THE 2015 SPORTS SCIENCE SUMMIT

ABSTRACTS

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Day 1:

Invited Speakers Abstracts

Lipolysis during exercise in obesity patients: etiology and magnitude of disturbance and impact of exercise training

Dr. Dominique Hansen, Revalidatie en Inspanningsfysiologie in Inwendige Ziekten, Assistant Professor, Rehabilitation and Exercise Physiology in Internal Diseases, Biomedisch Onderzoeksinstituut (BIOMED), REVAL-Revalidatie Onderzoeksteam, Universiteit Hasselt, Campus Diepenbeek, Agoralaan, Gebouw A, Belgie

Patients with obesity are often referred to rehabilitation centres or sports facilities, and/or advised to increase physical activity, with the aim to decrease adipose tissue mass. However, a premise for optimal adipose tissue mass reduction through exercise training is a sufficient lipolytic response to exercise. In this lecture, it will be shown that the lipolytic response to exercise is severely suppressed in the obese, and it will be discussed as to whether long-term exercise training could lead to improved lipolysis during exercise in obese subjects.

Two Voices: Recovery from Disordered Eating as told by an Elite Male Athlete and his Sports Nutritionist.

Dr Paula A. Quatromoni, DSc, MS, RD, Associate Professor of Nutrition and Epidemiology Sargent College of Health & Rehabilitation Sciences, Boston University, Boston, USA and Mr David Proctor, Boston University, Manchester, UK

This talk will feature an elite male runner who experienced a restrictive eating disorder during his collegiate track career at an American Division 1 university, presenting alongside the sports nutritionist who treated him. The athlete will share his perspective and experiences of the disorder that affected his health, emotional well being, and physical abilities to train, Hastings compete and recover from sports injuries. The nutritionist will discuss the therapeutic approach and strategies used to restore the athlete's health, improve his relationship with food, and help him to achieve success in his sport through proper fueling and wellness of body and mind.

Computational Modelling of Energy Metabolism and Heat Transport in a Professional Cyclist during a Tour de France Stage

Dr Johannes HGM van Beek, Section Functional Genomics, Dept Clinical Genetics, VU University medical centre, Van der Boechorststraat 7, 1081BT Amsterdam, The Netherlands

A computer model is presented of energy metabolism and heat transport in a professional cyclist. A mountain time trial in the Tour de France is simulated. The buffering of energy (ATP) during the work stroke in muscle using creatine and mitochondrial energy production is simulated. Brain temperature reaches 39 degrees Celsius in 15 minutes and leg muscles reach almost 40 degrees Celsius in 5 minutes.

Biomarkers of Oxidative Stress and Inflammation Pre/Post a Simulated Fight of Professional Mixed Martial Arts Athletes

Dr. Marcelo Paes de Barros, Ph.D., Programa Mestrado/Doutorado Ciências do Movimento Humano Instituto de, Ciências da Atividade Física e do Esporte (ICAFE) Universidade Cruzeiro do Sul, São Paulo, Brazil

Given the complexity and changeability of techniques in a Mixed Martial Art (MMA) combat, professional fighters must combine strength and high cardiovascular capacity to perform at high level. Therefore, MMA athletes are important subjects for studies focused on exhaustion, oxidative stress and inflammation. Our study measured oxidative stress (antioxidant capacity, uric acid, free iron, glutathione, and lipoperoxidation) and inflammation indexes (IL-6, IL-10, and TNFα) in plasma of 13 Brazilian MMA athletes pre/post simulated fights. Based on the sophisticated Flow Cytometric Bead Array Technique (CBA), high levels of pro-inflammatory cytokines showed correlation with antioxidant depletion and uric acid increase in plasma.

Case Study describing a Dietary Strategy to Increase Muscle Mass and Improve Recovery in an Elite Sprint Kayaker

Dr Karen Reid, Registered Sport and Exercise Nutritionist, Performance Food Ltd, Roehampton University, United Kingdom

This presentation describes a case study of a nutrition intervention with a 19 year-old male elite Sprint Kayaker to increase muscle mass. Prior to the intervention daily energy intake was 3247 kcal (protein 1.8 g/kg, carbohydrate 3.6 g/kg) and the athlete was unable to eat sufficient food to meet the energy demands of training. During the intervention the athlete's daily energy intake increased to 5279 kcal (protein 3.2 g/kg, carbohydrate 7.7 g/kg) by including milk based drinks pre and post-training and before bed. This
simple dietary intervention, along with a structured strength and conditioning programme, resulted in an increase of 10 kg body mass without any significant change in body fat. In addition the athlete reported the milk based drinks were easy to consume, and for the first time, was able to maintain weight during intensive phases of the training cycle.

**Shackleton 2015 Live**
Miss Harriet Coppock and Mr Stew Edge, Shackleton 2015 LIVE!, Charing, United Kingdom
In October 2015, SHACKLETON 2015 LIVE!, one of the most ambitious polar expeditions ever, will attempt the first crossing of Antarctica via the South Pole on foot. using Sir Ernest Shackleton's planned route. SHACKLETON 2015 LIVE! is a global communications platform designed to track and report on the progress of 4 extreme athletes who will undertake this 1800m journey across the most hostile environment on earth over 3 months. Their bodies will endure extreme cold, exhaustion, malnourishment and the physiological and psychological affects will be monitored and recorded along the way.

