the body, each family containing sub-families and multiple splice variance; they differ in selectivity for cyclic nucleotides, sensitivity to inhibitors and activators, physiological roles, and tissue distribution.

Nowadays, million of individuals of different ages take phosphodiesterase's inhibitors (e.g. PDE-5i) daily, not only as therapeutic agent to treat erectile dysfunction (ED), but also for non-therapeutic purpose (e.g. recreational use). Interestingly, there are many anecdotal reports of the use of PDE-5i to increase performance in sports, both in humans and animals.

Experimental studies have indicated that sildenafil, the firstly used PDE-5i, positively influences exercise capacity in subjects affected by cardiopulmonary diseases (e.g. pulmonary hypertension) and in healthy subjects in hypoxic conditions. Some Authors also hypothesized that subjects with particular responsiveness to the exercise-enhancing effect of PDE-5i, in hypoxic condition, exist. In contrast, other Authors observed that the evaluation of the effects of sildenafil on exercise capacity at a simulated altitude did not provide conclusive data.

In healthy male athletes we observed that, compared to placebo, a single tadalafil (i.e. a long-term PDE-5i) administration significantly reduced systolic BP before and after exercise, decreased O2/HR at individual ventilatory threshold (IVT), but did not influence individual O2 max, IVT, and individual anaerobic threshold. Furthermore, we observed that, compared to placebo, tadalafil administration was able to amplify the mean salivary C and T responses to a maximal physical exercise, with concomitant further decrease of salivary DHEAS/C and T/C ratios. We hypothesized that in our experimental conditions, tadalafil could have: a) influenced the CNS sensitivity threshold to exercise-related stress, and/or, b) maximized, at different levels, the HPA and HPG response to physical stress, and/or, c) influenced the cytochrome P450 (CYP) 3A-mediated steroids metabolism.

Athletes taking PDE-5i, and also their physicians, are still unsure whether PDE-5i in some sports might negatively influence performance or whether specific health risks, related to the interaction between intense physical activity and PDEs inhibition, exist.

The observed effects of PDE-5i on exercise performances may be relevant not only in terms of therapeutic use of PDE-5i for diseases other than ED, but, if further confirmed, also in terms of their possible fraudulent utilization to influence exercise performance in sports, raising the difficult question of whether, particularly in some circumstances (e.g. high altitude and/or induced hypoxia), the PDE-5i might be considered as "prohibited substances" (i.e. doping) in athletes. Moreover, very few investigations are actually available when the effects of PDE5i on sport performance are concerned. Particularly, it remains to confirm if a non-therapeutic PDE5i administration in athletes at higher doses (i.e. non-therapeutic) or a prolonged use influences sport performances in field conditions.

Studies to verify the effects of different PDE5i treatments on both athlete's health and exercise performance, and to explore all the pathways involved are warranted.

Upper extremity problems in children (Maladaptation and chronic syndromes of the shoulder)

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Pediatric participation in sports increases each year. Sports injuries in children becomes an important topic consequently. A considerable percent (%32) of serious injuries in children (5-17 years) occurs during sports and/or recreational activities.Girls are effected less than boys. (%20, %40 respectively).

Chronic Sports injury in a child is caused by chronic submaximal trauma repeating over the healing capacity of the body (microtrauma, overuse, misuse) and comes to stage as tendinopathy, stress fracture, osteochondritis, traction apophysitis, maladaptation (flexibility and strength). The deforming forces either acute or chronic has effects on growth plate, apophysis, immature muscle development may cause permenant damages if not prevented and/or treated.

Shoulder maladaptation and chronic injuries in children are common in sports with repeating overhead movements. Chronic shoulder injury in a child can occur because of internal factors like; immature musculoskeletal system, poor dynamic shoulder stabilization, improper technique. There may also be external factors as; level of competition, quality of the sports, improper sportswear and protective equipments, frequent competitions, and improper training program.

Chronic injury of a child may come to scene as rotator cuff injury or SLAP lesion which is easier and more effective to prevent than treat. For prevention we have to be aware of two important concepts of the body motion.

The first one is 'anticipating postural adjustments' (APA). This can be defined as the position, body takes during kicking, throwing, and running to provide the balance and keeps on with programmed muscle activations. The muscle activations generate and control forces by providing interactive moments and loading the joints.

The other concept is kinetic chain segment activation (KCSA). This term is the description for core activation for distal force development. The force is generated at the gravity center of the body (core activation) and transferred to the related extremity through the joints by muscle interactions to do the intentional movement (distal force development). As a matter of fact shoulder motions are not created by the periscapulary muscles but the whole body. APA and KCSA, provides body stability proximally while performing the activity distally in maximum strength.

Chronic injuries in children occurs due to technical and structural deficiencies in APA and KCSA. Kinetic chain segment activation is different in children. So should be the APA. Therefore to diagnose and treat the weak ring in the chain will prevent the forthcoming shoulder injury in pediatric athletes.

Driver's physical condition, physical training a WTCC experience

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An explanation of the fundamentals of how a WTCC Racing Team prepares and maintains its pilot's physical condition. Includes detailed explanations of what the driver's job is, his physical necessities, how to adapt a personalized training program to improve the driver's results and how to structure a recovery or recuperation program after a race or accident.

Motor Sport competitions vary, from cars to motorbikes, but the basics of the physical training for drivers are common for all. A motor sport team needs the contribution of a large number of members and all the efforts are focused on improving the performance of the car and the driver. The mechanical parts of the car are looked after by engineers and technicians, the driver is looked after by a doctor, a physiotherapist and a physical trainer. Not only does the driver travel around the world for demanding races and tests, but he also attends manufacturer's and press events.

Driving a car is an aerobic activity, although it may become anaerobic, especially when fighting to win. The driver needs to resist high temperatures wearing an overall, fireproof underwear, balaclava and helmet. In addition to the stress of the race, car control requires a huge muscular effort in an oppressive position which produces high levels of peripheral and central fatigue.

OBJECTIVE

1. General Endurance; Resilience to long-journey duress. (heat, cold)
2. Muscular Endurance and Balance: Permanent and complete car control.
3. Body Composition; Ideal balance between body weight, fat percent and muscular percent.

Basic and Functional training.

Basic training is focused on general endurance. Even if drivers enjoy sports training, time limitations require that all the training sessions be previously scheduled. Physical activity should be fun, and for drivers this implies "wheels and engines" such as: cycling, motor bikes, snow and water bikes, skiing, ice hockey, beach volley. Balanced nutrition guidelines should be established and body composition monitoring should be effected monthly.

