ABSTRACTS

14\textsuperscript{th} Scandinavian Congress of Medicine & Science in Sports

February 1-3, 2018
Copenhagen, Denmark

www.sportskongres.dk
Physiological assessment of a high altitude trek: association between Borg’s rating of perceived exertion and heart rate

Dr. Josh Bakker-Dyos¹, Dr Karl Cooper¹, Dr Phyl Scott¹, Prof John O’Hara², Prof Chris Boos²,³, Prof Adrian Mellor¹,²
¹Defence Medical Services, Whittington Barracks, United Kingdom, ²Leeds Beckett University, City Campus, United Kingdom, ³Department of Cardiology, Poole Hospital, United Kingdom

Introduction:
Intense exercise is an integral part of high altitude (HA) exposure and is linked to an increased risk of acute mountain sickness. Quantification of exercise intensity at HA is challenging and prone to inter-individual variability. The Borg rating of perceived exertion (RPE) scale allows for quantitative measure of exercise intensity however its relationship to heart rate (HR) at HA has not previously been examined. This study aimed to assess the relationship between HR and Borg RPE scale during exercise at HA.

Materials and Methods:
Seventeen healthy adults (median age 32, 25-54 years) were studied at HA during a trek from 1180 to 5140m over 11 days. Subjects were issued with individual Polar watches (RS400) which were linked to a Polar HR monitors and set to record continuously throughout the trek. The RPE was quantified using Borg 6-20 scale and was collected at random intervals during the trek. HR data was paired to corresponding RPE.

Result:
419 paired observations of HR and RPE were recorded. The median RPE score was 10.0 (IQR 9.0-11.0) with an average HR (mean ± SD) of 110±18bpm. There was a significant increase in HR with increasing RPE category: 100±17bpm (RPE 6-9), 114±14bpm (RPE 10-13) and 131±12bpm (RPE 14). HR and RPE significantly correlated across all altitudes (p<0.001) and at each altitude range 1200-3500m (p<0.01), 3600-4600m (p=0.043) and 4600-5140m (p<0.01).

Conclusion:
The Borg 6-20 RPE scale significantly correlated with HR at HA and appears to be an effective method for monitoring exercise intensity at HA.
Validity and Reliability of an Ultrasound Measurement of the free length of the Achilles tendon

PhD, MD Kristoffer Weisskirchner Barfod1, MD Anja Falk Riecke2, PhD, MD Boesen Anders3, PhD, MD Philip Hansen4, MD Jens Friedrich Maier5, PhD Simon Døssing5, Prof., PhD, DMS, MD Anders Troelsen6
1Sports Orthopedic Research Center - Copenhagen (SORC-C), Department of Orthopedics, Copenhagen University Hospital Hvidovre, Kettegårds Alle 30, Denmark, 2Department of Orthopedics, Zealand University Hospital, Lykkebækvej 1, Denmark, 3Department of Radiology, Copenhagen University Hospital Frederiksberg-Bispebjerg, Bispebjerg Bakke 23, 2400 København NV, Denmark, 4Department of Radiology, Zealand University Hospital, Lykkebækvej 1, Denmark, 5Institutet of Sports Medicine, Copenhagen University Hospital Frederiksberg-Bispebjerg, Bispebjerg Bakke 23, 2400 København NV, Denmark, 6Clinical Orthopedic Research Hvidovre, Department of Orthopedics, Copenhagen University Hospital Hvidovre, Kettegårds Alle 30, Denmark

Introduction:
Valid length measurements of the different segments of the Achilles tendon are needed in order to investigate if differential elongation of the Achilles tendon takes place after rupture. The purpose of this paper is to present data concerning accuracy and reliability of an ultrasound measurement of the free part of the Achilles tendon.

Materials and Methods:
Both legs of 19 non-injured subjects were examined by MRI and ultrasound. The length from the distal tip of the soleus muscle to the tendon insertion on calcaneus was measured by three independent ultrasound examiners. Repeated ultrasound measurements were performed and compared to MRI measurements. Intra- and inter-rater reliability and the agreement between MRI and ultrasound were determined. Data were evaluated using the Intraclass Correlation Coefficient (ICC), the Standard Error of the Measurement (SEM) and the Minimal Detectable Change (MDC).

Results:
The measurement showed excellent intra-rater reliability (ICC 0.94 [0.91;0.96], SEM 5mm and MDC 13mm) and inter-rater reliability (ICC 0.96 [0.93;0.97], SEM 4mm and MDC 11mm). Ultrasound measurements on average exceeded the MRI measurements by 2mm (n.s.); resulting in a measurement error of 5%.

Conclusion:
The ultrasound measurement of the free part of the Achilles tendon showed good reliability and accuracy. For comparison between groups of non-injured subjects differences of more than 5mm can be detected. For repeated assessment of individual subject differences ≥ 13mm can be detected.
Treatment of Osteoarthritis with mechanically treated cells from Abdominal Adipose Tissue - a Pilot Study

PhD, MD Kristoffer Weisskirchner Barfod, MD Lars Blønd

1Sports Orthopedic Research Center - Copenhagen (SORC-C), Department of Orthopedics, Copenhagen University Hospital Hvidovre, Kettegårds Alle 30, Denmark, 2Zealand University Hospital, Lykkebækvej 1, Denmark

Introduction:
Treatment of knee osteoarthritis with minimally manipulated cell therapies have gained increasing popularity. The purpose of the present study was to investigate the feasibility and safety issues of treatment of knee OA with intra-articular injection with mechanically treated cells from abdominal adipose tissue.

Materials and Methods:
The study was performed as a prospective cohort study with follow up after 3, 6 and 12 months. The primary endpoint was any adverse event at 3 months. Secondary endpoint was KOOS. Abdominal adipose tissue was harvested and prepared for implantation using the Lipogems system; an enzyme-free technology that works through a mild mechanical tissue cluster size reduction. Implantation of 8-16ml of the stromal vascular fraction of abdominal adipose tissue in the knee was performed using a 21 gauge syringe.

Result:
20 patients were included and 19 participated in follow up. Mean (SD) age was 49 (9), weight 89kg (22), height 170cm (23). One adverse event was registered as a patient complaint of cosmetically changes to the abdominal subcutaneous tissue. At 3 months KOOS Pain increased 17 (p<0.01) points, Symptoms 9 (p=0.09), ADL 13 (p=0.07), Sport 15 (p<0.01) and QOL 19 (p<0.01). And improved further at one year: KOOS Pain 18 (p<0.01) points, Symptoms 13 (p=0.03), ADL 18 (p<0.01), Sport 20 (p<0.01) and QOL 21 (p<0.01).

Conclusion:
Treatment of knee osteoarthritis with intra-articular injection with mechanically treated cells from abdominal adipose tissue. Efficiency of the treatment is promising but high quality randomized controlled trials are needed to elucidate efficiency.
A Physical Activity Intervention in School Induces Positive Life Style Changes in Young Adulthood – a 11-Year Prospective Controlled Study

MD Amanda Lahti1, Prof., Magnus Karlsson1, MD, PhD Björn Rosengren1, PT Jan-Åke Nilsson1

1Department of Clinical Sciences and Orthopaedic Surgery, Inga Marie Nilssons gata 28, 4th floor new building, Sweden

Introduction:
A majority of children do not reach recommended levels of physical activity (PA). This trend is disquieting since low PA is a risk factor for disease. We examined whether daily PA during compulsory school encourages children to be more physically active, and whether this habit continues into adulthood.

Materials and Methods:
This prospective controlled study, followed the same 124 children (aged 7.7±0.6; mean±SD) – 81 children in an intervention group and 43 controls - during a 7-year controlled exercise intervention study, and four years after the intervention. The intervention included daily school PA (200 minutes/week) and controls continued with Swedish standard of 60 minutes PA/week. Using questionnaires, we gathered data about total PA, leisure time PA and sedentary activities (SA). Group comparisons are adjusted for age and gender and data are provided as means with 95% confidence intervals.

Results:
At baseline, we found no statistical significant differences in duration of PA and SA between groups. After seven years, the intervention group were more physically active than controls, whereas SA was similar. Four years beyond the intervention, the intervention group were still more physically active than controls (2.7 (0.8,4.7) hours/week) whereas SA was still similar (-3.9 (-9.7,1.7) hours/week).

Conclusion:
Intervention with daily school PA throughout compulsory school is associated with a more physically active lifestyle that remains into young adulthood.
Relation Between Demographical, Individual, Social and Environmental factors and Duration of Physical Activity in Eight-Year-Old Children

MD Amanda Lahti1, MD, As.Prof., Björn Rosengren1, MD Tomas Pettersson2, PT Jan-Åke Nilsson1, Prof., MD Magnus Karlsson1

1Clinical and Molecular Osteoporosis Research Unit, Department of Orthopedics and Clinical Sciences, Inga Marie Nilssons gata 28, 4th floor new building, Sweden, 2Department of Sports, Malmö University, Inga Marie Nilssons gata 28, Sweden

Introduction:
If we can identify factors that influence physical activity (PA) in young years, we can possibly address these to achieve more physically active children. We therefore tried to identify factors, across several domains that in young children was associated with PA.

Materials and Method:
We assessed in a population based cohort of 341 children (189 boys and 152 girls) aged 7.7 ± 0.6 years (mean ± SD), duration of PA and factors within demographic/biological, psychological/behavioral, social and environmental domains through a questionnaire. Height and weight was measured by standard measurements. We used ANCOVA model to evaluate factors that independently associated with PA.

Result:
The factors included in the model explained 21% of the variance in duration of PA (21% in boys and 29% in girls). Parental attitude was the only factor that in all children was independently associated with duration of PA. Children with parents finding PA of importance spent 1.5 (0.6, 2.3) (mean, 95% CI) hours more on PA per week (boys 2.5 (1.1, 3.9) and girls 0.6 (-0.4, 1.5)), than children with parents not regarding PA as being important.

Conclusion:
In 8-year old children, parental attitude towards PA was in our model the only independent factor associated with duration of PA. It therefore seems reasonable to influence parent’s attitude when designing interventions that aim at improve PA in young children.
A School-Based Exercise Intervention Program Improves a Composite Risk Score for Fracture

MD Felix Cronholm¹, MD, PhD Magnus Dencker², MD, PhD Björn Rosengren¹, MD, PhD Magnus Karlsson¹
¹Clinical and Molecular Osteoporosis Research Unit, Department of Clinical Sciences and Orthopedics, Lund University, Skåne University Hospital, , Sweden, ²Department of Physiology and Clinical Sciences, Lund University, Skåne University Hospital, , Sweden

Introduction:
We have previously shown that a long-term intervention of daily school-based physical activity (PA) results in skeletal benefits in girls but not in boys. However, since several traits influence fracture risk, a composite score (summarizing multiple traits) may better capture any fracture preventive effect.