**Poster Presentation Abstracts**

**THIGH MUSCLES ACTIVITY DURING DYNAMIC STRETCHING AND HIP RAGE OF MOTION AFTER DYNAMIC STRETCHING**
Yumi Okayama, Shinichi Daikuya
Department of Rehabilitation, Kishiwada Eishinkai Hospital, Kishiwada, Osaka, Japan

**Introduction**
In our previous study, it was observed that thigh muscle strength had to be weakened after a frequent dynamic stretching (DS) due to not only a muscle fatigue but also the alteration of quality of recruitment state of motor unit. To clarify the alteration of recruitment status of motor unit, thigh muscles activity was studied by surface electromyography in the condition of repeated the number of times during frequent DS. In addition, the alteration of hip range of motion was compared with pre and post DS.

**Subjects**
Subjects were orthopedic and neurological healthy twelve males, who were . Their mean age was 24.0 ± 1.3 years. Prior to the experiment, all of the subjects were informed the purpose of this study based on the descriptions, and their agreement for participation was obtained from all of the subjects.

**Methods**
DS was the fifty times repeated action in dominant leg of a simultaneous flexion of hip and knee from natural standing position to both 90 degree flexion in one second and return to the natural standing position in also one second. Surface electromyography was recorded during DS from the ipsilateral following muscles; Rectus femoris (RF), tensor fasciae latae (TFL) and adductor longus (AdL). The raw wave was rectified, and calculated the integral electromyography (IEMG). And, the range of motion (ROM) of hip flexion and the angle of the straight leg raising (SLR) was measured before and after DS.

**Results**
Although a more the number of repetitions of DS the higher IEMG was acquired in all muscles up to thirty seconds this study, IEMG was temporarily decreased in per thirty times. ROM of hip flexion, SLR in hip rotational intermediate position and SLR with hip internal rotation were significantly increased after DS (p<.05, paired-t test). However, SLR with hip external rotation was significantly decreased after DS (p<.05, paired-t test).

**Discussion and Conclusion**
From the result of IEMG, it was thought that the influence of muscle fatigue was less up to about 30 times DS. After about 30 times, although activation of motor unit was recognized, it was thought to be a consequence of muscle fatigue.
On the other hand, as the effectiveness of DS, ROM of hip flexion and SLR except with hip external rotation were increased due to the reciprocal inhibition and/or an elongation properties by repetitive motion. The decrease of SLR with hip internal rotation was the result of the tightness of TFL, as an internal rotator, due to fatigue caused by repetitive contraction during DS.
From the result of this study, the adequate repetition numbers of DS was considered up to 30 times.
ELECTROPHYSIOLOGICAL FINDINGS AFTER RECONSTRUCTION OF ANTERIOR CRUCIATE LIGAMENT AND ANKLE SPRAIN -A CASE STUDY-

Shinichi Daikuya
Department of Rehabilitation, Kishiwada Eishinkai Hospital.

Introduction
We use the electrophysiological methods for physiotherapy assessment after sports injury to clarify the neuro-muscular function (i.e. spinal and supra-spinal excitability) using evoked electromyography. We experienced two particular electrophysiological findings. In this study, the electromyographical findings and the clinical characteristic in those cases were reported.

Subjects
Subject A was an eighteen year-old male and high school basketball player after a reconstruction of right ACL and subject B was an twenty-one year-old male college basketball player diagnosed left ankle lateral ligament injury (grade II) after ankle sprain.

Methods
In physiotherapeutic assessment and medical check to prevent an injury, we measure the H-reflex and/or mixed-nerved silent period (SP) from soleus muscle. H-reflex and SP from soleus muscle was evoked by sixteen times' single stimulation to tibial nerve at the popliteal fossa on prone position at rest (H-reflex) or with a tonic slight voluntary contraction of soleus (SP). H-reflex was calculated the peak-to-peak amplitude, and its amplitude was divided by amplitude of maximal M-wave (amplitude ratio of H/Mmax). SP was calculated the duration from the artifact due to electrical stimulation to re-starting electromyographic bursting of tonic muscle contraction. And we determined a coefficient of variation of the duration of SP in each recording.

In case A, the recording of H-reflex and SP was started at one month after operation, and ended at six months post operation with a test at every month. In case B, H-reflex was recorded at medical check (pre injury), three days after injury and one month after injury.

Results
In case A, the amplitude ratio of H/Mmax was increased at post four months after ACL reconstruction on operative side. Variation of SP in operative side was increased compared with non-operative side and gradually decreased until post six months. And, on the operation side, long-latency reflex (LLR) was appeared during SP from two months to five months after operation. In case B, the amplitude ratio of H/Mmax was increased at three days after sprain on both side compared with both before and one month after injury. And, LLR was appeared on the only injured side.