Functional training enhances propioception skills and enables the driver's ability to fully control body movements even when the car is shaking during a crash. Balance training is presented as a challenge, starting from a basic level the driver increases the difficulty of the exercises on a weekly basis using fit-balls, bosus, elastic bands, balls, and bars. The driver's strength is increased but not his weight or volume.

Complete recovery after a hard day of racing and testing is just as important as pre-race training. Drivers are instructed in stretching and yoga techniques to relax their muscles. They get physiotherapy treatment to prevent and treat muscular soreness and joint swelling, particularly the cervical area which is difficult to stretch individually. Spa bath and sauna sessions are used when available.

Prevention of dental trauma in contact sports

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In contact sports, players physically interact with each other, trying to prevent the opposing team or person from winning. Contact sports such as rugby, hockey, boxing, basketball or martial arts belong to the high-risk sports. A blow or kick from the rival most often causes injury to one tooth, while a fall or blow from a hard object often results in injuring more than one tooth. Enamel fracture, crown fracture with or without pulp exposure, root fracture, luxation injuries, avulsion and fracture of the alveolar process are types of dental trauma. Dental damage following these injuries is usually irreversible and can cause functional, esthetic and psychological impairment.

Prevention of these injuries must be the prime emphasis of sports dentistry. With the introduction of mouthguards at about the turn of the century and their widespread use, there has been a reduction in sports-related dental injuries. Mouthguards have a significant role in absorbing and dissipating very important part of the energy in the impact zone. Its main functions are reduction of the impact of direct and indirect contacts resulting in the orofacial injuries, soft tissue lacerations, temporomandibular joint damage, concussion, and mandible fractures.

It must be kept in mind that various mouthguards have, to some degree, an injury-preventing effect. Many sports-related dental and orofacial injuries can still occur regardless of whether a mouthguard is worn or not. The obvious cause of injury in mouthguard-wearing cases is when the impact force far exceeds the protective capability of a mouthguard. However, the ordinal impact power in sports is estimated to be smaller than that found in traffic accidents and mouthguards are found to be the most effective way of preventing dental injuries.

It is usually found difficult to wear the stock or boils-and-byte type of mouthguards, because of oral dryness, nausea, instability, difficulties in breathing and speaking. New studies report that such kind of problems and the performance of the athlete are not negatively affected, when a custom-made type of mouthguard is used.

Over the recent years, there has been an increasing interest in studies related to the protective properties of mouthguards like reinforcement by various techniques for better shock absorption, better adaptation and some other details for athletes' satisfaction, which will be focused on in this lecture. Besides the importance of sports dentistry and the role of sports institutions on increasing the awareness of mouthguard use will be emphasized.

Stretching: Effects of strength and injury prevention

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Many athletes use some type of pre-participation warm-up routine to prepare themselves for athletic practice or competition. Traditionally, these warm-ups have included some form of stretching, and stretching has been commonplace in a multitude of sports. Many athletes, athletic trainers and other rehabilitation professionals believe that stretching promotes better performance and/or reduce the risk of musculoskeletal injury during strenuous exercise or strength assessment tests by improving flexibility or pain-free range of motion about a joint. Athletes and coaches use many different types of stretching that are usually based only on their personal preference, but no optimal type or amount of stretching has been identified. There are various techniques of stretching, including ballistic, proprioceptive neuromuscular facilitation (PNF), static, and dynamic stretching. Among these, static stretching is widely used because its application is easy and safe. Recently, numerous studies have examined the effects of static or dynamic stretching on maximal isometric, concentric, or eccentric dynamic muscle strength. Typically, it was shown that pre-exercise static stretching may temporarily compromise a muscle's ability to produce strength either isometrically or isokinetically. In contrast, some evidence exists indicating that dynamic stretching exercises may improve muscle strength performance. This has implications for athletes involved in sports that require high levels of strength and force production. Some researchers have proposed that static stretching prior to competition may hinder performance and prompted recommendations that static stretching be omitted or replaced by dynamic stretching during warm-ups. On the other hand, stretching is commonly perceived as an important way to prevent injury by the public, sports coaches and sports medicine professionals. However, in the literature, conflicting data have been reported concerning the relationship between flexibility and athletic injury. The literature reports opposing findings from different samples. A number of reviews of the stretching literature exist, in which authors advocate stretching as an important part of an injury prevention program, although these conclusions are not based on any clinical evidence. But, at the same time, other numerous recent systematic reviews on this matter have shown no evidence that stretching does, in fact, reduce injury risk. Therefore, no definitive conclusions could be drawn as to whether stretching reduces the incidence of exercise-related injury due to the heterogeneity and poor quality of the studies. Consequently, based on the studies in the literature, there is not sufficient evidence to endorse or discontinue routine stretching to prevent injury among competitive or recreational athletes. Better research is needed to determine the proper role of stretching in sports, especially as there are increasing numbers of athletes and growing recognition that all people need to increase their physical activity to improve their health and quality of life.

Prevention of football injuries

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A program of sport injury's prevention is mandatory in medical support to sport activities. Working in a club with more than 150.000 affiliated and with a sport activity more than 2500 a day, we have to plan a program that can reduce the number of injuries. Twenty years ago European Council organized a program of Sport injury's prevention and in the following years different sport organizations adapted those recommendations. In our Club, SPORT LISBOA AND BENFICA - SLB, we organize the program in classic items.

Primary prevention: Characterize the risk factor (intrinsic and extrinsic)
Secondary prevention: Correction of risk factors
Tertiary prevention: treatments of dysfunctions

The medical department is multidisciplinary; we have sport medicine doctors and orthopedics and other specialties physiotherapists, psychologists, nurses, physiologists, nutritionist, homeopaths and administrative support. Organize a program in different sports is difficult and we began with soccer and we are now speeding to basketball futsal, volleyball, handball and roller skating. In the beginning we have a deep dialog with all the staff (technicians, coaches etc.). In the material support we have to “built” new gymnasium and to organize the training camps and in the stadium, new methods of registration of the mobility of the players. For each player we have a registration of medical condition, psychological, nutritional conditional capacities and we evaluate cardiac and biochemistry adaptations every training and game. Special program of UEFA, surveying of sport injuries is already available. We asked to be included in that program. After two years working with the program or sport injuries prevention we have in season 2008/2009 very good results.

Workshop ultrasound of the wrist and hand

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The wrist and hand have a very complex anatomy that is well demonstrated on modern high resolution ultrasound. The first part of this workshop will refresh relevant anatomy, the second “hands on” part will demonstrate these anatomic pecularities, where as in the last part the relevance of this anatomy will be demonstrated in pathological cases. The regions that are addressed are the dorsal hood and extensor mechanism, the flexor tendons, the ulnar collateral ligament of the thumb with special interest in the detection of Steners lesion. The ulnar nerve and Guyon’s canal. And the extensor compartments with special focus on the first (De Quervain’s) compartment and the sixth or ECU compartment.