Materials and Methods:
In a controlled trial we increased PA in one school to 200 min/week whereas three control schools maintained 60 minutes/week PA. We followed 89 boys and 51 girls from mean age 8 to 15 years. At baseline and follow-up we assessed 5 musculoskeletal traits; Lean mass (LM), bone mineral content (BMC) and bone area by DXA; bone quality as speed of sound (SOS) by quantitative ultrasound; muscle strength as knee flexion peak torque (PT) by a computerized dynamometer. We calculated age and sex-specific individual Z-scores for each trait (number of SD above or below the mean value) using the control-cohort as reference population, and calculated the composite risk score for fracture as average Z-score of all traits.

Results:
Both intervention boys and intervention girls had at follow-up better composite scores than their respective controls (boys 0.3 (0.05, 0.6) (mean difference 95% CI), girls 0.4 (0.1, 0.8)). For single traits, we found no statistically significant differences between intervention and controls in boys for LM (p=0.24) and SOS (p=0.37) and in girls for LM (p=0.49) and PT (p=0.13).

Conclusion:
When using single traits as end-points there is a risk to underestimate overall PA-effects. The program confers a beneficial composite risk score in both sexes.
A 7-Year School-Based Exercise Program Increased the Level of Physical Activity in Children

MD Felix Cronholm1, MD, PhD Björn Rosengren1, MD, PhD Caroline Karlsson1, MD, PhD Magnus Karlsson1

1Clinical and Molecular Osteoporosis Research Unit, Department of Clinical Sciences and Orthopedics, Lund University, Skåne University Hospital, Sweden

Introduction:
The activity-stat theory infers that physical activity (PA) in children is constant and cannot be increased by intervention. We aimed to assess if a school-based PA intervention program could increase the duration of total PA in children in a long-term perspective.

Materials and Methods:
We followed in a prospective and controlled population-based PA intervention study, at baseline 6-9 years old children. In the intervention group (n=152) we increased physical education in school from the Swedish standard of 60 minutes/week to 200 minutes/week, while the controls (n=76) maintained 60 minutes/week. We registered durations of total and leisure-time PA and screen-time activities at baseline and after 5 and 7 years using questionnaires.

Results:
Before study start, durations of PA and screen-time activities were similar between intervention and control groups. With the intervention program the intervention group achieved higher durations of weekly total PA than the controls at all follow-up evaluations (all p<0.001). The PA benefits remained in the intervention children also when boys and girls were evaluated separately. We found no statistically significant group differences in the duration of leisure-time PA (p ranging from 0.08 to 0.77) or screen-time activities (p ranging from 0.31 to 0.91) when comparing intervention and control groups.

Conclusion:
A school-based PA intervention-program increases the total duration of PA in both sexes, without any compensatory decrease in leisure-time PA or increase in screen-time activities. This opposes the activity-stat theory, which infers that the total duration of PA in children is constant.
Kinetic Chain Strength and Psychosocial Aspects in Recreational Runners with AT: a Case Control Study

PT Igor Sancho1, PhD Christian Barton3, PhD Dylan Morrissey1, As. Prof., PhD Peter Malliaras2
1Sports and Exercise Medicine. Queen Mary University of London, Mile End Hospital, Bancroft road, E1 4DG, Great Britain, 2Department of Physiotherapy. School of Primary and Allied Health Care. Faculty of Medicine, Nursing and Health Science. Monash University, PO Box 527 3199, Australia, 3Sport and Exercise Medicine Research Centre, La Trobe University, Plenty Road, 3068, Australia

Introduction:
Achilles tendinopathy (AT) is a prevalent injury in running sports. Muscle weakness and pain beliefs have been suggested to be associated with AT. The aim of this case-control study was to investigate factors that discriminate the presence of AT among active participants in a multivariate model.

Materials and method:
Thirty-one active male who ran at least once per week were recruited, including 17 with AT and 14 healthy active controls. Participants completed five questionnaires related to Achilles tendon function, activity and psychosocial aspects (VISA-A, IPAQ, ATBQ, TAMPA, PASS20) and performed six lower limb strength tests (standing calf raises, seated calf raises, leg extension, leg curl, hip abduction, hip extension) and 2 ankle flexibility tests (knee extended, knee bent) in a randomised order. A forward stepwise logistic regression analysis to identify discriminating factors for the presence of AT was performed.

Results:
Runners with AT had lower seated calf raise strength (16% lower, large effect size, SMD=1.29, 95%CI) and showed exaggerated altered fear-avoidance beliefs based in ATBQ questionnaire (31% higher, medium effect size, SMD=1, 95%CI) compared to healthy controls. The rest of the included outcomes were not associated with AT.

Conclusion:
Our cohort of runners with AT had soleus and long ankle flexor muscle dysfunction and adverse beliefs about Achilles tendon pain. We recommend that clinical assessment incorporates these factors and are considered as therapeutic targets in future rehabilitation efficacy research.
Hip Abductor Muscle Strength is not related to Unipedal Balance Parameters among professional Football Players

MSc, PT Francis Fasuyi1,2, PhD Ayodeji Fabunmi3, Prof., PhD, PT Babatunde Adegoke1,2
1Department of Physiotherapy, University of Medical Sciences, Nigeria, 2Department of Physiotherapy, University of Ibadan, Nigeria

Purpose:
With known contribution of Hip Abductor muscles’ contribution to lower-extremity alignment, limited data exists on the relationship between abductor strength and unipedal non-dominant leg balance among football. This study was designed to explore this relationship, as well as to evaluate the influence of visual system on unipedal non-dominant leg balance parameters among professional football players.

Participants and Method:
This descriptive correlational study involved 32 purposively recruited male professional football players who met the inclusion criteria. Participants’ unipedal non-dominant balance parameters was assessed using Wii balance-board in two test situations (eyes open (EO) and eyes closed (EC)) while Isometric Hip Abductor Muscle Strength (IHAMS) was measured using a modified sphygmomanometer. Data obtained were analyzed using Wilcoxon sign rank test and Spearman correlation coefficient at α = 0.05.

Results:
Participants’ mean age, weight, height and isometric hip abductor muscle strength were 28.19 ± 4.10 years, 71.31 ± 7.45kg, 1.76 ± 0.07m and 140.50 ± 20.55mmHg respectively. Participants had significantly higher (z = -2.67, p < 0.05) medio-lateral velocity during the EC balance test with a medium effect size of r = 0.35. No significant relationship was found between IHAMS and the unipedal non-dominant leg balance parameters during both balance test conditions.

Conclusion:
There is no significant correlation between hip abductor muscle strength as measured in this study and unipedal non-dominant leg balance among footballers.
Contribution of some Physical Characteristics to Unipedal non-dominant lower Limb Balance among Footballers

MSc Francis Fasuyi, PhD, PT Babatunde Adegoke

Department of Physiotherapy, University of Medical Sciences, Laje Road, Nigeria, Department of Physiotherapy, University of Ibadan, Nigeria

Objective:
The objective was to determine the correlations between each of age, body mass index (BMI), foot length, tibia length and calf circumference and Unipedal Non-dominant Lower Limb Balance (UNLLB) and the contribution of each to its performance among professional football players in a Nigerian National Football League club.

Design:
This descriptive correlational study

Setting:
Football club treatment room

Participants:
Thirty-two male professional football players who met inclusion criteria were purposively recruited.

Assessment:
Participants’ Age was recorded along with height, weight, foot-length, tibia-length and calf circumference measured using standardized procedures while their UNLLB was assessed using the Wii balance board.

Main Outcome measures:
The primary outcome measure in this study was UNLLB measures as centre of pressure parameters. The data were analysed using Spearman Rank Order Correlation while Stepwise Multiple Linear Regression Analysis was used to explore the contributions of the selected variables to UNLLB at 0.05 alpha level.

Result:
All the listed variables except age were significantly correlated with UNLLB. Stepwise regression analysis showed limb length (13.2%, p=0.023), calf circumference (22.3%, p=0.004) and weight (11.5%, p=0.033) were significant contributors to UNLLB with visual input allowed, while tibia length (14.9%, p=0.017) and foot length (9.5%, p=0.048) were significant predictors with visual input denied.

Conclusion:
Limb length, calf circumference, body weight, tibia length and foot length are significant predictors of unipedal non-dominant limb balance among professional footballers.
Elite professional Soccer Players’ Experience of Injury Prevention

MSc Jakob Bredahl Kristiansen¹,², PhD Ingalill Larsson¹
¹Lund University, Faculty of Medicine, Box 117 221 00 Lund, Sweden, ²Brøndby IF, Brøndby Stadion 30, Denmark

Introduction:
Injuries are common in professional soccer and might interfere with the ability of the team and the individual player to perform. Several studies have shown the benefits of exercise as a means to prevent injuries in soccer, but research is needed to substantiate, how injury prevention strategies are best implemented.

Purpose:
The purpose of this study was to describe and interpret soccer players’ experience of injury prevention.

Method:
A hermeneutic phenomenological approach was used as described by van Manen.

Respondents:
Eight professional Danish soccer players were interviewed with open-ended interviews.

Results:
The players’ lived experience of injury prevention across all the interviews were shown as the interaction between three overreaching themes: (1) being a part of a performance environment, (2) the need for an individual approach and (3) strong personal ambitions. Interaction between the three themes empowered the players to engage in injury prevention.

Conclusion:
Professional soccer players’ experience of injury prevention can be interpreted within the four components of the empowerment model: (1) impact, (2) competence, (3) meaningfulness and (4) choice. The presence of the four components empowered the players to engage in injury prevention in the soccer club.
Is Hip Muscle Strength normalized in Patients with Femoroacetabular Impingement Syndrome one Year after Hip arthroscopic Surgery?

MSc Signe Kierkegaard¹, As. Prof. Inger Mechlenburg², Dr. Bent Lund¹, Prof. Kjeld Søballe², As. Prof. Ulrik Dalgas³

¹Department of Orthopaedic Surgery, Horsens Hospital, Sundvej 30, Danmark, ²Department of Orthopaedic Surgery, Aarhus University Hospital, Tage Hansensgade 2, Denmark, ³Section for Sport, Aarhus University, Dalgas Avenue 4, Denmark

Introduction:
Hip arthroscopy (HA) for femoroacetabular impingement syndrome (FAIS) aims to decrease pain and improve functional capacity. Patients with FAIS are predominantly young physically active patients, characterized by decreased hip muscle strength when compared to reference persons. The aim of this study was to assess hip muscle strength in patients with FAIS before and one year after HA and compare hip muscle strength with a matched reference group.