Discussion and Conclusion
H reflex was a useful index to examine the excitability of spinal neural function and muscle activation. Amplitude ratio of H/Mmax was an adequate parameter, which is expressed the excitability of spinal neural function compared to relative distal muscle condition. Duration of SP may be able to become an index of the degree of facilitation of the brainstem or motor cortex, and we have tried to apply the silent period to clarify the magnitude of facilitation (or disinhibition) of the brainstem or motor cortex in the field of physiotherapy.

From the results in case A, a following hypothesis was obtained; until post six months after ACL reconstruction, even the small and simple task during SP recording in this study (sustained plantar flex contraction) needs to an intervention of a various supra-spinal function. In case B, the excitability of spinal neural function related to soleus muscle was increased at three days after injury, and this factor was the effect of a pain, a joint effusion, and/or an adaptation to activities of daily life with pain and instability due to ankle sprain. And the influence of increase of excitability of spinal neural function on injured side spread to non-injured side. Moreover, on the injured side, supra-spinal function was accelerated due to the alteration of excitability of spinal neural function followed by the adaptation to painful and unstable activities of daily life.
Invited Speakers Abstracts

Oxygen and our gas guzzling brains; from molecules to medals!
Professor Damian Miles Bailey FPVRI FRSC FACSM, Neurovascular Research Laboratory, Faculty of Life Sciences and Education, University of South Wales, UK

Molecular oxygen exists in air as a free radical revealing a more nebulous side to a gas traditionally considered the “elixir of life”. It is a double-edged sword, capable of sustaining life yet fatal in excess or indeed when limited. The current presentation will discuss how free radicals influence oxygen transport to the human brain across the spectrum of health and disease, from the “super-fit” Olympian to the "super-sick” patient; in essence, how we provide what is provocatively considered the most important “organ” in the Body with the most important “molecule” in the World!

Dr Douglas Johnson, ATC, EES, CLS, Senior Vice President, Clinical and Scientific Affairs, Multi Radiance Medical, Solon, OH, US

Visuo-vestibular mismatch (i.e. motion sickness) and sport performance
Philippe Perrin, MD, PhD, University of Lorraine and University Hospital of Nancy, Villers-lès-Nancy, France

The most commonly accepted theory explaining motion sickness refers to a sensory conflict, in particular visuo-vestibular, and between actual and anticipated signals from the sensory organs. The practice of sport decreases the dependency upon visual input, improves the use of vestibular afferences, involving a process of habituation leading to a better handling of visuo-vestibular conflicts, and improves the use of somato-sensory input. Nevertheless, some sports are more prone than others to generate motion sickness in provocative situations (e.g. sailing in rough sea conditions, skiing in foggy days, discus compared to hammer throwing, rally car co-driving).

Magnetic Resonance Imaging of the Rotator Cuff: Pitfalls in Interpretation of Tendon and Muscle Injury at the Shoulder
Dr Derik Davis, M.D., University of Maryland School of Medicine, Department of Diagnostic Radiology & Nuclear Medicine, Musculoskeletal radiology section, Baltimore, MD, US

Shoulder pain and dysfunction are problems commonly encountered in clinical practice. Magnetic resonance imaging (MRI) is the gold standard for non-invasive imaging of the rotator cuff and is useful for evaluation of the athlete or non-athletic patient. Since MRI often influences patient management, correct characterization of shoulder injury is essential for best patient outcomes. Members of the audience who attend this talk will be able to: (1) discuss pitfalls of imaging techniques for shoulder MRI; (2) recognize imaging features that may lead to misinterpretation of rotator cuff injuries; and (3) describe shortcomings of commonly used grading systems.

Testing of physical performance is common practice
Associate Professor Christer Malm, Head of Sports Medicine Unit, Umeå University, Department of Surgery and Perioperative Science Sports Medicine Unit, Gösta Skoglunds väg 3, SE-901 87 Umeå, Sweden

Testing of physical performance is common practice among athletes, and in many cases mandatory for participation. One might ask WHY? If the purpose is to assess current performance capacity, the only true test is a competition. All other tests will have lower validity, when correlations between test results and athletic performance in most cases are low. If we want to predict future performance, is this possible? Predictions have embedded errors, and when striving for elite performance, fractions of a percent is the difference between winning and losing. The multifactorial facets of athletic performance may not easily be captured, even in the most elaborate testing procedures.

The science behind the assessment & retraining of movement impairments to manage recurrent pain, injury risk & improve performance
Mr Lincoln Blandford Performance Matrix Tutor, Performance Matrix & St Mary's University, Twickenham, UK

Stretching and strengthening protocols are seen to be limited with regards to injury prevention whilst contemporary strategies assess movement control through multi-joint task performance and under differing intensity demands. Evidence supports the reliability of movement control testing in addition to the presence of a heightened injury risk for those individuals free of pain yet failing such assessment. In light of such key findings, ‘The Performance Matrix’ screening protocol provides a description of site, direction and intensity of control deficits. This profile subsequently steers specific retraining so as to reduce injury occurrence, limit recurrence of pain and support performance enhancement.
Optimising performance in sport

Dr Mark King, Reader in Sports Biomechanics, Loughborough University, United Kingdom

Optimising sports performance using experimental and theoretical approaches in sports biomechanics will be considered. In cricket fast bowling an experimental approach will be used to investigate the factors that characterise fast bowling performance. In gymnastics a theoretical approach will be used to investigate the factors that limit to performance in tumbling. In particular the importance of strength and technique will be considered. Are the best performers the strongest?