Olympic performance: beyond genes & genome

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My main argument in this presentation is that the traditional dyad of genes and environment, as a cause of top sport performance, may require revision to consider epigenetic influences witch play a crucial role in regulation of genotypic functions of complex human traits, and hence, we need to go beyond gene and genome to understand the nature of Olympic performance.

Genetic influences. Heritability estimates for phenotypes related to sport performance is in the 50-90% range. Findings from twin studies lead to the conclusion that genetic influence is so ubiquitous and persuasive in sport performance that we now ask: not what is heritable, but what is not heritable. During the past decade, Quantitative Genetics and Molecular Genetics have began to come together to identify specific genes responsible for substantial heritability of determinants of sport performance, although so far no definite evidence was found that DNA sequence variants in a given gene is reliably associated with performance variation.

Environmental influences. A high heritable attributes does not mean that it is unaltered, fixed and predetermined and the environment has no effect. It only indicates that observed individual differences in the given attribute are due to genetic differences and are highly predictable. Genetic potential is not a passive possibility, but an active disposition, actualized through laborious effort and the sweat of the brow. However, training can exert its profound effect only with the fixed limits of heredity.

Epigenetic influences. The picture emerging is consistent with the notion that superior sport performers are endowed with high genetic potential for their specific sport, actualized through hard, prolonged and prodigious effort. Yet, there is an increasing body of experimental evidence suggesting that epigenetic influences may play an important role in superior performance. The process of epigenesis mediates variations in gene expression that occur in response to changes in a person’s internal and external environment. It has been shown that young identical twin pairs are essentially indistinguishable in their epigenetic markings, in various tissues including muscle, whereas older identical twin pairs exhibit remarkable differences in their overall content and genomic distribution of 5-methylcytosine DNA and histone acetylation, affecting their gene – expression profile.1 Findings we obtained from identical twin athletes of Olympic level are consistent with an important role of epigenetic alterations in both biological and behavioral phenotypes. Apparently such alternation inevitably mold our DNA, silencing some genes and promoting the expression of others, thereby facilitating cognitive, emotional and behavioral changes that empower the athlete to push himself to his limits.

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Can supplements increase performance? Should they be on the list?

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Recent reports show that between 70 and 100% of all athletes use nutritional supplements. Total global consumer spending on nutraceuticals (dietary supplements for sport and health reasons) is estimated at $187 billion and still rising with 6-7% per annum.

Nutritional supplements among others are used by athletes to enhance energy supply and performance, to enhance recovery from exercise and anabolic effects in muscle, to enhance immune system function, and to enhance performance via effects on the central nervous system. Properly designed scientific studies for many popular supplements have failed to confirm the effects claimed by suppliers. This review lecture will focus on creatine, caffeine, and bicarbonate: 3 supplements for which hard scientific evidence has been generated that they have an ergogenic effect using properly designed performance tests in several laboratories and confirmed by evidence on the underlying mechanisms. Creatine improves high intensity intermittent exercise performance in laboratory conditions. This effect is not of particular practical relevance in athletic events, but is most useful in soccer, hockey etc, that is in events that depend on outrunning members of the other team in repeated sprints. As 1-3 kg weight gain is a side-effect and as there is no effect on endurance performance, its use is better avoided by endurance athletes. No evidence has been published for its claimed muscle anabolic effect in humans. Caffeine improves exercise performance in events lasting > 60 sec, but its effect on sprinting performance is inconclusive. Ingestion of 5-6 mg/kg bw (3-6 cups of coffee) can improve performance; ingestion of more does not lead to larger effects. Caffeine has central effects, but the exact mechanism still is not known. Caffeine potentially reduces muscle glycogen breakdown, but there are many studies that have failed to find this effect. Bicarbonate ($NaHCO_3$ 300 mg/kg) ingestion 1-3 h before exercise improves performance in events lasting 0.5 to 7 min, but may lead to nausea, gastro-intestinal discomfort and diarrhoea. The effect is most likely due to increased efflux of intracellular lactate and H^+, leading to a delay in a critical decrease in intramuscular pH that impairs metabolic and contractile function. Finally some critical notes will be made on the excessive use of sports drinks containing antioxidants as several free radicals play important roles in exercise induced microvascular recruitment and training adaptation.

Why anti-doping? The need for an operational ethics

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During the last decades there has been a steady increase in the kinds and numbers of bio-chemical and bio-technological means for physical and mental enhancement. International surveys show that attitudes towards such means seem to change in a liberal direction. The heated debate over WADA's whereabouts system may be an indication of more serious public challenges to anti-doping in the time to come. Anti-doping needs a clear and operational ethical justification that is easy to communicate in convincing ways.

In the WADA Code, doping is defined as fundamentally contrary to 'the spirit of sport'. 'The spirit of sport' is explained as '…the celebration of the human spirit, body and mind and is characterized by the following values: ethics, fair play and honesty; health; excellence in performance; character and education; fun and joy; teamwork; dedication and commitment; respect for rules and laws; respect for self and other participants; courage; community and solidarity'.

Although these are key values in sport, the references are of a general kind and hard to apply when it comes to concrete cases. Some values, such as fairness and health, can also be twisted in the direction of a more liberal doping policy. By combining a view of sport as the 'virtuous development of talent' (Tom Murray) with biological insights, an outline will be given of an operational interpretation of 'the spirit of sport'. Such an interpretation holds that the development of talent towards sporting and human excellence implies utilizing the adaptive responses of the human organism as developed through evolution, and not overruling such responses with external means. This view will be elaborated, and an argument will be given that an operational anti-doping ethics can be communicated to the public in simple and convincing ways.

The 2010 prohibited list – open questions

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The World Anti-Doping Program is composed by three levels of documents. At the first level we have the most important document - the World Anti-Doping Code, describing the major principles of the fight against doping. At the second level we have five international standards, describing different practical procedures to be followed by all anti-doping organizations worldwide. At the third level we have the model guidelines, that are very pragmatic documents, and not mandatory as the previous ones.

The Prohibited List is a level two document that defines the prohibited substances and methods. The Code defines the criteria that must be fulfil to determine the integration of one substance or method in the List: 1 - Medical or other scientific evidence, pharmacological effect or experience that the substance or method has the potential to enhance or enhances sport performance; 2 - Medical or other scientific evidence, pharmacological effect or experience that the use of substance or method represents an actual or potential health risk to the athlete; and 3 – WADA's determination that the use of the substance or method violates the spirit of sport described in the introduction to the Code.