Materials and methods:
In this prospective, cohort study, patients were eligible for inclusion if they were scheduled for HA and had a diagnosis of FAIS. Patients underwent HA and followed a homebased rehabilitation program. Furthermore, age and gender matched persons reporting no hip problems were included as a reference group. Forty-five patients (mean age 36 years, 26 females) were tested before and one year after HA as were 23 reference persons. Muscle strength was assessed by dynamometry and after submaximal familiarization trials, testing of maximal voluntary contraction was performed isometrically at hip angle of 45 degrees and isokinetically at an angular velocity of 60 degrees/second.

Results:
Compared to before HA, patients’ concentric, isometric and eccentric hip flexion strength increased by 13±21% (p<0.01), 12±18% (p<0.01) and 6±17% (p=0.01) one year after HA, while improvements in hip extension strength varied much in the group. One year after HA, patients displayed 11-14% lower muscle strength than the reference group, with most comparisons being statistically significant.

Conclusion:
Despite significant improvements in hip muscle strength one year after HA, patients with FAIS remain weaker than reference persons.
Role of McConell taping and Kinesiology taping in patellofemoral pain syndrome: A comparative analysis

Dr. Mukul Mittal, Prof Deepak Chaudhary, As Prof Deepak Joshi, Dr Bhibhu Nayak

1Sports Injury Centre, Vardhman Mahavir Medical College and Safdarjung Hospital, India, 2Sports Injury Centre, Vardhman Mahavir Medical College and Safdarjung Hospital, 3Sports Injury Centre, Vardhman Mahavir Medical College and Safdarjung Hospital, 4Sports Injury Centre, Vardhman Mahavir Medical College and Safdarjung Hospital, India

Title:
Role of McConell taping and Kinesiology taping in Patellofemoral pain syndrome: A comparative analysis

Introduction:
Patients with patellofemoral pain syndrome (PFPS) present with gradual onset of anterior knee pain treated with an exercise program targeting knee and hip strengthening. Taping is an adjunct which aims at correcting patellar alignment and/or aid muscle activation. The purpose of this study is to evaluate the role of McConell taping (MT) and Kinesiology taping (KT) and compare them to controls and each other.

Materials and methods:
Randomized controlled trial with 150 patients divided in three treatment groups; controls, MT and KT. All groups received a home base knee and hip strengthening program. Outcome were assessed using VAS, KUJALA score, Step test and Triple jump test at 3 weeks, 6 weeks.

Results:
At 3 weeks, outcomes improved in all 3 groups, with no statistical difference in KT & MT group; although statistically significant than control. At 6 weeks, KUJALA and step test were better in MT & KT than controls; KUJALA (p: 0.037), step test (0.000) & triple jump test (p: 0.048) were better in MT than KT group. In patients with mal tracking MT had significantly better results than KT and controls.

Conclusion:
Taping is a useful, low cost adjunct that can be used in PFPS, Taping method used should be individualized to the patient and no recipe approach used for treating PFPS. Larger, multi centric studies would be required to affirm the results obtained.
Reasons and predictors of discontinuation of running after a running course for novice runners

MSc Tryntsje Fokkema¹, Dr. Fred Hartgens², Dr. Bas Kluitenberg³, Dr. Evert Verhagen⁴, Prof. dr. Frank JG Backx⁵, Dr. Henk van der Worp³, Prof. dr. Sita MA Bierma-Zeinstra¹⁶, Prof. dr. Bart W Koes¹, Dr. Marienke van Middelkoop¹

¹Department of General Practice, Erasmus MC, University Medical Center, The Netherlands, ²Departments of Epidemiology and Surgery, Research School CAPHRI, Maastricht University Medical Center+, Sports Medicine Center Maastricht, The Netherlands, ³Center for Sports Medicine, University of Groningen, University Medical Center Groningen, The Netherlands, ⁴Amsterdam Collaboration on Health & Safety in Sports, Department of Public and Occupational Health, Amsterdam Movement Sciences, VU University Medical Center, The Netherlands, ⁵Department of Rehabilitation, Physical Therapy Science & Sports, Rudolf Magnus Institute of Neurosciences, University Medical Center Utrecht, The Netherlands, ⁶Department of Orthopedics, Erasmus MC, University Medical Center, The Netherlands

Introduction:
The aim of this study was to determine the discontinuation rate among participants of a running course for novice runners and investigate the main reasons to discontinue and characteristics associated with discontinuation.

Materials and methods:
771 participants of Start to Run, a 6-week running course for novice runners, participated in this study. Before the start of the course, information on demographics, physical activity and perceived health was collected with a baseline questionnaire. In the 26-weeks follow-up questionnaire information on the continuation of running (yes/no) and main reasons for discontinuation were obtained. To determine predictors for discontinuation of running, multivariable logistic regression analysis was performed.

Results:
29.2% of the participants (n=225) stopped running within 26 weeks after the start of the 6-week running course. The main reason for discontinuation was a running related injury (48%). Being female (OR 1.74; 95% CI 1.13-2.68), being unsure about the continuation of running after the course (OR 2.06; 95% CI 1.31-3.24) and (almost) no alcohol use (OR 1.62; 95% CI 1.11-2.37) were positively associated with discontinuation of running. Previous running experience less than one year ago (OR 0.46; 95% CI 0.26-0.83) and a higher score on the RAND-36 subscale physical functioning (OR 0.98; 95% CI 0.96-0.99) were negatively associated with discontinuation of running.

Conclusion:
Almost one-third of the novice runners dropped out from running within six months. A running-related injury was the main reason to stop running. Especially women with a low perceived physical functioning and without running experience were prone to discontinue running.
Anterior cruciate ligament injury: Who succeeds without reconstructive surgery?

PhD Hege Grindem1, PhD Elizabeth Wellsandt2,4, PhD Mathew Failla2,5, Prof Lynn Snyder-Mackler3, Prof May Arna Risberg1,6

1Norwegian Research Center for Active Rehabilitation (NAR), Department of Sports Medicine, Norwegian School of Sport Sciences, Norway, 2Biomechanics and Movement Science Program, University of Delaware, USA, 3Department of Physical Therapy, College of Health Sciences, University of Delaware, USA, 4Division of Physical Therapy Education, University of Nebraska Medical Center, USA, 5Department of Rehabilitation and Movement Science, University of Vermont, USA, 6Norwegian Research Center for Active Rehabilitation (NAR), Department of Orthopaedics, Oslo University Hospital, Norway

Introduction:
The aim of this study was to identify early predictors of successful 2-year outcomes after non-surgical treatment of an anterior cruciate ligament (ACL) injury.

Material and methods:
118 ACL-injured athletes (age 28.6 SD 10.5 years) who chose not to undergo ACL reconstruction were consecutively included and prospectively followed for 2 years in Oslo (n=69) or Delaware (n=49). Successful 2-year outcome was defined as having 2-year International Knee Documentation Committee (IKDC2000) scores ≥ the 15th normative percentile and not undergoing ACL reconstruction. Multivariable logistic regression models were built using demographic and knee function data (quadriceps strength, 4 hop tests, IKDC2000 and Knee Outcome Survey-Activities of Daily Living Scale[KOS-ADLS]) collected at baseline or after a 5-week rehabilitation program.

Results:
After 2 years, 52 of 97 (54%) patients had a successful outcome (82% follow-up rate). In the multivariable baseline model, higher age, female sex, better performance on the single hop test and higher KOS-ADLS score were significantly associated with a successful 2-year outcome. After rehabilitation, higher age, female sex and a higher IKDC2000 score significantly increased the odds of successful 2-year outcome. The two models had comparable predictive accuracy (post-rehabilitation AUC=0.78[95% CI:0.68-0.88], baseline AUC=0.81[95% CI:0.72-0.89]).

Conclusion:
Athletes who have better knee function early after injury, are older or female are more likely to have successful 2-year outcomes with non-surgical treatment of an ACL tear. Prediction models which include measures of knee function, assessed either prior to or after rehabilitation, can estimate 2-year prognoses with non-surgical treatment and thereby aid shared surgical decision-making.
The Consequences of Knee Joint Injury in Youth Sport

Dr. Jackie Whittaker¹,2,3, Dr. Clodagh Toomey⁴, Dr. Jacob Jaremko⁴, Dr. Carolyn Emery⁵

¹Faculty of Rehabilitation Medicine, University of Alberta, 8205-114 Street, Canada, ²Glen Sather Sport Medicine Clinic, University of Alberta, Kaye Edmonton Clinic, 11400 University Avenue, Canada, ³Sport Injury Prevention Research Centre, Faculty of Kinesiology, University of Calgary, 2500 University Drive, NW, Canada, ⁴Department of Radiology & Diagnostic Imaging, Faculty of Medicine and Dentistry, University of Alberta, WC Mackenzie Health Sciences Centre 8440 112 St. NW, Canada

Introduction:
Youth sport participants are vulnerable to joint injury and subsequent osteoarthritis. Improved understanding of the period following joint injury could inform osteoarthritis prevention strategies. This research examines the association between youth sport-related knee injury and health-related outcomes, 3-10 years post-injury.

Methods:
Participants include 100 youth who experienced a sport-related knee injury 3-10 years previously and 100 age, sex and sport-matched uninjured controls. Outcomes include: Knee Injury and Osteoarthritis Outcome Score (KOOS); Intermittent and Constant Osteoarthritis Pain; body mass index (BMI), fat mass index (FMI); weekly physical activity; estimated VO₂ max; hip and knee muscle strength; dynamic balance; MRI and radiographic-defined osteoarthritis. After describing baseline characteristics multivariable conditional regression (95%CI) was used to evaluate the association between injury history and each outcome, considering differences by sex, time-since-injury and injury type.

Results:
Participant median age was 22 years (range 15-26) and 55% were female. The previously injured group reported poorer KOOS scores, more intermittent pain, higher BMI (1.8 kg/m²; 95%CI 0.9,2.6) and FMI (1.1 kg/m²; 0.5,1.6), weaker knee muscles (-0.21 Nm/kg; -0.0031,-0.011), poorer balance and more frequent MRI-defined OA (OR 10.0; 2.3,42.8) than controls. Greater differences in KOOS, BMI, FMI, VO₂ max, knee muscle strength, and balance existed between injured and uninjured females than males. Longer time-since-injury influenced the association between previous injury and KOOS, knee extensor strength and balance.