Evaluation of Australia’s bicycle helmet laws

Colin F Clarke, Right To Ride representative, East Yorkshire, York, UK

Australia’s bicycle helmet laws were introduced in 1990–1992. The laws discouraged cycling, by more than 40% in some cases. Per million population, approximately 2 cyclist deaths occur annually compared 2000 from cardiovascular disease. The helmet laws have not delivered a net societal health benefit with a calculated cost benefit ratio of 109 to 1 against. Comparing cyclists to pedestrians, pre-law (1986-89) cyclist deaths were 16.4% of pedestrians in number and in 2010-13 the figure was 22.7%. This evaluation finds the helmet laws have failed in aspects of promoting cycling, health, accident compensation, environmental issues and civil liberties.

Arthroscopic treatment of primary shoulder instability

Dr Jonas R. Rudzki, M.D., Orthopaedic Surgery, Shoulder Surgery, & Sports Medicine Washington Orthopaedics & Sports Medicine, Clinical Assistant Professor of Orthopaedic Surgery The George Washington, University School of Medicine, Chevy Chase, MD, US

Primary glenohumeral shoulder instability is a controversial topic in which arthroscopic surgical intervention has the potential to significantly reduce recurrence risk, cartilage injury, and total cost of care while enhancing quality of life. Evidence-based medicine has helped us to better define specific patient populations that would benefit from arthroscopic surgical stabilization and identify those patients who are better treated conservatively. We will review the latest surgical techniques, outcomes data, and rehabilitation considerations for optimizing patient care for shoulder instability.

Protect their knees: examining injury risk in youth sport

Professor Mark De Ste Croix PhD, BA (Ed) Hons, CSci, Professor of Paediatric Sport and Exercise, Faculty of Applied Sciences Postgraduate Research Director, Co-Director Exercise and Sport Research Centre, University of Gloucestershire, Gloucester, UK

Understanding the issues of growth and maturation in relation to injury risk is complex and multifactorial and very few studies have explored the link between injury risk factors and injury incidence in youth athletes. Understanding changes in neuromuscular and muscular capability through normal growth and maturation, alongside high training loads, with potentially short recovery periods, is essential in minimising the injury risk in elite youth performers. Data examining the injury incidence of serious knee injuries (eg Anterior Cruciate ligament (ACL) injuries) in youth participants demonstrates a dramatic increase in incidence between the ages of 12-17 years. It is also well recognised that females appear to have a greater relative risk of non-contact ACL injury compared to males when hours of athlete exposure are taken into account (up to 8 times greater risk). Therefore due to the social, personal and financial outcomes of serious injuries appropriate prevention strategies are essential. However, to be able to design age and sex appropriate screening and prevention strategies a clearer understanding of the mechanisms associated with injury risk in youth is required.

Mechanisms of head injury in sport and energy management characteristics of helmet technologies

Dr Blaine Hoshizaki PhD, Director, Neurotrauma Impact Science Laboratory, University of Ottawa, Ottawa, Ontario, Canada

Head injuries in sport are proving to be much more complex than originally described. Dynamic response time curves resulting from impacts to the head are influenced by the striking mass, compliance, impact velocity, impact locations and direction of force. The dynamic response curves are specific to the types of head impacts experienced in specific sports. The relationship between the dynamic response of the head to impacts and the risk of injury describe unique mechanisms of injury. These unique mechanisms of head injury described for each sport provide opportunities to develop more effective head protection in sport and physical activities.
SELF-ESTIMATION DIFFERS SIGNIFICANTLY FROM TRI-AXIAL ACCELEROMETER MEASURES OF NON-EXERCISE GENERAL ACTIVITY OVER 7-DAYS

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Physical activity is important in managing type 2 diabetes and other chronic diseases. Up to 65% of UK adults fail to meet current recommended levels and adults with chronic disease are even less likely to exercise than their healthy counterparts. Objectively measuring one’s own activity is difficult and self-estimation unreliable. This presents problems in clinical management and appraisal of different lifestyle interventions. The advent of accelerometers promises objective measurement of activity but the new technology is largely untested on patient groups. We studied the practicality, and reliability of the Fitbit One device on 101 participants (20-77yrs), to measure self-assessment accuracy. Consenting participants completed questionnaires on self-perceived activity, sleep, mood and anthropometrics: they wore the Fitbit for 7 days, with readout display covered. Questionnaires were then repeated and the participant’s estimation of number of steps was compared to the actual.