The Prohibited List is revised at least once a year. The annual revision of the Prohibited List is an elaborate and dynamic process involving international scientific experts and the solicitation of input from stakeholders so that changes are founded on expanding anti-doping knowledge and trends. The development of the Prohibited List begins with the circulation of a draft to stakeholders. Comments received are considered by WADA's List Committee, who then presents its conclusions to WADA's Health, Medical and Research Committee. This Committee submits its final recommendations to the Executive Committee, who discusses the recommendations and makes a final decision at its September meeting. The Prohibited List is published in the WADA's website at October 1st, in order to allow the anti-doping organisations (international federations and national anti-doping organisations) to inform their affiliates about the new Prohibited List that will be in force in January 1st.

The construction and the revision of the Prohibited List represents a very difficult task taking in consideration the huge amount of prohibited substances and methods and also the complexity of the scientific methods involved in their detection. To increase even more the complexity of detection some prohibited substances are also produced endogenously.

The objective of this presentation is to underline some open questions concerning the Prohibited List and the inherent detection methods in the following sections:

S1. Anabolic Agents – the limitations of IRMS analysis and the importance of endogenous steroid profiling in the endocrinological model of the Athlete's Passport;

S2. Peptide hormones, growth factors and related substances - The use of hypotalamic releasing factors, the development of new erythropoiesis-stimulating agents and the enhancement performance properties of different route of administration of platelet-derived preparations (e.g. Platelet Rich Plasma, "Blood Spinning");

S3. β-2 Agonists – Need to determine a threshold level for the detection of formoterol and terbutaline;

M1. Enhancement of Oxygen Transfer - Difficulties to detect autologous blood transfusions and erythropoiesis-stimulating agents with very narrow windows of detection and the importance of blood profiling in the blood model of the Athlete's Passport;

M2. Chemical and Physical Manipulation – The inclusion of proteases as an example in the prohibited list;

S6. Stimulants – Scientific bases for the reintroduction of pseudoephedrine;

S9. Glucocorticosteroids - Difficulties in establishing the way of administration of glucocorticosteroids taking in consideration the detected urinary concentrations and need to define different threshold levels for detection.

Finally we underline the importance of the WADA's program for financing research projects in order to revise the Prohibited List and improve the methods of detection. WADA committed more than US $ 44 million to that program since 2001.

Should oxygen be on a prohibited list

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In the draft of the 2010 prohibited list for the first time is prohibited the use of hyperoxic conditions, except for medical emergencies and in those sports where the use of supplemental oxygen is mandated as a safety requirement (aeronautic, mountaineering). This raised attention of various groups of experts, as well as athletes. There are no clear definitions of hyperoxic conditions, but one of the definitions for hyperoxia is a condition characterized by greater oxygen content of the tissues and organs than normally exists at sea level (Merriam Webster dictionary). In reality, we could make greater oxygen content in our body by breathing pure oxygen from the bottle, by using hyperbaric therapy or using different kinds of hypoxic devices, including living in the hypoxic environment. All methods are providing more oxygen in our tissues. Does it mean that all those methods are forbidden? For example hypoxic training is frequently used by competitive athletes to improve sea-level performance, but benefits are controversial. Hypoxic exercise may increase the training stimulus, thus magnifying the effects of endurance training, but conversely, hypoxia limits training intensity, which in elite athletes may result in relative deconditioning. Even modern approach of living and training at altitude have not been proven to be advantageous compared with equivalent training at sea level. Totally the opposite hyperbaric oxygen (HBO) therapy is defined as a medical treatment in which the patient breathes 100% oxygen intermittently while inside a chamber at a pressure greater than 1 atmosphere absolute. The Undersea and Hyperbaric Medical Society currently approves 13 medical indications for treatment with HBO. But certain sport experts try to direct professional and college athletic teams to use HBO to treat sports injuries, to speed recovery after exercise, and as an ergogenic aid to enhance performance, but without real proof of the oxygen activity. Finally, bottled oxygen is the most frequently accessible method by many athletes. When is acceptable and justifying using that kind of oxygen and other methods, it is the open question which should be discussed. There are many guidelines for using the oxygen and only WADA seeks international harmonization to prohibit it. Oxygen should not be added to the list, since there is no clear evidence that enhance performance, has negative health effect and it is against the spirit of sport, which means that doesn't fulfil the criteria for doping substance.

The role of exercise in osteoporosis management

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Osteoporosis is a condition of decreased bone mass which leads to an increased risk for fractures. It is a predominantly silent disease that has become a major public health problem in Europe and the rest of the world, especially amongst the elderly populations. By the year 2050 it is estimated that over one third of the European population will be over 60 years of age with the concomitant increase in the incidence of osteoporosis. In fact fractures of the hip are expected to double over the next 50 years. This will lead not only to a decrease in the quality of life of our elderly population but also of a significant increase in health care costs. Physical activity as part of a healthy lifestyle has an important role to play in the prevention and management of the osteoporotic patient. Exercise at a young age will help maximize the bone mineral density and if continued lifelong will continue to stimulate bone formation, strengthen muscles and improve balance and coordination. These are all important elements, not only to aid in the management of osteoporosis but also to reap multiple other health benefits. The chosen exercise ideally should involve weight bearing physical activities such as running and jumping. However, all forms of physical activity can benefit the osteoporotic patient since they contribute to an avoidance of falls and thereby decreased fracture incidence.

Hemodynamics of swimming in health and disease

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Swimming is a special kind of head out water immersion. Based on own results, this presentation demonstrates studies of central hemodynamic (heart rate, stroke volumen, cardiac index, Frank-Starling Diagram) response during stepwise increasing head out water immersion. In addition, respiratory function with respiratory mechanics, respiratory gas exchange and ventilatory control are shown with different depth of water immersion. These changes also do occur in patients.

Water immersion and training in water has to be critically seen in patients with high blood pressure, unstable coronary artery disease, heart failure or pulmonary hypertension. So-called swimming testing with telemetric ECG transmission is strongly recommended in patients with cardio-pulmonary diseases.

A some more moderate form of training is the newly developed aqua-riding. Aquajogging may be prescribed when legs cannot be used after sports injury but endurance training should be done.

Today, the effect of regular training swimming as an approach to primary prevention has not been demonstrated by an evidence based investigation. Prospective cohort studies are required to answer this question. In osteoporosis, swimming is without effect.