Conclusions and Relevance:
Outcomes consistent with future osteoarthritis and other negative health states are more prevalent in individuals 3-10 years following a range of youth sport-related knee injuries compared to uninjured matched controls.
Comparative effectiveness of therapeutic hip and knee exercise for patellofemoral pain: a protocol for a pragmatic randomized trial

PT, MSc Rudi Neergaard Hansen¹, PhD Michael Skovdal Rathleff², PhD Christoffer Brushøj³, PhD Marius Henriksen¹

¹Department of Physical and Occupational Therapy, Bispebjerg-Frederiksberg Hospital, Bispebjerg bakke 23, Denmark, ²Research Unit for General Practice in Aalborg, Department of Clinical Medicine, Aalborg University, Fredrik Bajers Vej 5, Denmark, ³Institute of Sports Medicine Copenhagen, Bispebjerg-Frederiksberg Hospital, Bispebjerg Bakke 23, Denmark

Introduction:
Patellofemoral pain (PFP) is prevalent in adolescence and adulthood and often persists. Therapeutic hip and knee exercise produce similar small to moderate beneficial effects in pain and physical function. However, the PFP population is very heterogeneous and ‘one-size-fits-all’-approaches presumably are sub-optimal. The aim of present study is to (1) assess the comparative effectiveness of two different exercise programs (QE vs. HE) on self-reported pain and function in individuals with PFP and (2) to explore candidate patient characteristics that predict differential responses to the two exercise programs (QE vs HE) on self-reported pain and physical function in individuals with PFP.

Materials and Methods:
The study is a randomized, controlled, assessor-blinded, equivalence trial with a 2-group parallel design. 200 participants will be recruited from the Institute of Sports Medicine Copenhagen (ISMC), Bispebjerg-Frederiksberg Hospital, Denmark, and randomized to either hip or quadriceps training for 12 weeks. The effects are compared at the end of the training period (12 weeks) and again after another 3 months. At each time point we will identify which baseline characteristics that predict outcome.

Perspectives:
The study will contribute to the development of a stratified physiotherapeutic treatment regimen in patients with PFP and be an important first step in the development of an evidence-based algorithm that can be used to tailor physiotherapy to the patients. The results of the will be immediately applicable in clinical practice.
Upper-extremity functional performance tests: reference values for overhead athletes

PT Dorien Borms¹, Prof. Dr. Ann Cools¹
²Ghent University, De Pintelaan 185, Belgium

Introduction:
Upper-extremity functional performance tests are commonly used as part of an athletes’ screening program or in rehabilitation. However, little or no reference values for overhead athletes exists despite the clinical need for cut-off values as criteria for injury prevention and return to play. Therefore, the study purpose was to provide an age, gender and sports based normative database for three functional shoulder tests: Y Balance Test – Upper Quarter, Closed Kinetic Chain Upper Extremity Stability Test (CKCUEST) and Seated Medicine Ball Throw (SMBT). A second aim was to discuss gender, age and sports differences. Finally, correlation between tests was evaluated.

Materials and Methods:
Overhead athletes (106 male, 100 female) between 18 and 50 years old and from three different sports (volleyball, tennis and handball) performed all tests. A linear mixed or regression model was applied to determine significant differences in performance between gender, age and sports. Pearson correlation coefficients were analyzed to determine the relationship between tests.

Results:
Normative values for the three upper-extremity functional tests were divided by gender, sports and age. Results showed significant gender and age differences for all tests. For YBT-UQ, also significant side and sports differences were recorded. CKCUEST is moderately correlated with SMBT and YBT-UQ. Weak correlation was found between SMBT and YBT-UQ.

Conclusion:
This study provides normative data for YBT-UQ, CKCUEST and SMBT which is clinically relevant for functionally screening overhead athletes and benchmark their performance to others from the same gender, age and sports. A combination of included tests is recommended.
The effect of aerobic Exercise on cognitive performance of Athletes with Nocturnal Sleep Deprivation

Dr. Khadijeh Irandoust¹, Dr. Morteza Taheri²

Khadijeh Irandoust, Imam Khomeini International University, Qazvin, Iran, ²morteza taheri, Imam Khomeini International University, Qazvin,

Purpose:
The purpose of the research was to investigate the acute effect of low intensity aerobic Exercise on psychomotor performance of Athletes with Nocturnal Sleep Deprivation

Methods:
16 professional female volleyball players were studied twice in a balanced, randomized design. Subjects were measured for psychomotor performance using Vienna system test. The participants were asked to fill the Pittsburgh Sleep Quality Index (PSQI) prior to the beginning of the study and their Nocturnal activity was recorded at 1-minute intervals and scored with the Actiwatch Sleep Analysis. Movement detection test (MDT); Cognitrone test (COG); visual pursuit test (VPT) and Determination test (DT) were measured as psychometric performance by Vienna System Test.

Results:
The results suggested that all psychomotor tests were significantly impaired by nocturnal sleep deprivation (p≤0.05). Moreover, it was shown that the experimental group didn’t have any deteriorating change in the mentioned tests (p≥0.05).

Conclusions:
Although nocturnal Sleep deprivation could result in cognitive malperformance in professional athletes, the light aerobic exercise would alleviate the deleterious effect of sleep deprivation in decisive task among athletes.

Keywords:
Psychomotor- Nocturnal Sleep Deprivation- Pittsburgh Sleep Quality Index (PSQI)-athlete.
Training for a (half-)marathon: weekly training volume and longest endurance training run in relation to performance and running related injuries

MSc Tryntsje Fokkema¹, BSc Ankie ADN van Damme¹, Dr. Maarten WJ Fornerod², Dr. Robert-Jan de Vos³, Prof. dr. Sita MA Bierma-Zeinstra¹,³, Dr. Marienke van Middelkoop¹

¹Department of General Practice, Erasmus MC, University Medical Center, The Netherlands, ²Departments of Pediatric Oncology and Cell Biology, Erasmus MC, University Medical Center, The Netherlands, ³Department of Orthopaedics, Erasmus MC, University Medical Center, The Netherlands

Introduction:
With the increasing popularity of long-distance running, more runners may train with a lower training volume during the preparation of a (half-)marathon. However, the effect on performance and running-related injuries (RRIs) is unknown. The aim of this study was to examine the associations of training volume with (half-)marathon performance and RRIs.

Materials and methods:
Two weeks before the running event, 434 half-marathon and 339 marathon participants completed a questionnaire, in which information on RRIs and average training volume over the preceding month was collected. Finish times were provided by the organization of the running events. With finish time and RRIs as dependent variables, linear and logistic regression analyses were performed to test the associations with weekly training volume.

Results:
In the half-marathon runners a low training volume (<20km/week) was associated with a higher injury risk (OR 2.09, 95%CI 1.14;3.84), while a high training volume (>32 km/week) was associated with a better finish time (β -4.23, 95%CI -6.56;-1.91). A low training volume (<32 km/week) (β 6.95, 95%CI 1.11;12.78) was associated with a worse finish time in marathon runners, while a high training volume (>65 km/week) was associated with a better finish time (β -13.14, 95%CI -21.74;-4.54) and lower injury risk (OR 0.25, 95%CI 0.10;0.64).

Conclusion:
Results of this study indicate that preparation on a (half-)marathon with a relatively low training volume and shorter endurance runs can result in an equal or even higher injury risk and a worse (half-)marathon performance. However, the role of a prior injury cannot be excluded.
The role of the vascular and structural response to activity in the development of Achilles tendinopathy: a prospective study

PhD Evi Wezenbeek\textsuperscript{1}, Prof Tine Willems\textsuperscript{1}, Dr Nele Mahieu\textsuperscript{1}, Prof Martine De Muynck\textsuperscript{2}, Prof Luc Vanden Bossche\textsuperscript{2}, Prof Adelheid Steyaert\textsuperscript{2}, Prof Dirk De Clercq\textsuperscript{3}, Prof Erik Witvrouw\textsuperscript{1}

\textsuperscript{1}Ghent University, Department of Rehabilitation Sciences and Physiotherapy, De Pintelaan 185, Belgium, \textsuperscript{2}Ghent University Hospital, Department of Physical and Rehabilitation Medicine, De Pintelaan 185, Belgium, \textsuperscript{3}Ghent University, Department of Movement and Sport Sciences, Watersportlaan 2, Belgium

Introduction:
Several risk factors have been suggested in the development of Achilles tendinopathy but large scale prospective studies are limited. Therefore, the aim of this study was to investigate the role of the vascular response to activity of the Achilles tendon, tendon thickness, UTC tendon structure and foot posture as possible risk factors in the development of Achilles tendinopathy.

Materials and Methods:
Three hundred freshmen students in sports sciences at Ghent University were tested and followed prospectively for 2 consecutive years. At baseline, foot posture index and ultrasound tissue characterisation were investigated bilaterally. Blood flow and tendon thickness were measured before and after a running activity. Cox regression analyses were performed to identify significant contributors to the development of Achilles tendinopathy.

Results:
During the two-year follow-up, 27 of the included 250 participants developed Achilles tendinopathy (11%). Significant predictive effects were found for female gender and blood flow response after running (\(p=0.022\) and \(p=0.019\), respectively). The hazard of developing Achilles tendinopathy increases if the blood flow increase after running is lowered, regardless of sex, foot pronation and timing of flow measurements. The model had a predictive accuracy of 81.5\% regarding the development of Achilles tendinopathy, with a specificity of 85.0\% and a sensitivity of 50.0\%.

Conclusion:
This prospective cohort study identified both female gender and the diminished blood flow response after running as significant risk factors for the development of Achilles tendinopathy. UTC tendon structure, Achilles tendon thickness and foot posture did not significantly contribute to the prediction of Achilles tendinopathy.

**Dr. Mukul Mittal¹, Dr. Bhibhu Nayak², Dr. Gaurav Sharma³**

¹Sports Injury Centre, Sports Injury Centre, India, ²Sports Injury Centre, Safdarjung Hospital, India, ³Department of Radiology, Safdarjung Hospital, India

**Title:**

**Introduction:**
Partial tears of common extensor tendons are acute traumatic or chronic degenerative injuries which can be difficult to treat. PRP aims to augment the healing process and improve overall function.

**Materials and Methods:**
32 patients who failed 2 months of conservative therapy received 3 bi-weekly intra tendinous injections under ultrasound guidance and followed at 4, 12, 24 weeks after last injection. VAS and ultrasound evidence of healing were outcome measures.

**Results:**
Statistical analysis revealed significant improvement in VAS score at 12 weeks which continued to improve at 24 weeks. Ultrasound evidence of healing was significant at 24 weeks and correlated with VAS scores.

**Conclusion:**
PRP injections are safe, minimally invasive treatment for management of partial tendon tears of common extensor group of muscles. They are efficient in improving the sonographic changes associated with these tendon tears.
Assessment of acute bone-remodelling with molecular imaging-concentric versus eccentric exercise loading

MSc Haddock Bryan¹, PhD Audrey Fan², As. Prof Charlotte Suetta¹, PhD Feliks Kogan², Dr Garry Gold²
¹Dept. of Clinical Physiology, Nuclear Medicine and PET, Rigshospitalet, Copenhagen University Hospital, Nordre Ringvej 59, Denmark, ²Department of Radiology, Stanford University, Stanford University, USA

Introduction:
Methods to assess acute effects of loading on bone tissue are needed to get a deeper understanding of exercise induced bone-remodelling. Previous animal studies using 18F-Sodium Fluoride (NaF) have found acute increases in uptake following heavy loads on bone [2]. However, the acute response of bone to a more physiological stimulus is still poorly understood. The aim of this study was to measure the impact of two different types of exercises on the acute changes in bone perfusion and remodelling with NaF-PET imaging.