Results

Of 60 devices, 18 did not record data. From the remaining devices, 49 women and 51 men walked an average of 67128 and 72954 steps respectively. Pre-study estimates and actual activity levels correlated weakly (R2= 0.0422 [95% CI= -0.0609, 0.1453] and 0.3014 [95% CI= 0.1038 to 0.4990]) Bimodal peaks of steps occurred in age groups 20-30 and 60+. BMI 20-25 and 25-30 categories averaged 70,000 steps/wk vs. 60,000/wk for BMI >30 (obese). Correlation between females and males differed between post-estimated and actual steps (R2 =0.4890 [95% CI; 0.3017, 0.6763] and 0.1120 [95% CI; 0.0411,0.266] respectively). Estimating accuracy and the number of steps was inversely related. Males and females were equivalent in proportions of exercise intensity: 8.6% of total activity was at higher intensity. Estimation of exercise accuracy correlated with positive mood (R2=0.352, but not sleep quality (R2=0.101 or BMI (R2=0.1563).

Conclusions

This study shows self-estimation to be an inaccurate measure of activity levels with participants, with a tendency to over-estimate. The use of FitBit One in this study was acceptable and practical but suffered severe reliability issues and could not record non-stepwise activity, e.g. cycling or rowing, accurately. Despite these caveats, devices accelerometers could provide a realistic aid in primary care for assessment of activity in patients suffering from chronic diseases.

Limitations:
The 30% device failure rate was a composition of human and device errors. The remaining devices performed uniformly well. Activities not involving steps (cycling swimming weightlifting) are poorly captured, but are quantifiable in other ways.

IT’S NOT THE WILL TO WIN THAT MATTERS—EVERYONE HAS THAT, IT MAY JUST COME DOWN TO THE GENETICS

D Greenbaum, Lawrence NY, 11559 USA

Every year promising young athletes drop dead on the playing field. Often times these kids have undiagnosed genetic predispositions to diseases such as sudden cardiac death. As genetic testing and analysis become cheaper and more freely available, it seems imprudent not to test athletes for genetic traits related to known risks. And, in contrast to some direct to consumer commercial tests that market the ability to determine athletic traits to new parents, genetic testing for predispositions to hypertrophic cardiomyopathy and for other genetic predispositions related to injuries provide actionable and relevant information to athletes and their teams. This information can be used to target and/or change diet, modify exercise regimens, direct post-injury recovery, or, in some instances, recommend leaving the sport altogether. Professional athletes in particular also provide a great population for genetic analysis and further research as they tend to have well documented corresponding physiological traits. However, genetic testing is not without risk. There are non-trivial concerns regarding privacy, information disclosure to teams and families, and the discovery and the reporting of unrelated incidental findings. More globally, as we decipher the genetic aspects of sport, we may begin to see athletes not as the result of their blood, sweat and tears, but as unmerited sets of genes doled out randomly by nature, potentially opening the door to similarly seemingly unmerited skills resulting from genetic and biomechanical enhancement.
A NEW, NON-INVASIVE, NON-LABORATORY DEVICE AND METHOD TO ASSESS PULMONARY VENTILATION AND ANAEROBIC THRESHOLD DURING EXERCISE

Prof. Mickey Scheinowitz, PhD
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Background: The anaerobic threshold (AT) is a fundamental physiologic measure to assess exercise intensity and to improve cardiorespiratory (aerobic) fitness by training. Currently, the principal methods for the detection of AT is performed in the laboratory and is limited for blood sampling (lactate measurement) or non-invasively using cardio-pulmonary exercise testing (CPET). Aim: To develop a new, non-invasive, non-laboratory device and method for the detection of the AT during exercise.

Methods: A prototype made of a stretch sensor, vertical accelerometry, and heart rate monitoring was built as a chest belt to measure exercise intensity and the equivalent of pulmonary ventilation. All sensors were connected to a data processing and logging unit. The stretch sensor was characterized by changes in breathing interval (corresponding to breathing frequency) and changes in the equivalent of tidal volume (TV, driven by thorax expansion), both generating pulmonary ventilation (VE). CPET (ZAN 600) were conducted while simultaneously using the AT-strap to compare between the two methods. RR and AT results were compared using Bland–Altman Analysis.

Results: Initial AT-strap optimal length has been determined at 16 to 20 cm stretching, using 3 stretch sensors in parallel for signal stabilization. RR tests (N=74) results have shown high agreement between methods (mean difference: 0.2 [1/min], limits of agreement 95% (LoA): -2.7 - 3.2 [1/min]). Increase in amplitude of AT-strap signal has been noted with the linear equivalent of thorax expansion in the breath simulation. Results were consistent in all RRs tested (0.2-1 Hz). Comparative experiments of AT determination with CPET have been tested in N=10 normal healthy volunteers showing mean difference of 1.5 [watt], LoA: (-14) - (17) [1/min]).

Conclusions: The new AT-strap stretch sensor successfully detects pulmonary attributes (RR, relative TV, and equivalent of VE) relevant for the detection of AT non-invasively, in the field. High agreement was found between AT-strap and CPET results. Additional tests should be taken to successfully validate the agreement between both devices under a larger and more diverse individuals, athletes, and patients.

Figure: Illustration of the chest strap that accurately measure the anaerobic threshold (AT) during exercise. The figure illustrates the tests used to compare the chest strap with a standard cardiopulmonary exercise testing (CPET).