Proprioception: Definition, clinical importance and evaluation methods

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The ability that transmit the sensation of body position, perception and interpretation of this data and giving an conscious or unconscious reaction resulting in approximate posture and movement is called proprioception. Proprioception is a specialized variation of the sense of touch that encompasses the sensations of joint motion (kinesthesia) and joint position (joint position sense). Mechanoreceptors are the sensory receptors located in soft tissue articular structures. Three distinct morphological types of mechanoreceptors are situated within ligamentous tissue (Ruffini endings, Pacinian corpuscles, and Ruffini corpuscles), and two types of mechanoreceptors appear in the musculotendinous tissue that surrounds the joint (muscle spindles and GTOs). Mechanoreceptors function by transducing some form mechanical deformation into a frequency modulated neural signal which is transmitted via afferent and efferent pathways. The disruption of muscle and joint mechanoreceptors from physical trauma results in partial deafferentation of the joint and surrounding musculature, thus resulting in diminished proprioception. The results of current investigations indicate the need for proprioceptive training during any rehabilitation program designed to return athletes to preinjury levels of activity following ligament and muscle injuries. A lot of measurement methods of proprioception have been defined in the literature. Based on these measurements, scientists comment the proprioceptive status in some specific conditions. Has the proprioception influenced by braces, elastic bandages, surgical or conservative treatments, has the increased proprioception decreases the incidence of injury, enhances the sportive performance and the other questions about the proprioception aimed to be answered by measuring the proprioception with different methods. However, to measure the proprioception is difficult and cannot be done directly. Thus, the testing conditions are not the same with the instant of injury. Patients are usually in supine position, and their extremity is positioned in a computerized system for proprioceptive measurements. Non weight-bearing and static positions are not relevant to the injury position in the real life. Hence, it is doubtful that the existing measurement techniques and their results can reflect the real status of proprioceptive level in injured or uninjured persons. Another important issue on testing methods of proprioception is that they are not specific to a tissue, a ligament, capsule or a joint. For example, during a knee joint evaluation, the test results may be influenced by the pathologies of hip joint and/or ankle in almost all measurement techniques. Thus no test method can evaluate the proprioception separately when accompanying lesions are found in the same joint.

Sports traumatology, sports medicine and proprioception

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The primary function of proprioception is prevention of both traumatic and overuse related sports injuries. Other tasks of proprioception include providing the athlete return to sport activities safe again with reduced, or even without injury risk following injury or surgery and enhancing the sports performance of the athlete. It has been shown in a study that the majority of injuries during soccer occurred in the lower extremities with 81%. The most common injury type within these injuries was ankle sprains (17.2%). The authors concluded that the cause for this high ratio may be insufficient ankle joint stability and/or sensorimotor deficiency. In parallel some authors suggested that ankle sprains can be prevented by external ankle supports and proprioceptive/coordination training, especially in athletes with previous ankle sprains. Training of neuromuscular and proprioceptive performance as well as improvement of jumping and landing technique seems to decrease the incidence of severe knee and ACL injuries. Such prevention programs are likely to be more effective in groups with an increased risk of injury. A study regarding this issue exhibited with stretching, strengthening, plyometrics, proprioception, and sports-specific drills an 88% decrease following 1 year, and 74% reduction following 2 year in ACL injuries. Alike, it was stated again that using a neuromuscular training program may have a direct benefit in decreasing the number of ACL injuries. A recent article recommended as the most important initial treatment approach in patients with ACL injuries improving dynamic single-limb stance balance and training threshold for detection of passive motion (kinesthesia) proprioceptive ability. On the basis of, that osteoarthrosis is associated with decreased proprioception, incorporating a multi-station proprioceptive exercise program also in patients with bilateral knee osteoarthrosis exhibited 30-40% improvements in sensorimotor tests following proprioceptive and balance training. On the other hand, it was signified that subjective knee function is related to proprioception. This means, patients with ACL rupture having symptoms possess more proprioceptive deficits compared to asymptomatic patients. Besides, abnormal knee joint proprioception was also established in individuals with patello-femoral pain syndrome (PFPS) and authors advised here also that proprioceptive rehabilitation techniques should be incorporated into the treatment of PFPS. Differently, it was demonstrated that isokinetic exercise in rehabilitation protocols of patients with PFPS also has a positive effect in improving knee joint proprioceptive acuity. Regarding the role of proprioception in sports performance, a recent study emphasized that rhythmic gymnasts have developed abilities in postural stability, balance, and “transfer” to bipedal postural sway, especially in medio-lateral displacements and that these capabilities constitute an important role in their successful sports career. In conclusion, sensorimotor system is important in terms of preventing injuries and improving performance. It is crucial to evaluate, reinforce, and develop the sensorimotor system for scientists coping with sports injuries and sports performance.

New challenges for detection of doping in sport

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The inevitable use of growth factors for enhancing muscle strength and athletic performance is a major concern of the World Anti-doping Association as well as the antidoping agencies in individual countries. Although this now involves expert scientists with powerful analytical methods, the so called “counter culture” also includes well trained scientists, team doctors and coaches who are under pressure to ensure their sports people succeed. The Olympic Games as well as being known for what city they were held in have also somewhat cynically be named after the prevalent type of doping that has been used. We have had for example, the beta agonist, the EPO, the steroid games etc. Based on the present interest and the next games retrospectively, may be called the “growth factor games”. Recently, much effort has been expended on developing a treatment for muscle wasting associated with a range of diseases as well as in ageing. Emerging molecular techniques have made it possible to gain a better understanding of the growth factor genes involved and how they are activated by physical activity in young individuals. In addition to hGH and IGF-I two factors some growth factors such as MGF a type of IGF-I which is a very positive regulator of muscle hypertrophy and strength and strategies for reducing the negative effect of myostatin, will be described. As well as an initial method for screening large numbers of sports people it is necessary to have at least one confirmatory test that will stand up in a Court of Law to convince the Judge that a substance had been taken to alter the individual’s physiology advantageously. Developments in mass spectrometry combined with robotics and analysed by powerful computer programmes such as neural networks allow hundreds of blood and urine samples to be analyses within a day or so, to detect a changed metabolic profile to be detected. This is the new branch of chemistry known as “metabolomics”. In order to establish these methods, collaborative work was carried out with analytical chemists at Nottingham Trent University and the race horse testing laboratories at Newmarket UK. This initial screening approach enables hundreds of blood samples to be analysed within a day. We used blood from samples from mice and also human volunteers that had been “doped” using hGH and were used to determine abnormal patterns of metabolites such as leucine rich glycoprotein (LRG) which are good indicators of doping. Following this those suspected of doping are subjected to confirmatory tests which are more expensive in time and money but which is physiologically based and could lead to a conviction in a Court of Law. One confirmatory test that was established in the author’s laboratory will be described.