Materials and methods:
12 healthy subjects (20-43yrs) were recruited for a baseline (24 hour abstention from exercise) and post-exercise NaF-PET scan on a PET/MRI scanner (GE-SIGNA). After injection of 93 +/- 2 MBq 18F-sodium fluoride each subject performed an exercise regimen using the right leg to step up onto a 30 cm high stool and hopping down, landing on the left leg 100 times.

Results:
Both types of loading induced acute changes. In the left landing leg there was an increased uptake in the knee (70%), tibia (53%) and foot (100%). In contrast, the lifting leg demonstrated increased uptake in the knee (73%), primarily at the insertion of the patella tendon, but not the foot (-3%) or tibia (4%).

Conclusion:
With the present study we were able, for the first time, to measure the acute effects of bone loading, with an exercise specific uptake of NaF as a marker of bone-remodelling. This can prove to be a promising tool in research of biomechanics and bone physiology.
Viscosupplementation for knee osteoarthritis – a sports medicine perspective

Dr. Mandy Zhang1, Dr Ivy Lim2

1Mandy Zhang, 2 Simei Street 3, Changi General Hospital, Singapore, 2Ivy Lim, 2 Simei Street 3, Changi General Hospital, Singapore

Introduction:
Osteoarthritis can occur in athletes due to excessive or repetitive participation in sport, or previous major joint trauma. Intra-articular viscosupplementation is commonly used for functional improvement and pain relief.

Methods:
The audit was carried out retrospectively on all intra-articular viscosupplementation injections done for knee osteoarthritis in 2016 in two sports medicine clinics in Singapore.

Results:
285 injections for 213 patients were done. Majority of patients were 50-59 years old. This peak is at a younger age compared to other studies, and may be because of the larger proportion of secondary OA due to previous sports injury. 32.6% of patients in this series have a history of prior joint trauma. A large proportion of patients had Kellgren-Lawrence grade 3 osteoarthritis, even though viscosupplementation is preferred and has better outcomes in earlier stages of knee osteoarthritis. This may be due to sportsmen tolerating pain and seeking medical treatment later. Sports participation in our cohort is mostly greater than 300 minutes per week, double the recommended 150 minutes of moderate exercise per week. Running is the most popular sport among subjects, which may be reflective of the sport’s popularity in the nation. 2.8% of our patients developing a flare reaction to Synvisc-One®, consistent with published data of 1 to 8%.

Conclusion:
Knee osteoarthritis in Asian athletes may occur at a younger peak age due to prior joint trauma. Viscosupplementation is a safe treatment option. Further prospective studies to evaluate the functional outcome following viscosupplementation in our Asian athletic population should be done.
Predictors of pain and physical function at 12-months after primary anterior cruciate ligament reconstruction - A retrospective cohort study

BSc. Med Michael Houlind Larsen¹, PhD, MD. Nis Nissen¹, As. Prof., PhD, MSc. Carsten Jensen¹,²
¹Dept. of Orthopaedic Surgery and Traumatology, Lillebaelt Hospital, Skovvangen 6, Denmark, ²Institute of Regional Health Research, University of Southern Denmark, Winsløwparken 19, 3, Denmark

Introduction:
The intensity of pain is rarely used as indication for surgery in patients with anterior cruciate ligaments tear. The aim of this study was to investigate whether age, gender, preoperative pain and knee instability could predict changes in pain and physical function 12 months after anterior cruciate ligaments reconstruction (ACLR).

Materials and Methods:
A retrospective cohort study (2013 to 2015) using the Danish Knee Ligament Reconstruction Register. Patients >18 years of age with primary ACLR participated. The Knee injury and Osteoarthritis Outcome Score (KOOS) and surgeon reported outcomes combined with selective demographics were used as predictor variables.

Results:
The degree of preoperative pain predicted postoperative improvements in both pain and physical function. Hence, patients with moderate and severe/extreme preoperative pain improved their postoperative KOOSpain score by 13 (95% CI: 10 to 16) and 26 (95% CI: 21 to 30) points, respectively and postoperative KOOSADL scores improved by 11 (95% CI: 8 to 14) and 24 (95% CI: 20 to 28). Surprisingly, patients with near normal to abnormal preoperative knee instability didn’t improve the postoperative pain and physical function as much as patients with normal preoperative instability. Age, gender and knee pivot shift had no predictive value.

Conclusion:
Preoperative KOOSpain predicted changes in postoperative pain and physical function 12 months after ACLR. The primary use of pivot shift test and knee instability, as indication for ACLR needs reconsideration.
Cross-Sectional Associations of Objectively-Measured Physical Activity with Body Composition and Cardiorespiratory Fitness in Mid-Childhood: The PANIC Study

Dr. Paul Collings 1,2, Kate Westgate 1, Juuso Väistö 3,4, Dr Katrien Wijndaele 1, Dr Andrew Atkin 1,5, Dr Eero Haapala 3,6, Dr Niina Lintu 7, Dr Tomi Laitinen 7, Prof Ulf Ekelund 1,8, Dr Soren Brage 1, Prof Timo Lakka 3,7,9
1 MRC Epidemiology Unit, Institute of Metabolic Science, Addenbrookes Hospital, University of Cambridge, UK,
2 Bradford Institute for Health Research, Bradford NHS Foundation Trust, UK,
3 Institute of Biomedicine, Physiology, University of Eastern Finland, Finland,
4 Institute of Dentistry, University of Eastern Finland, Finland,
5 UKCRC Centre for Diet and Activity Research (CEDAR), University of Cambridge School of Clinical Medicine, UK,
6 Department of Biology of Physical Activity, University of Jyväskylä, Finland,
7 Department of Clinical Physiology and Nuclear Medicine, Kuopio University Hospital and University of Eastern Finland, Finland,
8 Department of Sport Medicine, Norwegian School of Sport Sciences, Norway,
9 Kuopio Research Institute of Exercise Medicine, Finland

Introduction:
The minimum intensity of physical activity (PA) that is associated with favourable body composition and cardiorespiratory fitness (CRF) remains unknown. We investigated associations of PA with body composition and CRF in mid-childhood.

Materials and Methods:
The study was performed in a population-based sample of 410 Finnish children (aged 7.6 ± 0.4y). Combined heart-rate and movement sensing provided estimates of the cumulative time (min/day) spent above single metabolic equivalent (MET) levels, which were also collapsed to categories of light, moderate, and vigorous PA. Fat mass index (kg/m²) and trunk fat mass index (kg/m²) were derived from dual-energy X-ray absorptiometry. Maximal workload from a cycle ergometer test provided a measure of CRF (W/kg FFM). Adjusted linear regression and isotemporal substitution models were used for analyses.

Results:
The cumulative time above 2 METs was inversely associated with fat and trunk fat mass index whereas only time spent above 3 METs was positively associated with CRF; CRF increased and adiposity decreased dose-dependently with increasing MET intensities. All PA categories (including light) were inversely associated with adiposity; the magnitude of associations depended on the activity being displaced but were consistently stronger for vigorous PA. Moderate PA and more so vigorous PA were positively related to CRF.

Conclusion:
PA exceeding 2 METs is associated with lower adiposity in mid-childhood, whereas PA of 3 METs is required to benefit CRF. Vigorous PA was most beneficial for fitness and fatness, from a time-for-time perspective, but displacing any lower-for-higher intensity may be an important first-order public health strategy.
Preventing running-related injuries using evidence-based online advice: a randomized-controlled trial

MSc Tryntsje Fokkema¹, Dr. Robert-Jan de Vos², Dr. John M van Ochten¹, Prof. dr. Jan AN Verhaar², Prof. Irene S Davis³, Prof. dr. Patrick JE Bindels¹, Prof. dr. Sita MA Bierma-Zeinstra¹,², Dr. Marienke van Middelkoop¹
¹Department of General Practice, Erasmus MC, University Medical Center, The Netherlands, ²Department of Orthopaedics, Erasmus MC, University Medical Center, The Netherlands, ³Spaulding National Running Centre, Department of Physical Medicine and Rehabilitation, Harvard Medical School, USA

Introduction:
Running-related injuries (RRIs) are frequent. However, no successful injury prevention program has been developed so far. The aim of this study was to investigate the effect of an evidence-based online injury prevention program on the number of RRIs in recreational runners.

Materials and methods:
Both novice and experienced runners, aged 18 years and older, who registered for a running event (distances 5 km up to 42.195 km) were asked to participate in this study. After completing the baseline questionnaire, participants were randomized into the intervention or control group. Participants in the intervention group had access to the online injury prevention program, which consisted of information on evidence-based risk factors and advice to reduce the injury risk. The primary outcome measure was the number of self-reported RRIs in the time frame between registration for a running event and one month after the running event (mean follow-up 4.5 (1.6) months).

Results:
2378 runners (52.6% males; mean age 41.2 (11.9) years) participated in this study. Preliminary analyses show that 26.0% (95%CI 23.5-28.6) of the participants in the intervention group sustained a new injury during follow-up compared to 27.4% (95%CI 24.9-30.1) in the control group. Differences seem to exist in knee (20.5% vs. 26.0%) and lower leg (49.1% vs. 42.1%) injuries between the intervention and control group respectively.

Conclusion:
This is the largest randomized-controlled trial on RRIs so far. Preliminary analyses indicate that the online evidence-based injury prevention program had no effect on the total number of RRIs in recreational runners.
Does exercise dose matter in the management of rotator cuff tendinopathy? A meta-analysis and meta-regression of randomised controlled trials.

As. Prof. Peter Malliaras¹, Ms Gabrielle Seneque¹, Dr Chris Littlewood², Prof Terry Haines¹

¹Monash University, Frankston, Australia, ²Keele University, UK

Aim:
To synthesis current evidence for progressive resisted compared with non-progressive and non-resisted exercise in managing rotator cuff tendinopathy.

Design:
Systematic review

Data sources:
Cochrane, PEDro, Medline, Embase and Cinahl databases.

Eligibility criteria for selecting studies:
Randomised controlled trials (RCTs) comparing progressive resisted exercise or non-progressive and/or non-resisted exercise with a placebo, control, no intervention or inert treatment (meta-regression), or comparing progressive resisted exercise interventions with either non-progressive and non-resisted interventions or lower dose (volume or load) resisted progressive exercise (meta-analysis).