THE USE OF ECHOGRAPHY TO ASSESS CERVICAL SPINE IMPACT ON FIRST ROW RUGBY PLAYERS: AN INNOVATIVE MEASURE FOR INJURY PREVENTION

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4Department of Health Innovation and Technology, Fontys University of Applied Sciences, Eindhoven, The Netherlands.

Objectives: Changing the players' position in rugby, especially having back end players replace front row players, often results in injuries. This is exacerbated in certain rugby age-groups where the rules allow...
This study aims to assess whether echography could be used as a tool to advise players before such position switches, in addition to standard range of motion assessment. As such the question to answer within each age-group is whether significant differences in neck and back musculature can be detected between the different row-players, in which case those could be used as benchmarks to advise players on position switches or assess the impact of a specific preparation exercise program before such switches are considered.

Methods: 129 subjects aged 15 to 54 years old (28 ± 11.95 years old) were divided in 3 age categories (Junior: < 19 years old; Senior: between 19 and 35; and Veteran: > 35 years old). Every category has been divided into 4 sub-groups (front row: junior n=10, senior n=12, veteran n=11, forwards junior n=12, senior n=12, veteran n=10, control group n=10 in each category, backs: junior n=10, senior n=11, veteran n=11, control group n=10 in each category (none of them playing rugby)). “Cervical range of motion” was assessed for each subject, namely the amplitude in flexion, extension, bilateral rotation, and bilateral inclination of the neck. The thicknesses of anterior and posterior muscles of the neck were also measured with echography: trapezius, splenius capitis, semispinalis capitis, semi spinalis colli and sternocleidomastoid muscles (SCOM).

Results: Compared to the control group, we observed a significant decrease of the rugbymen’s range of motion, and particularly in extension with the front row players of every age category, results also showed a highly significant increase in front row rugby players compared to the control group of the global muscular neck circumference in every age category. Echography results showed a significant increase in rugby players compared to the control group of the global muscular neck volume described above in every age category, as well as the volume of trapezius muscles, semispinalis capitis and SCOM. The junior pack has a significant increase of 139.81% of the semispinalis cervix compared to the controlled group. Senior first row compared to the senior back has a significant increase of the trapezius (138.87%), splenius capitis (140.08%), semispinalis capitis (145.49%) and the total volume of the global muscles described in methods (126.15%)

Conclusion: It is necessary to have an adapted cervical musculature to face the severe constraints that the players of the front row are subject to, especially during scrums. This points to the fact that players normally in the back should not play in the front row without specific prior preparation. A better choice would be the players from the pack. Specific tests including both range of motion tests and echography assessment as undertaken in this study to advise a rugbyman whether to play in the front row could constitute a significant breakthrough for the protection of players against injury. This study exemplifies the benefit of implementing ultrasonography in injury prevention strategies and has the advantage of being non-invasive and permitting quantitative measurements of the muscles.

Poster Presentation Abstracts

INTERVAL AEROBIC TRAINING SUPPRESSES HYPOXIA-INDUCED INFLAMMATORY THROMBOSIS IN SEDENTARY MEN

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Acute hypoxic exposure increases vascular thrombotic risk. The release of procoagulant-rich microparticles from neutrophils accelerates the pathogenesis of inflammatory thrombosis. This study explicates the manner in which interval and continuous exercise regimens affect neutrophil-derived microparticle (NDMP) formation and neutrophil/NDMP-mediated thrombin generation (TG) under hypoxic condition. A total of 60 sedentary males were randomized to perform either aerobic interval training (AIT; 3-minute intervals at 40% and 80%VO2max) or moderate continuous training (MCT; sustained 60%VO2max) for 30 min/day, 5 days/week for 5 weeks, or to a control group who did not receive any form of training. At rest and immediately after hypoxic exercise test (HE, 100W under 12%O2 for 30 min), the NDMP characteristics and dynamic TG were measured by flow cytometry and thrombinography, respectively. Before the intervention, HE 1) elevated coagulant factor VIII/fibrinogen concentrations and shortened activated partial thromboplastin time (aPTT), 2) increased total and tissue factor-rich/phosphatidylserine-exposed NDMP counts, and 3) enhanced the peak height and rate of TG promoted by neutrophils/NDMPs. Following the 5-week intervention, AIT exhibited higher enhancement of VO2max than MCT did. Notably, both MCT and AIT attenuated the extents of HE-induced coagulant factor VIII/fibrinogen elevations and aPTT shortening. Furthermore, the two exercise regimens significantly decreased tissue factor-rich/phosphatidylserine-exposed NDMP formation and depressed neutrophil/NDMP-mediated dynamic TG at rest and following HE. Hence, we conclude that AIT is superior for reducing the formation and activity of procoagulant microparticles.
to MCT for enhancing aerobic capacity. Moreover, either AIT or MCT effectively ameliorates neutrophil/NDMP-promoted TG by down-regulating expressions of procoagulant factors during HE, which may reduce thrombotic risk evoked by hypoxia. Moreover, either AIT or MCT effectively ameliorates neutrophil/NDMP-promoted TG by down-regulating expressions of procoagulant factors during HE, which may reduce thrombotic risk evoked by hypoxia.