Results Management – from a reprimand to a life ban

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The revised World Anti-Doping Code that entered in to force last January 1st 2009 introduced more flexibility and proportionality in the sanctioning system of anti-doping rule violations. The article 2.1 “Presence of a Prohibited Substance or its Metabolites or Markers in an Athlete’s Sample” and 2.2 “Use or Attempted Use by an Athlete of a Prohibited Substance or Prohibited Method” defines two of the more important and frequent anti-doping rule violations. The Prohibited List defined two types of prohibited substances: the specified and non specified substances. The specified substances are those substances that can be used for therapeutic purposes and have low enhancement performance properties and most times the anti-doping rule violations concerned with these substances are due to negligence of the athlete rather than a real doping purpose.

As the general rule for anti-doping rule violations concerned with non specified substances, the period of ineligibility imposed for a first anti-doping rule violation shall be in general two years, unless the conditions for eliminating or reducing the period of Ineligibility or the conditions for increasing the period of ineligibility are met. For violations involving specified substances the period of ineligibility shall be for a first violation at minimum, a reprimand and no period of ineligibility from future events, and at a maximum, two years of ineligibility.

For multiple violations the Code defines a very broad spectre of sanctions, depending on the kind and seriousness of the anti-doping rule that were committed.

The objective of this presentation is to demonstrate, giving examples, the importance of the scientific expertise to support an ideal proportionality in sanctioning anti-doping rule violations:

Case one – a rider that participated in an international event had two adverse analytical findings for a glucocorticosteroid (betamethasone) and claimed that the results were covered by an abbreviated therapeutic use exception (ATUE). The scientific expertise demonstrated that the concentration profile of the concerned specified substance in the urine along the event couldn't be explained by the ATUE;

Case two - a football player had an adverse analytical finding for a glucocorticosteroid (methylprednisolone). The athlete and team physycian claimed that the result was cover by an ATUE for Methylprednisolone, where an intra-articular administration of 20 mg of that compound was declared 38 days before the in competition test and that the fact of a previous surgery on that joint could explain the delay in the urinary excretion. The delay could be explained to a chronic inflammation of the synovial membrane after surgery. The scientific expertise demonstrated that the concentration profile of the concerned specified substance in the urine couldn't be explained by the ATUE;

Cases tree and four – two athletes, one a football player and the other a rally pilot, had adverse analytical findings for cannabis – a specified substance. The first one was sanctioned with a reprimand ant the obligation to be submitted to tests for detection of social drugs lasting a minimum of six months and the second one was sanctioned with two years of ineligibility taking in consideration the risk of accidents caused by that administration to the pilot itself, to the co-pilot, to other competitors, officials and public.

Case five – a shooter had an adverse analytical finding for an anabolic agent (clembuterol), a non specified substance. The athlete and its defence claimed that the result was originated by an intake of meat in a "Rodizio" restaurant in Rio de Janeiro. The scientific expertise demonstrated that the concentrations of the substance found in the urine couldn't be explained by the ingestion of such a meal.

Case six – a rider had an anti-doping rule violation due to the fact that proteases were found in is urine. The purpose for it to be found there was to manipulate the detection of EPO. In this case the athlete used a strategy to deceive the anti-doping laboratory in the detection of EPO – this fulfils the conditions for increasing the period of ineligibility.

In conclusion, in the results management of some anti-doping rule violations, the scientific expertise can be decisive to fulfil the proportionality of the sanction.

Femoroacetabular impingement: Anatomy, pathofysiology and radiological imaging

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Femoroacetabular impingement has recently been recognised as a cause of early osteoarthritis. This impingement is particularly frequent in sports activities with forceful flexion activities at the hip as is the case in soccer players. Two mechanisms of impingement are recognised. Cam type is caused by a non-spherical head where as pincer type is caused by excessive acetabular cover. Both types of bone deformities are frequently encountered, in the series of Beck et al over 12 % of individuals were involved, cam type being almost twice more frequent than pincer type. Both deformities may exist together. These two types of bone deformities cause different types of articular damage. In cam impingement the cartilage is sheared off the bone during flexion, by the non-spherical femoral head while the labrum remaines untouched. This separation between labrum and cartilage is located at the anterosuperior acetabular cartilage. In pincer the impingement is caused by excessive cover of the head of the femur by the acetabulum. During flexion the labrum is crushed between the acetabular rim and the femoral neck causing degeneration and ossification of the labrum. Standing antero posterior plain radiographic examination of the pelvis is accurate for the detection of femur head and acetabular bone deformities that are responsible for cam and pincer impingement respectively. Labral and hyaline cartilage damage is responsible for the typical C pain at the hip region during the FADDIR (flexion, adduction and internal rotation of the hip) impingement test. The cartilage and labral lesions are best demonstrated on MR-arthrographic examination. De purpose of the presentation is to illustrate the pathophysiological mechanism of femoroacetabular impingement, to give diagnostic clues for the radiographic identification of the responsible bone deformities and to demonstrate the spectrum of cartilage and labral abnormalities that are encountered on MR-arthrography.

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Arthroscopic treatment of FAI (femora-acetabular impingement)