Results:
The meta-regression included eight studies (9 comparisons) and identified a moderate and significant cumulative effect favouring the exercise interventions compared with placebo, no treatment or inert treatment control (SMD = 0.66 [0.30, 1.01]). Progressive and resisted exercise (b = 0.78 [0.20, 1.37], p = 0.009) and frequency of exercise (b = 0.93 [0.20, 1.66], p = 0.013) were associated with superior pain and function outcome. Among the four studies in the meta-analysis there was a moderate and significant cumulative effect (SMD = 0.69 [0.01, 1.38]) favouring higher dose progressive and/or resisted exercise in the short to medium term (6 weeks to 3 months). Evidence from both analyses was low level according to Grading of Recommendations, Assessment, Development and Evaluation (GRADE) approach.

Conclusions:
Resisted and progressive exercise, especially if greater dose, and greater exercise frequency appear to be associated with improved pain and function outcomes among people with rotator cuff tendinopathy. These findings should be tested in high quality, adequately powered, RCTs given the low level of evidence.
Degenerative changes in the knee 1 to 5 years after ACL reconstruction and related risk factors: A prospective MRI evaluation

Dr. Adam Culvenor¹,², PT Brooke Patterson¹, Dr Christian Barton¹, Prof. Ali Guermazi³, Prof. Kay Crossley¹
¹La Trobe University Sport and Exercise Medicine Research Centre, Bundoora, Australia, ²Paracelsus Medical University, Institute of Anatomy, Austria, ³Boston University School of Medicine, Department of Radiology, USA

Introduction:
Early identification of the whole joint process of ACL rupture leading to osteoarthritis may aid in preventing osteoarthritis onset and progression in young adults. Therefore, we describe patellofemoral and tibiofemoral joint changes on MRI 1- to 5-years post-ACL reconstruction (ACLR), and explore participant characteristics associated with these changes.

Materials and Methods:
Early tibiofemoral and patellofemoral osteoarthritis features were assessed with the MRI Osteoarthritis Knee Score (MOAKS) in 78 participants (48 men, 32±15 years) at 1- and 5-years post-ACLR. The primary outcome was worsening (i.e., incident or progressive) cartilage defects, bone marrow lesions (BMLs), osteophytes and meniscal lesions. Logistic regression with generalised estimating equations evaluated participant characteristics associated with worsening features.

Results:
Worsening of cartilage defects in the patellofemoral, medial and lateral tibiofemoral compartments was present in 34 (44%), 8 (10%) and 10 (13%) participants, respectively. Worsening patellofemoral, and medial and lateral tibiofemoral BMLs (14 (18%), 5 (6%), 10 (13%)) and osteophytes (7 (9%), 8 (10%), 6 (8%)) were less prevalent, while 17 (22%) displayed deteriorating meniscal lesions. Being overweight (BMI >25kg/m²) was consistently associated with elevated odds (between 2-5 fold) of worsening patellofemoral and tibiofemoral osteoarthritis features. Older age (>26 years at surgery) was associated with three-fold greater odds of worsening patellofemoral and tibiofemoral cartilage defects.

Conclusions:
High rates of degenerative changes occur in the first 5-years following ACLR, particularly the development and progression of patellofemoral cartilage defects. Older individuals with a higher BMI appear to be at particular risk, and should be educated about this risk.
Longitudinal cartilage changes after posterior cruciate ligament reconstruction

Dr. Adam Culvenor1,2, Tobias Jung3, Dr. Wolfgang Wirth2, Heide Boeth4, Gerd Diederichs5, Georg Duda4, Prof. Felix Eckstein2

1La Trobe University Sports and Exercise Medicine Research Centre, Bundoora, Australia, 2Paracelsus Medical University, Institute of Anatomy, Austria, 3Charité – University Medicine Berlin, Center for Musculoskeletal Surgery, Germany, 4Charité – University Medicine Berlin, Julius Wolff Institute, Germany, 5Charité – University Medicine Berlin, Department of Radiology, Germany

Introduction:
Knee cartilage is known to undergo pathological changes after anterior cruciate ligament (ACL) rupture. Little, however, is known about the development of structural pathologies and their progression after posterior cruciate ligament (PCL) injury and reconstruction (PCLR).

Materials and Methods:
Fifteen adults (age 39±10 years, 12 men) with PCLR 8 years prior (median; range 3-15) had MRIs acquired at baseline and 1-year follow-up. Changes in knee cartilage thickness and T2 relaxation-times (and baseline thigh muscle cross-sectional areas) were determined quantitatively after segmentation, and compared with changes in 13 uninjured active controls (age 45±4 years, 6 men).

Results:
Following PCLR, the annual loss of cartilage thickness was greatest in the medial femoral condyle (mean -4.0%, 95% confidence interval [95%CI] -6.7, -1.4), medial tibia (mean -3.7%, 95%CI -6.1, -1.3), and patella (mean -3.2%, 95%CI -4.7, -1.6). In the lateral tibiofemoral compartment, changes were only modest. In the medial femoral condyle and trochlea, the PCLR group lost significantly more cartilage thickness than uninjured controls (p<0.05). Deep and superficial zone T2 relaxation-times were relatively constant over time, without longitudinal differences between PCLR and control knees. Baseline muscle status was not significantly different between groups and not associated with subsequent cartilage changes, but higher BMI was.

Conclusions:
PCL injured and reconstructed knees displayed substantially greater rates of cartilage loss in the medial tibiofemoral and patellofemoral compartments compared to uninjured controls, highlighting that the process of cartilage structural pathology remains active many years after injury. Post-operative weight control may be essential in limiting longer-term structural progression.
Development and internal validation of a prognostic model for change in patient-reported outcomes 1 year following arthroscopic meniscal surgery

MSc Kenneth Pihl¹, PhD Joie Ensor², PhD George Peat², MD, PhD Martin Englund³, MD, PhD Stefan Lohmander⁵, MD, PhD Uffe Jørgensen⁶, MD, PhD Nis Nissen⁷, MD, PhD Jakob V Fristed⁸, PhD Jonas B Thorlund¹

¹Department of Sports Science and Clinical Biomechanics, University of Southern Denmark, , Denmark, ²Centre for Prognosis Research, Research Institute for Primary Care & Health Sciences, Keele University, , UK, ³Lund University, Faculty of Medicine, Department of Clinical Sciences Lund, Orthopedics, Clinical Epidemiology Unit, , Sweden, ⁴Clinical Epidemiology Research and Training Unit, Boston University School of Medicine, , USA, ⁵Lund University, Faculty of Medicine, Department of Clinical Sciences Lund, Orthopedics, , Sweden, ⁶Department of Orthopedics and Traumatology, Odense University Hospital, , Denmark, ⁷Department of Orthopedics, Lillebaelt Hospital, , Denmark, ⁸Department of Orthopedics, Lillebaelt Hospital, , Denmark

Introduction:
Factors such as symptom onset and presence of mechanical symptoms are often considered important for the successful outcome of arthroscopic meniscal surgery. Yet, no single factor has proven strongly prognostic of outcome. Thus, we developed and internally validated a prognostic model to identify patients with largest change in patient-reported outcomes following arthroscopic meniscal surgery.

Materials and Methods:
641 patients (mean age 48.7 years (SD 12, range 18-76) 56% men) undergoing arthroscopic meniscal surgery from the Knee Arthroscopy Cohort Southern Denmark. We identified 18 potential prognostic factors from literature and/or orthopaedic surgeons (demographics, medical history, symptoms, etc.) and combined them in three multivariable linear regression models; model I including all patients, model II including patients aged >40 years (n=491), and model III including patients aged ≤40 years (n=150). The outcome was change in 4 of 5 subscales of the Knee Injury and Osteoarthritis Outcome Score (KOOS₄) from pre-surgery to 52 weeks after surgery. The prognostic performance of each model was assessed using R²-statistics and internally validated by adjusting for optimism using 1000 bootstrap samples.

Results:
One year after surgery, average change in KOOS₄ was 18.5 (SD 19.7, range -38.0 to 87.8). The strongest prognostic factors were previous meniscal surgery (in index knee) and knee extension deficit. R² was 0.16 in model I and II and 0.42 in model III, while optimism adjusted R² was 0.08, 0.07 and 0.11, respectively.

Conclusion:
Prognostic models including several preoperative prognostic factors showed very limited ability to identify patients with greatest improvement after meniscal surgery.
Association of specific meniscal pathology features with self-reported mechanical symptoms: A cross-sectional study of 566 patients undergoing meniscal surgery

MSc Kenneth Pihl, PhD Aleksandra Turkiewicz, MD, PhD Martin Englund, MD, PhD Stefan Lohmander, MD, PhD Uffe Jørgensen, MD, PhD Nis Nissen, MD, PhD Jeppe Schjerning, PhD Jonas B Thorlund

1Department of Sports Science and Clinical Biomechanics, University of Southern Denmark, Denmark, 2Lund University, Faculty of Medicine, Department of Clinical Sciences Lund, Orthopedics, Clinical Epidemiology Unit, Sweden, 3Clinical Epidemiology Research and Training Unit, Boston University School of Medicine, USA, 4Lund University, Faculty of Medicine, Department of Clinical Sciences Lund, Sweden, 5Department of Orthopedics and Traumatology, Odense University Hospital, Denmark, 6Department of Orthopedics, Lillebaelt Hospital, Denmark, 7Department of Orthopedics, Lillebaelt Hospital, Denmark

Introduction:
We explored associations between specific meniscal pathologies and other concurrent structural knee pathologies with presence of self-reported mechanical symptoms in patients undergoing meniscal surgery.

Materials and Methods:
We included patients having meniscal surgery between February 2013 and January 2015 from Knee Arthroscopy Cohort Southern Denmark (KACS). Pre-surgery, patients completed online questionnaires including self-reported presence of mechanical symptoms. At arthroscopy, the surgeon recorded information about specific meniscal pathologies and other concurrent structural knee pathologies. Relative risks (RR) were estimated to assess associations between specific meniscal pathologies and other structural knee pathologies with preoperative mechanical symptoms from a multivariable logistic regression.

Results:
566 of 641 patients (mean age 48.6[SD 12.9] years, 57% men) with complete data were included. Most evaluated joint pathologies were not associated with mechanical symptoms, with RRs close to 1.0. Meniscal tears involving the entire meniscus (n=22) were associated with knee catching and/or locking (RR 1.49[95%CI: 1.15-1.93]) and meniscal tears classified as unstable (n=292) and a tear in both menisci (n=49) were each associated with inability to straighten the knee fully (RR: 1.23[95%CI: 1.02-1.49], RR: 1.32[95%CI: 1.01-1.73], respectively). A partial (n=29) and total ACL rupture (n=37) was each associated with inability to straighten the knee fully (RR: 1.83[95%CI: 1.47-2.28] and RR: 1.44[95%CI: 1.05-1.98], respectively).