Day 3:

Invited Speakers Abstracts

Fractures in Sport: Their Management and Outcome

Mr Greg Robertson, Edinburgh Orthopaedic Trauma Unit / University of Edinburgh, Edinburgh, UK
Fractures have the greatest morbidity of all sports injuries; however literature regarding them is limited. In the Lothian adult population, from 2007-2008, there were 990 sport-related fractures, an incidence of 1.8/1,000/yr.
The most common sports were football(35%) and rugby(15%). The most common fractures were finger phalanx(21%) and distal radius(17%). Eighteen percent required surgical management.
Return times to football and rugby were 15 weeks. Lower limb fractures took significantly longer to return than upper limb fractures. Surgically-managed fractures took significantly longer to return than conservatively-managed fractures.
Our findings provide a clearer picture of the epidemiology, outcome and management of these injuries.

Anatomy is not function. Examining the evidence for injuries to be assessed and treated with an integrated approach

Mr Julian Baker, Functional Fascia, ECBS Ltd UK
Anatomy is not function
Our understanding of injury is based on our understanding of anatomy and physiology. Yet anatomy is just the process of naming parts and not the understanding of how these parts relate and what connects them.
A new field, known as Integral Anatomy, considers, through dispositive evidence, the effects of movement and injury from one part of the system to another, allowing problem solving and prevention for recurring injuries.
Application approaches and current evidence will also be discussed

Knee Complexes in Involution and its implication on how to avoid graft impingement

Dr. Wangdo Kim, Research Associate, Univ Tecn Lisboa, Fac Motricidade Humana, Estrada da Costa, Lisbon, Portugal
Current prostheses, braces, models for gait, and reconstructive surgery are based on an approximation of the knee axis in considering only its kinematics. In addition, the most important predictor of clinical outcome in anterior cruciate ligament (ACL) reconstruction is tunnel placement.
For when the knee is in equilibrium it takes up as position of stationary energy, and the absolute velocity along the line of the graft must be identical; otherwise, there exists the possibility of ACL graft impingement (entrapment). We recommend a new surgical technique based on the least action principle because the current technique did not follow any principle.

The role of the TCA cycle intermediates in facilitating oxidative metabolism

Dr Simon Marwood, Senior Lecturer in Physiology, Programme Leader BSc (Hons) Sport & Exercise Science, Health Sciences, Liverpool Hope University, Hope Park, Taggart Avenue, Liverpool, L16 9JD, UK
At the onset of exercise there is an exercise intensity-dependent increase in the concentration of the TCA cycle intermediates (TCAi) which reaches a peak after 10–15 minutes of exercise before declining. Since this phenomenon parallels the increased oxidative metabolism and thus TCA cycle flux, it has been suggested that the concentration of TCAi may be of functional importance for oxidative phosphorylation. However, studies utilising a range of nutritional, pharmacological and exercise-based interventions have failed to demonstrate an association between TCAi pool size and oxidative energy provision either at the onset of exercise or at the limit of exercise tolerance.

Differences in movements of temporomandibular joints in athletes with and without orofacial injuries

Nikolina Lesic, DMD, University of Zagreb Croatia, Trg Francuske Republike, Zagreb Croatia
All sporting activities have an associated risk of orofacial injuries due to falls, collisions and blows. In this presentation results of recent investigation on athletes with anamnestic blow to the jaws will be presented.
Immediately after injury, they have had stiffness/pain of masticatory muscles, pain in region of TMJ, and limitation of jaw movements. All symptoms diminished and finally were gone after some time. Ultrasonic device ARCUStigma was used for tracing movements of the mandibular. Results reveal that injuries of the orofacial system could produce changing of the temporomandibular joints movements and alter the protrusive, laterotrusive, mediotorusive and retractive paths.

Oral Presentation Abstracts
Oral presentations will be added after the submission deadline

A NOVEL APPROACH TO HAMSTRING TRAINING: IS IT EFFECTIVE?
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Background: Hamstring injuries are very common, usually occurring when the muscle group contracts eccentrically during the late swing phase of running. Eccentrically training the hamstrings can shift the peak torque angle, allowing them to generate maximum force at a more extended length, and hence reducing injury risk. The Mujo Training System (Mujo Mechanics Ltd, UK) is a new approach to training using a biarticular mechanism, which is postulated to increase the peak torque angle of the hamstrings.

Objectives: This exploratory study sought to explore the impact of this system on the angle of peak torque during eccentric hamstring contractions in healthy individuals.

Methods: 6 subjects (21±0.58 years; 1.78±0.07m; 71.3±8.72kg) completed a twice weekly, 6-week long training protocol on the Mujo System and a further 6 subjects (22.2±1.17 years; 1.74±0.08m; 73.0±12.1kg) formed a control group with no intervention. Subjects' peak torque angle was determined for their dominant leg, pre- and post intervention, using an Isokinetic Dynamometer. 6 repetitions of an eccentric protocol were performed with the angle of peak torque being the primary outcome measure. The difference in angle pre- and post-intervention between groups was compared using an independent two tailed t test (p<0.05).

Results: No differences were observed between groups. Subjects in the Mujo group reported an overall increase in peak torque angle post intervention (5.02±4.10 degrees), whilst the control group reported a reduction (-2.13±2.19 degrees), however the difference between groups was not statistically significant (p=0.335), and widespread variability amongst participants was noted.