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WHAT IS FAI? Impingement itself is the premature and improper collision or impact between the head and/or neck of the femur and the acetabulum
TYPES 1-Cam-type : Excessive bone (bump) over femoral head and neck causes friction/ impingement.
2-Pincer-type : Overgrowth of the acetabular rim and acetabular version problem cause friction/ impingement.
3-Combined (Mixed) type: Cam + Pincer
When the extra bone on the femoral head and/or neck hits the rim of the acetabulum, the cartilage and labrum that line the acetabulum can be damaged
SYMTOMPS • Groin pain: Sports incluiding repetative hip hyperflexion and external rotation can cause intra-articular hip problems(soccer, ice scating,hockey,tennis,golf). Labral and chondral lesions can be seen in agilitiy sports (runners). • Pain during prolonged hip flexion and tortions (standing up from sitting position, wearing socks, puting on shoes , going up & down. • Walking uphill is also found to be difficult. • The pain can be a consistent dull ache or a catching and/or sharp, popping sensation. • Pain can also be felt along the side of the thigh (L3 dermatome) and in the buttocks. • Byrd – C sign
DIFFERENTIAL DIAGNOSIS • Back pain, • Arthritis, • Apophyseal avulsions, • Pubalgia, • Avascular necrosis, • Benign Tumors (Osteoid osteoma, Osteochondroma), • Chondral lesions, • Dysplasi, • FAI, • Gastrointestinal or genitourinary problems, • Gluteus medius syndrome, • Hernia, • Hip joint instability, • İliopsoas snapping hip, • İliotibial band snapping hip, • İntrapelvic disorders, • Labral tears, • Legg-Calve-Perthes disease, • Ligamentum teres rupture, • Loose body, • Musculotendinous sprains, • Osteitis pubis, • Osteochondritis dissecans, • Pigmented villonoduler synovitis, • Piriformis syndrome, • Sacroiliac disorders, • Siatalgia, • Septic arthritis, • Slipped capital femoral epipyhsis, • Stress fracture, • Synovial Chondromatosis, • Synovitis, • Throcanteric bursitis,
DIAGNOSIS • Physical examination : Impingement test (+) : Pain during flexion+adduction+internal rotation of the hip joint in the intra-articular problems, • X-Rays: Standard AP and Frogleg (Abduction+external rotation) x-ray: (Femoral bump, Acetabular rim overgrowth,Calcified labrum, Acetabular cross-over sing can be seen), • ArthroMRI: MRI taken after injection of intra-articular solution of 0.2cc Omniscan + 20cc SP + 6ccCitanest + 8cc Omnipaque under flouroscopy (Acetabular labral tear and chondral lesions can be visualized Decrease or loss of the pain after injection in 4-5 minutes means intra-articular problems.
CONSERVATIVE TREATMENT • Rest, • Activity modification (restriction of activities which includes hip flexion over 80 degrees like squating,cycling,leg press, backward running...etc), • NSAID, • Postural rehabilitation(to decrease pelvic inclination), • Restoration of pelvic ring reclinination with abdominal and gluteus maximus muscle strengthening + iliopsoas and paravertebral muscle stretching which can decrease anterior coverage of femoral head
SURGICAL TREATMENT • Open Surgery (with safe dislocation): Increased avascular necrosis risk, Morbidity of Trochanteric osteotomy , Prolonged rehabilitation period, Cosmetic problems.
ARTHROSCOPIC TREATMENT OF FAI Under general anesthesia with the traction table and flouroscopy control, hip arthroscopy is started from anterolateral portal. Then anterior portal is opened. Depending on surgeon needs, additional portals (porximal-distal anterolateral portals) can be placed. With these portals, central compartment arthroscopic procedures can be done (Acetabular rim (pincer) resection, labral excision or labral repairs with anchors).After central compartment arthroscopy, the traction is released and hip flexion up to 45 degrees and portals are replaced from the same skin insicion to femoral neck region for peripheral compartment arthroscopy. With these position and portals, femoral neck bump (cam) resection can be done.
POSTOPERATIVE TREATMENT• 1-2 days hospitalisation, • Mobilisation with crutches (30-50 % weigth bearing), • Full weigth bearing after 2 weeks, • Leave up cruthes after 3 weeks, • Non-weigth bearing for 6 weeks after microfracture procedure, • Running after 6-8 weeks, • Return to sports after 3-4 months, • Studies have shown that 85-90% of hip arthroscopy patients return to sports and other physical activities at the level they were at before their onset of hip pain and impingement
COMPLICATIONS • Numbness on groin region (excessive and prolonged traction causes temporary nerve paralysis), •Temporary impotance in males (traction can cause pudental nerve neuropraxia), • Stress fracture of femoral neck (excessive femoral neck resection), • Decubitus lesions over scrotum,perineum,labia depending on traction, • Retroperitoneal fluid extravasation, • Iatrojenic chondral and labral lesions, • Intra-articular breakage of guide pin/ surgical equipments, • Heterotrofic ossification, • Avascular necrosis of femoral head, • Infection, • DVT, • Hip instability(excessive capsular release).
CONCLUSION Hip arthroscopy is indicated when conservative measures fail to relieve symptoms related to femoro-acetabular impingement, a condition that has been poorly understood and under-treated in the past. Advances have made hip arthroscopy a safe and effective alternative to open surgery of the hip, a tremendous advantage in treating early hip conditions that ultimately can advance to end-stage arthritis

EMG applications in sports medicine

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Earlier studies have proven that high-level athletes have a different activation-relaxation and/or co-contraction strategies than that of middle class or beginners. These findings motivates the researchers to concentrate on defining certain strategies for given sports branches. The purpose of the current paper is to share the latest findings of high-level athletes in archery, female volleyball and soccer.

The findings that will be presented in this session have been gathered by using basically Electromyography (EMG). So, the current manuscript tries to define both some certain muscular activation-relaxation and/or co-contraction strategies in given sports branches and mention the importance of EMG findings in evaluating high-level performance.

The first findings will be from sport archery and the muscular activation strategies during the release of the bowstring. Two different muscular activation strategies have been defined in the literature. In the first strategy, archer releases the bowstring by actively contacting the forearm extensor and gradually relaxing the forearm flexor muscles. The archer releases the bowstring with clear relaxation of forearm flexors and without active involvement of forearm extensors in the second strategy. The second strategy is known to decrease the lateral deflection of the bowstring, which is reputed to increase the score on the target.

As for the studies related with male soccer, the findings have demonstrated that high level soccer players show more agonistic activation during forward swing and ball contact phase and less antagonistic activation during follow through; whereas middle class soccer players demonstrated less agonistic activation during forward swing and ball contact phase and high antagonistic activation during follow through phase during the kicks to a stationary ball. It has been concluded that to increase ball speed on target; one should (1) increase the contraction values of Vastus Lateralis (VL) and Vastus Medialis (VM) during forward swing and ball contact phase, and (2) decrease contraction values of Gastrocnemius (GAS) during backswing and follow through phase.

The results that were related with high-level female volleyball players have shown that agonist-antagonist contraction ratios and coordination, landing technique and intramuscular coordination are the important factors for countermovement jump. Having high GAS activation values during landing may be explained by landing technique. VM, VL, GAS, GM and BF muscles are activated before ground contact in order to stiffen the joint in preparation for touch down. It can be said that pre-activation is important for the jumping performance. For the female volleyball players, it has been concluded that high level volleyball players showed higher muscular activation during propulsion phase, but lower during landing and post landing phases compared with control group.

In conclusion, high-level sportsmen have different contraction-relaxation and/or co-contraction strategies. These strategies may be used for; 1. Selecting talented athlete for given sport branches, 2. Decreasing the occurrence rate of any type of injury and 3. Monitoring the athlete's development.

The hazards of DXA, BMI and other golden standards

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Human Body Composition (BC) is characterized by data acquisition techniques classified in various models (morphological and chemical). For adiposity matters, single measures, indexes and prediction formulae have been validated using a variety of "golden standards". Hypothetically, different techniques should provide the same outcome. However, preliminary work indicates, the opposite.

Different techniques provide exact, identical and reproducible values, or, are these values simulations, approximations or predictions? Fact is that all in vivo techniques deliver indirectly obtained values. Fact is that many of these indirect techniques have been validated against other indirect techniques. Fact is that some golden standards never were validated against direct data. Fact is that for the clinic and public health, accuracy and precision are essential. Fact is that these issues have become manufacturer-dependent and not always quality controllable. The borderline between assumptions, predictions and accurate precision has become too vague and is too often ignored. The purpose of this work is to verify the value of 3 (indirect) standard BC systems, against direct values. The quality control of BMI, DXA and hydrodensitometry, respectively, will be dealt with separately.