Conclusion:
Four of 14 meniscal pathologies or other structural knee joint pathologies were associated with self-reported mechanical symptoms in patients undergoing meniscal surgery. Generally, these associations were weak, and most structural pathologies associated with such symptoms were rare findings in patients having meniscal surgery.
Introduction:
Mechanical symptoms are considered an important indication for meniscal surgery. We investigated if young (≤40 years) and older (>40 years) patients, respectively, with preoperative mechanical symptoms improved more in patient-reported outcomes after meniscal surgery than those without mechanical symptoms.

Materials and Methods:
Patients from Knee Arthroscopy Cohort Southern Denmark (KACS) undergoing arthroscopic meniscal surgery between February 2013 and January 2015 completed online questionnaires pre-surgery, and at 12 and 52 weeks follow-up. Questionnaires included self-reported presence of mechanical symptoms (i.e. sensation of catching and/or locking) and the Knee Injury and Osteoarthritis Outcome Score (KOOS). Between-group differences in change in 4 of 5 KOOS subscales (KOOS₄) from baseline to 52 weeks were analyzed using an adjusted mixed linear model.

Results:
150 young patients (mean age 31 (SD 7), 67% men) and 491 older patients (mean age 54 (SD 9), 53% men) constituted the baseline cohorts. In general, patients with mechanical symptoms had worse self-reported outcomes before surgery. At 52 weeks follow-up, young patients with preoperative mechanical symptoms had improved more in KOOS₄ scores than young patients without preoperative mechanical symptoms (adjusted mean difference 10.5, 95%CI: 4.3; 16.6), but did not exceed their absolute KOOS₄ scores. No essential difference in improvement was observed between older patients with or without mechanical symptoms (adjusted mean difference 0.7, 95%CI: -2.6; 3.9).

Conclusion:
Young patients (≤40 years) with preoperative mechanical symptoms experienced greater improvements after arthroscopic meniscal surgery compared to young patients without mechanical symptoms. Randomized controlled trials are needed to confirm this potential subgroup benefit.
Reliability testing of Ultrasound Tissue Characterisation in the Achilles tendon – Does position matter?

MSc Arturo Lawson¹, Dr. Lorenzo Masci², Dr. Marika Noorkoiv¹, MSc Jarrod Antflick³
¹Brunel University, Kingston Lane UB8 3PH, United Kingdom, ²Pure Sports Medicine, Point West Building, 116 Cromwell Road, United Kingdom, ³Tendon Performance, Lomax Bespoke Health, 293 Fulham Road, United Kingdom

Introduction:
To obtain an image of the Achilles tendon (AT) that can be analysed for tissue integrity using Ultrasound Tissue Characterisation (UTC), the slack of the tendon is taken up by adding dorsiflexion (DF) to the ankle, but published studies vary in methodology.
This study aimed to establish the effect of different longitudinal tensions on AT imaging reliability using UTC.

Materials and Methods:
Nine healthy, active volunteers (ages 23-49y) took part, with 17 Achilles tendons imaged.
Comparisons were made between 3 positions of tension: plantar-grade, 50% and 100% of maximal DF (range: 18°-32°). Ranges were established and standardised using the foot plate of an isokinetic dynamometer for accuracy. Plantar grade positioning was discarded as obtaining valid images was not consistently possible.
A test/re-test was carried out at each position to determine Intraclass Correlation Coefficients (ICC) and subsequently Minimum Detectable Change (MDC) per echotype. Images were collected and analysed using UTC software, Window size 9, where contouring was carried out at intervals of 0.5cm along the free tendon.

Results:
ICC between test 1 and 2 were 0.965, 0.962, 0.858, 0.739 at 100% DF, and 0.771, 0.551, 0.569, 0.429 at 50% DF for each echotype I-IV respectively.
MDC per echotype I-IV ranged between 4.1%-1.0% at 100% DF, and 17.2%-6.3% at 50%DF.

Conclusion:
Testing at maximum DF provides better reliability when evaluating tendon structure using UTC. ICC at 100% DF is higher and MDC is smaller for all echotypes.
Standardising test positions when using UTC is needed for more reliable comparison of results between studies.
Immediate Effects of Photobiomodulation Therapy on Achilles Tendon Structural and Viscoelastic Properties

PT, DPT Patrick Corrigan¹, PhD Daniel Cortes², PT, AT, PhD Karin Silbernagel¹
¹University of Delaware- Department of Physical Therapy, 540 South College Avenue, United States, ²Penn State University- Department of Mechanical and Nuclear Engineering, 329 Leonhard Building, United States

Introduction:
Clinical outcomes for Achilles tendinopathy are improved by supplementing a loading program with photobiomodulation (PBM) therapy. The mechanism and time course of these effects remain unclear. Therefore, we evaluated the immediate effects of PBM therapy on tendon morphology and viscoelastic properties in people with Achilles tendinosis.

Materials and Methods:
12 subjects with Achilles tendinosis received PBM treatment to one Achilles tendon and sham treatment to the other. Subjects were blinded and order of treatment was randomized. PBM treatment was administered to the side of greatest tendinosis. Tendon thickness, cross-sectional area (CSA), shear modulus, and viscosity were quantified with ultrasound imaging and continuous shear wave elastography. Experimental procedures were performed on both sides at baseline and immediately, 2-hours, and 4-hours after treatment.

Result:
There was a significant main effect of treatment side (p=0.001-0.01; η²Partial=0.45-0.63) for thickness and CSA, but not for viscoelastic properties (p=0.70-0.72; η²Partial=0.01). There was no significant main effect of time (p=0.13-0.97; η²Partial=0.01-0.16) or treatment by time interaction (p=0.32-0.73; η²Partial=0.04-0.10) for all variables. On the treated side, reductions in shear modulus (4-hours) and CSA (immediately, 2-hours, and 4-hours) were greater than MDC95%. On the sham side, viscoelastic properties did not change, but there were reductions in CSA (4-hours) and thickness (2- and 4-hours) greater than the MDC95%.

Conclusion:
PBM treatment appears to effect tendon viscoelastic properties after four hours, but not effect morphology. Since PBM treatment does not alter viscoelastic properties until four hours after treatment, PBM may be administered at any time during a treatment session.
High-Volume Injection with and without Corticosteroid in Chronic Midportion Achilles Tendinopathy – A randomized double blinded prospective study

MD, PhD Anders Ploug Boesen¹,², Prof Henning Langberg⁴, MSc Rudi Hansen², MSc, PhD Peter Malliaras⁵, MD, PhD Morten Ilum Boesen³

¹Arthroscopic Center, Ortopaedic department, Hvidovre Hospital, Kettegårds Alle 30, Denmark, ²Institute of Sportsmedicine, Bispebjerg Hospital, Bispebjerg Bakke 23, Denmark, ³Department of Ortopaedic, Køge Hospital, Lykkebækvej 1, Denmark, ⁴CopenRehab, Institute of Social Medicine, Department of Public Health, Faculty of Health and Medical Sciences, University of Copenhagen, Henrik Pontoppidansvej 6, Denmark, ⁵Department of Physiotherapy, School of Primary Health Care Faculty of Medicine, Nursing and Health Science, Monash University, PO Box 527, Australia

Introduction:
High Volume Injection (HVI) seems to show promising results in Achilles tendinopathy (AT). HVI consist of a large volume of saline with a small amount of corticosteroid.

Purpose:
To determine the effect of corticosteroid in HVI.

Material and Methods:
A total of 28 men (>18 years) with chronic (>3 month) AT were included and followed for 24-wks. Eccentric training was performed in all patients and randomized to either HVI with corticosteroid or HVI without corticosteroid. Outcomes included VISA-A, VAS and ultrasound imaging.

Results:
VISA-A improved in both groups (p<0.05), with greater improvement in HVI with corticosteroid (mean ± SEM; 6-wks=31±3 points; 12-wks=32±5 points) versus HVI without corticosteroid (6-wks=14±3; 12-wks=17±3) at 6 and 12-wks (p<0.05), but with no differences at 24-wks. VAS scores improved in both groups (p<0.05), with greater decrease in HVI with corticosteroid (6-wks=55±3 mm; 12-wks=53±5 mm) versus HVI without corticosteroid (6-wks=16±3 mm; 12-wks=25±5 mm) at 6 and 12-wks (p<0.05) with no differences after 24-wks. Tendon thickness showed a significant decrease in both groups (p<0.05), with a greater decrease in HVI with corticosteroid versus HVI without corticosteroid at 6 and 12-wks (p<0.05) with no difference at 24-wks.

Conclusion:
Treatment with HVI with or without corticosteroid in combination with eccentric training in chronic AT seems effective in reducing pain, improving activity level and reducing ultrasound tendon thickness and intra-tendinous vascularity. HVI with corticosteroid improved the conditions significantly better than HVI without corticosteroid in the short term. Thereby we argue that there is a corticosteroid effect in HVI treatment for AT.
Reliability of Barfod’s ultrasonographic length measure on patients with an Achilles tendon rupture.

PT, MSc Maria Swennergren Hansen¹, PT, PhD Morten Tange Kristensen¹², PT Thomas Budolfson¹, PT, PhD Karen Ellegaard⁴, MD, PhD Kristoffer Weisskrichner Barfod³

¹Physical Medicine and Rehabilitation Research – Copenhagen (PMR-C), Department of Occupational and Physiotherapy, Amager-Hvidovre Hospital, University of Copenhagen, Kettegård allé 30, Denmark, ²Department of Orthopaedic Surgery, Amager-Hvidovre Hospital, University of Copenhagen, Kettegård allé 30, Denmark, ³Sports Orthopedic Research Center – Copenhagen (SORC-C) Arthroscopic Center, Department of Orthopedic Surgery Copenhagen University Hospital, Amager-Hvidovre, Kettegård allé 30, Denmark, ⁴Parker Instituttet, Frederiksberg Hospital, Nordre Fasanvej 57, Denmark

Introduction:
Elongation of the Achilles tendon following rupture is a frequent and overlooked complication and is considered to affect gait, function and muscle strength, but the condition is sparsely investigated. Ultrasound is widely used to assess length of the tendon, but little is known concerning reliability. The aim of this study was to examine the reliability of Barfod’s ultrasonographic length measure in patients with Achilles tendon rupture at time of rupture (T1) and at 2 (T2), 4 (T3) and 12 (T4) months post-rupture.

Material and Methods:
56 patients were included: T1 n=13, T2 n=14, T3 n=13, T4 n=15. Measurements were made by two raters, blinded to each other’s ratings. Barfod’s ultrasonographic length measure was performed according to Barfod et al. 2014. With the patient in prone position the distance from the posterior and most superior corner of the calcaneus to the distal tip of the medial gastrocnemius head was measured.