Conclusions: It is not clear whether this new biarticular training approach demonstrates any value to preventing hamstring injury. Its findings also question the robustness of the angle of peak torque as an outcome measure during an eccentric contraction.

THE ROLE OF PELVIS AND THORAX ROTATION VELOCITY IN BASEBALL PITCHING
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Background: A high throwing velocity is one of the key factors in successful baseball pitching. It is suggested that pelvic kinematics play an important role in achieving high throwing velocities, specifically in the initiation of thorax rotation.

Hypothesis/Purpose: The objective of the present study was to examine the interaction of pelvis and thorax rotations in achieving high throwing velocities in pitching fastballs.

Study Design: Descriptive Laboratory Study.

Methods: During the preseason (T1) and four months later (T2), kinematic analyses of Dutch AAA team pitchers (n=8) were performed. Segment local coordinate systems and angular velocities of the pelvis and thorax were determined and separation, defined as the time between the maximal rotation velocities of the pelvis and thorax, was calculated. Throwing velocity was operationalized as the maximal velocity of a marker on the tip of the middle finger. Associations of peak rotation velocities of pelvis and thorax as well as separation with throwing velocity were determined using regression analyses (GEE). Comparable analyses were performed for the changes in these variables from T1 to T2.

Results: At T2, throwing velocity was 4.1 mph (95% CI: 2.1 – 6.0 mph) higher compared to T1. Also thorax peak rotation velocity was significantly higher at T2 compared to T1, with 33 °/s (95% CI: 17 - 50°/s). Pelvis peak rotation velocity and separation did not significantly differ between T1 and T2. Only separation with thorax rotation velocity was significantly different between T1 and T2.
was significantly associated with throwing velocity. When looking at the differences between T1 and T2, there was no significant association between changes in throwing velocity and changes in pelvis or thorax peak rotation velocity. However, the change in time between the peak rotation velocities of the pelvis and thorax between T1 and T2 appeared to be significantly and positively associated with the change in throwing velocity.

**Conclusion:** The relative timing of pelvis and thorax peak rotation velocity in pitching fastballs in baseball is a determinant of throwing velocity in skilled pitchers. Separation of segmental peak rotations deserves to be focused on in scientific research as well as in developing training programs in baseball pitching.

**Key Terms:** Pitching, Biomechanics, Pelvis and Thorax Rotation Velocity.

**What's known about this subject:** Associations are observed between high segmental rotational velocities and high throwing velocities in baseball pitching. The literature suggests that the body works as a kinematic chain, in which segments are rotated in a sequential order. This indicates that, in addition to high segmental rotational velocities, the sequential timing of segment rotation is important for achieving high throwing velocities.

**What this study adds to existing knowledge:** This study indeed shows that, in addition to high segmental rotational velocities, the sequential timing of thorax and pelvis peak rotation velocity is associated with throwing velocity.

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**CAN MATERIAL AND STRUCTURAL MODIFICATION OF ICE HOCKEY ARENA DASHER BOARDS CHANGE IMPACT CHARACTERISTICS OF BODY CHECKS?**

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Severity and incidence of ice hockey related concussions have increased during recent years (Biasca et al., 2002). Modifying and developing the playing environment may reduce concussion rate by influencing impact characteristics of body checks. Thus, the aim of this study was to determine how ice hockey dasher board materials and structures affect impact characteristics and thereby concussion risk.

Measurements were divided into three parts; in the first part, the physiological characteristics of body checks were determined in real game measurements (five games of the Finnish National Hockey League and two playoff games of the second highest ice hockey league in Finland), the second part consisted of simulation of body checks in the laboratory and in the third part repeatability of simulated body checks were compared in the laboratory setting and in the ice hockey arena. Four different commercially available dasher boards were tested in laboratory body check simulations. For the laboratory and ice hockey arena repeatability comparison only the best dasher board was tested. High speed cameras and accelerometers were used to collect data and peak forces, stopping distances and stiffness values were subsequently defined.

Dasher board materials and structures had a major effect on impact characteristics. Flexible protective shielding material (Acryl) resulted in 17% and 16% lower peak forces, 110% and 136% greater stopping distances and 62% and 56% lower stiffness values in the straight and the corner parts of the dasher board, respectively, compared to the reference dasher board (tempered glass). Single-framed dasher board was found to be 29% and 11% more flexible than its dual-framed counterpart, and heavier protective shielding resulted in 33% and 19% higher element stiffness in the straight and the corner parts of the dasher board, respectively. There were no significant differences in the impact characteristics of the stimulated body checks when laboratory data were compared to ice hockey arena data.

In light of the results, it seems that the most safe dasher board would be single-framed with light and flexible protective shielding material, and would not include shielding supporting posts. In addition, the current methodology can be used to test the impact characteristics of different commercially available dasher boards already mounted in the ice hockey arenas and, thus test whether they are within the values defined by Finnish Ice Hockey Association.

**References**

Poster Presentation Abstracts
Poster abstracts will be finalised weeks before the event

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