I. The Quetelet index (1832-1972) or the BMI (1972-…).

The use of BMI as an indicator of BC is based on its correlation with indirectly obtained values of adiposity.

Direct evidence for the validity of BMI as an adiposity index is lacking. The relationship of BMI with total body AT and other BC constituents is explored in human cadavers (N=29). Correlations between BMI and BC constituents were calculated and prediction equations with BMI as the dependent variable and all BC constituents as independent variables were developed. BMI was moderately related to AT but much stronger to bone mass. AT, nor its BC constituents improved the prediction. BMI is not an appropriate adiposity index in particular for elderly persons. The high proportion of unexplained variance between BMI and direct adiposity mass limits its use as a BC index. BMI might be an index for bone mass rather than for adiposity, and is not an indicator for stress, cancers, cholesterol, diabetes or obesity. The use of the BMI as measure of adiposity is not justified.

II. DXA, DEXA … Dual Energy X-Ray Absorptiometry.

Reviewing the literature of DXA application, one cannot avoid obtaining a controversial impression of this method of choice. Some studies support the DXA technique as convenient for % Fat, Lean Body Mass (LBM) and Bone Mineral Content (BMC) measures. Other studies suggest a violation of basic biological assumptions. Twelve porcine carcasses, viscera included, were measured with DXA and CT before dissection into its major components. Soft tissue samples allowed for chemical and hydration analyses and the complete skeleton was ashed for BMC. Part of the problem results from erroneous terminology. The predictive character of DXA is good. Significant differences indicate that clinical precision is at risk.

III. Hydrodensitometry.

Hydrodensitometry combines hydrostatic weighing and the calculation of (i) the body volume and (ii) density. This density is used to calculate % Body Fat. Hydrodensitometry was previously a golden standard, but has been criticized suggesting a violation of basic assumptions underlying its use. Despite numerous signals of error hydrodensitometry is used to day in sport medical laboratories still. Fat prediction anomalies in combination with in vitro information of bone densities and hydration should reinforce earlier criticism. In studies of middle-distance, marathon runners and professional football players 10 had negative AT with 2 subjects estimated at -12% AT. Biologically, this is impossible. Direct anatomical cadaveric data confirm a high inter- and intra-individual bone density hydration variability, re-confirming that the 2-component hydrodensitometry model is invalid and that it has been an erroneous reference for many in vivo BC studies in the past.

Methodological problems in body composition evaluation

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This paper attemps to give a brief overview of methodological problems in assessing athletes body composition measurements in field and laboratory settings. There are number of different methods available for field and laboratory settings. The available methods are based on concepts driven from five level, and two, three, four, and multiple compartment models of analysis of human body. Majority of the body composition contents are based on some assumptions, comparisons, calculations, and estimations. As the number of estimated compartments or contents of body composition increase, the amount of inherited error of calculation in the mathematical assumptions increase. Therefore, most of the body composition methods used have some inherited errors, based and assumptions of measurements and calculations. Using above mentioned basic concepts, there are number of widely used methods available in laboratory and field settings. Some of these methods are named as direct and some as indirect methods. Direct methods are used on human and animal cadavers with some chemical approaches in order to determine the amount of different tissues in the body, and, therefore, they are not used on living bodies. In some cadaver based studies the number of cadavers from which the mathematical modeling is driven can be the sourse of error. For example in Brozek et al, (1963) modelling there were only 3 cadavers on whom the density equations were driven for fat mass and fat free mass. Despite this direct methods are considered to have high validity, and are used to validate indirect methods. Among indirect methods hydrostatic weighing, anthropometric methods, bioelectric impedance methods, infrared interactance, and some part or whole body counter methods such as dual-energy x-ray absorptiometry are used.

The skinfold: Myth and reality (revisited)

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More than 10,000 studies and over 450 formulae using skinfolds to predict body fat reflect the extent of its popularity. Basic assumptions to understand the skinfold measure are tested with dissection data of 3 different cadaver collections.
Assumption I. A calliper produces a constant skinfold compressibility at all sites of the body? Skinfold thickness,

direct depth measurement of the subcutaneous adipose tissue (AT) layer and radiographic depth, skinfold compressibility could be obtained for each site. It was found that skinfold compressibility is by no means constant.
Assumption II. Skin thickness is a negligible part or a constant fraction of the skinfold? All skinfold measurements contain a double layer of skin of unknown thickness. Skin thickness was most marked at subscapular level, where it accounted for 28.1% of the skinfold reading (34.0% for males, 23.9% for females). The subscapular and triceps sites are most commonly used for predicting AT but have quite different proportions of skin. Skin thickness can lead to 30% error of the AT patterning.
Assumption III. AT patterning is constant (equal) all over the body? The patterning of subcutaneous AT exhibits large variations between individuals. To assess the value of various sites within the same individual, correlations between the calliper and incision thickness with the dissected subcutaneous adipose tissue mass are needed. Of the six best sites, all but one were on the lower limb. The triceps, a highly favoured site for 'fat' prediction ranked (a poor) eleventh. The best predictors were front thigh, medial calf, rear thigh and supra-spinale. But AT patterning is under no circumstances equally divided over the body.
Assumption IV. Predicting fat of the human body is conditional to the fat content within the AT? The assumed constancy of the 2-compartment model is no longer valid. Reported values range from 5.2 to 94.1% (generally in the range 60-85%). The fat content of AT increases with increasing adiposity. 'Fat' is ether-extractable, e.g. lipids, whereas 'adipose tissue' is a morphological entity. Confusing the two has become colloquial and should be avoided.
Assumption V. Skinfold callipers are only able to estimate subcutaneous adiposity? In order to estimate total body adiposity some assumptions must be made about the relation between internal and subcutaneous AT. Proportionality provides a rationale for the use of skinfolds, unless internal AT should be negligible, again providing justification for the use of callipers. Data suggest a good correlation between external and internal mass in both men (r=0.72) and women (r=0.86).
Assumption VI. Having rejected the concept of the prediction of body fat, we consider instead if total body adiposity can be confidently predicted from skinfolds? With a strong relationship between subcutaneous AT and total body adiposity, skinfolds should have the same relation with subcutaneous and total AT in men and women. A strong significant correlation between these entities was found in men (r=0.82), but not in women (r=0.56) , reflecting gender-associated different tissue masses distribution. This difference in basic relations jeopardises the use of skinfolds. 'Skinfolds for men only' seems somewhat obtuse.