Result:
The inter-rater reliability ICC2.1 (95%CI) for the injured side, were: T1 0.84 (0.41-0.95), T2 0.95 (0.84-0.98), T3 0.93 (0.81-0.97) and T4 0.96 (0.86-0.99). The corresponding SEM (SEM%) were: 0.8 cm (3.9%), 0.5 cm (2.5%), 0.5 cm (2.5%), 0.3 cm (1.5%), and MDC (MDC%): 2.2 cm (10.6%), 1.4 cm (7.0%), 1.4 cm (6.9%), 0.8 cm (4.1%). The mean (SD) difference between injured and non-injured side (the elongation) was 2.1cm (1.4) at T1 and 1.7cm (0.9) at T4.

Conclusion:
Barfod’s ultrasonographic length measure showed excellent relative reliability with low measurement error at 4 time points the first year following rupture.
Effects of Injury Prevention Program on Fitness Performance and Incidence Rates in Young Male Iraqi Football Players

Prof. Ahmed Farhan¹,², Prof. Adil Gatea³, Prof. Mohammed Kadhim³, Prof. Ghadah Shihap³
¹Department of Physiotherapy, Faculty of Health Sciences, Universiti Teknologi MARA, 42300, Malaysia, ²College of Physical Education and Sports Sciences, University of Thi-Qar, 64001, Iraq, ³College of Physical Education and Sport Science, University of Baghdad, 47069, Iraq

Introduction:
The rates of football injury are among the highest in sports, particularly among young soccer players. The aim of this study was to determine the effectiveness of an injury prevention program (IPP) among younger football players.

Materials and Methods:
Twenty-three (11) experimental (EXP), or 12 control (CON) young football players from Iraqi sports school (age 13.1±0.4 yr; BMI 21.7 ± 1.4 kg/m²; stature: 161 ± 0.3 cm) participated. The EXP group followed “IPP” training program (3 times/week) for 8 weeks, while the CON group was instructed to continue training and as usual. Pre- and Post the intervention, both EXP and CON groups performed a battery of soccer-specific physical tests (Prone hold, Horizontal jump and Running speed 20m). Changes in performance scores within each group were compared using independent t-tests (p ≤ 0.05). Over 1 year all injuries were documented monthly by physiotherapist. Complete monthly injury reports were available for (23 players).

Results:
Measures of core stability, leg power and running speed was increased significantly in EXP group compared with CON group (Prone hold: 43.4% vs 25.7%, respectively); (Horizontal jump: 3.9% vs 0.7% respectively); (Running speed: -2.6% vs 1.4 respectively). The incidence rates per 1000 hours of practice and match were 12.82 in the EXP group and 15.13 in the CON group, which equates to 18% fewer injuries in the EXP group.

Conclusion:
The results of this study show that “The IPP”, effective tool for improving football fitness performance and reduce incidence rates of young football players.
Sensory processing and central pain modulation in patients with chronic shoulder pain: A case-control study

PT, MSc Kevin Kuppens¹,²,³, MD, PhD Guy Hans⁴, PT, PhD Nathalie Roussel¹, PT, PhD Filip Struyf⁵, PhD Erik Fransen⁵, MD, PhD Patrick Cras⁶, PT, PhD Paul Van Wilgen²,³,⁷, PT, PhD Jo Nijs²,³,⁸

¹Rehabilitation Sciences and Physiotherapy, Faculty of Medicine and Health Sciences, University of Antwerp, Belgium, ²Departments of Human Physiology and Physiotherapy, Faculty of Physical Education and Physiotherapy, Vrije Universiteit Brussel, Belgium, ³Pain in Motion Research Group, Belgium, ⁴Department of Neurology, University Hospital Antwerp, Belgium, ⁵StatUa Center for Statistics, University of Antwerp, Belgium, ⁶Department of Physiotherapy and Rehabilitation, University Hospital Brussels, Belgium

Introduction:
Chronicity and recurrence in musculoskeletal shoulder pain are highly prevalent and can possibly be attributed to the concept of central sensitization. Available studies suggest a role for central sensitization in explaining chronic shoulder pain, but so far a comprehensive quantitative sensory testing (QST) protocol has not been used. The aim of this study was to gain knowledge on sensory processing and central pain modulatory mechanisms in patients suffering from chronic shoulder pain using such a QST protocol.

Materials and Methods:
Fifty study participants, including chronic shoulder pain patients and healthy controls, underwent a standardized, comprehensive psychophysical testing procedure. A static adapted QST protocol (including pressure algometry, vibration and mechanical detection) was applied. Thereafter, all subjects underwent dynamic measures of temporal summation and conditioned pain modulation. Questionnaires assessing psychosocial factors were completed by each subject.

Results:
No significant differences (P >= .05) were found between patients and controls based on pressure algometry, vibration detection, mechanical detection, temporal summation, and conditioned pain modulation. Moderate positive correlations (r = .5) were found between pressure pain thresholds (PPTs) and the amount of sports participation. Weak-to-moderate negative correlations (r = −.3 à −.5) were found between PPTs and psychosocial factors such as pain catastrophizing.

Conclusion:
Based on these findings, we can conclude that central sensitization is no characteristic feature in chronic musculoskeletal shoulder pain but can be present in individual cases.
Proximal Hamstring Tendinopathy – a systematic review

PT Anthony Nasser¹, Dr Alison Grimaldi¹, Dr Bill Vicenzino¹, Dr Adam Semciw¹
¹University of Queensland, School of Health and Rehabilitation Sciences, The University of Queensland, St Lucia, 4072 Australia, Australia

Introduction:
Proximal hamstring tendinopathy (PHT) is a recognised cause of persistent buttock pain in the athletic population. The aim of this systematic review was to evaluate the effect of non-surgical and surgical management on symptoms, physical function and quality of life.

Materials and Methods:
MEDLINE, CINAHL, EMBASE, SPORTSDISCUS and PUBMED were searched from inception to March 2017. A quality assessment was performed and standardised mean differences were calculated for between group comparisons. No studies were pooled due to heterogeneity.

Results:
18 studies of variable quality met inclusion criteria (n=582; female 227). Only two studies were randomised controlled trials (RCT). Eight surgical studies found improvements over time, for both symptoms (SMD 1.89 - 6.02) and physical function (SMD 4.08), but all were low quality retrospective studies. Platelet rich plasma (1 RCT and 3 case series) and corticosteroid injection (2 case series) demonstrated improvement in symptoms over time, however quality of studies were low. A high quality RCT on shockwave therapy found benefits over conservative management in terms of physical function (SMD 2.90) and pain (SMD 3.22) at one year. However, the program did not reflect successful conservative programs in other tendinopathies. Quality of other studies (2 case series) on conservative management were low.

Conclusion:
While different interventions showed positive effects, most studies were of low quality. Further research on impairments is required to inform high quality intervention trials.
The Start-to-run Distance and Running-related Injury among Obese Novice Runners: A Randomized Trial

MSc, PT Michael Lejbach Bertelsen¹, As. Prof, PhD Mette Hansen¹, PhD, MD Sten Rasmussen²³, PhD, MSc, PT Rasmus Oestergaard Nielsen¹

¹Section for Sports Science, Department of Public Health, Aarhus University, Denmark, ²Orthopedic Surgery Research Unit, Aalborg University Hospital, Denmark, ³Department of Clinical Medicine, Aalborg University, Denmark

Introduction:
High body mass index (BMI) is associated with an increased risk of running-related injury among novice runners. However, the amount of running participation plays a fundamental explanatory role in regards to running-related injury development.

Materials and Methods:
56 obese novice runners with a BMI between 30-35 were enrolled and randomized to receive one of the two following running programs: (i) a 4-week running program with a start-to-run distance of 3km per week including 3 sessions with 1km running per session (n=29), or (ii) a 4-week running program with a start-to-run distance of 6km per week including 3 sessions with 2km running per session (reference group, n=27). In both programs, the weekly running distance was increased by 10% each week throughout the follow-up.

Result:
The intention-to-treat analysis revealed a cumulative risk difference (CRD) of -16.3% (95%CI: -43.8%; 11.3%, p=0.25) after 4 weeks. Importantly, some participants completed much more running than prescribed (n=5) and some never uploaded any training (n=15). Therefore, a supplementary per-protocol analysis was performed revealing a CRD of -31.2% (95%CI: -57.0%; -5.2%, p=0.02) after 4 weeks. Furthermore, in the per-protocol analysis, the CRD of overuse-injury symptoms was -47.8% (95%CI: -81.0%; -14.6%, p=0.01) after 4 weeks of running.

Conclusion:
A 3km reduction from 6km per week to 3km per week in start-to-run distance appears associated with fewer running-related injuries and significantly fewer symptoms of overuse injury. Based on this, obese novice runners (BMI 30-35) are recommended a total start-to-run distance ≤ 3km the first week.
Tendon-related abnormalities identified with ultrasound are common in symptomatic hip dysplasia

MSc Julie Sandell Jacobsen1,2, MD Lars Bolvig3, Professor Per Hölmich4, Associate professor, PhD Kristian Thorborg5, PhD Stig Storgaard Jakobsen5, Professor Kjeld Søballe5, Professor Inger Mechlenburg6
1Department of Physiotherapy, Faculty of Health Sciences, VIA University College, Hedeager 2, 8200, Denmark, 2Department of Physiotherapy and Occupational Therapy, Aarhus University Hospital, Tage-Hansens Gade 2, 8000, Denmark, 3Department of Radiology, Aarhus University Hospital, Tage-Hansens Gade 2, 8000, Denmark, 4Sports Orthopaedic Research Center-Copenhagen (SORC-C), Department of Orthopaedic Surgery, Copenhagen University Hospital, Amager and Hvidovre, Italiensvej 1, 2300, Denmark, 5Department of Orthopaedic Surgery, Aarhus University Hospital, Tage-Hansens Gade 2, 8000, Denmark, 6Centre of Research in Rehabilitation (CORIR), Institute of Clinical Medicine, Aarhus University, Palle Juul-Jensens Boulevard 82, 8200, Denmark

Introduction:
Hip dysplasia is characterized by reduced acetabular coverage of the femoral head leading to an increased mechanical load on the hip joint and the local acting hip muscles.
The primary aim was to report the prevalence of tendon-related abnormalities identified by ultrasound in 100 patients with symptomatic hip dysplasia. The secondary aim was to investigate correlations between tendon-related abnormalities identified with ultrasound and muscle-tendon-related pain identified clinically.

Materials and Methods:
One hundred patients (17 men) with a mean age of 29 ±9 years were included. The prevalence of tendon-related abnormalities was identified with a standardized ultrasound examination. Correlations between tendon-related abnormalities identified with ultrasound and muscle-tendon-related pain identified clinically were tested with spearman´s rank correlation coefficient.

Results:
Iliopsoas-, adductor- and abductor-related abnormalities had the highest prevalence (iliopsoas: 50% (95% CI: 40; 60), adductor longus: 31% (95%: 22; 40) and gluteus medius/minimus: 27% (18; 36)). Significant correlations between ultrasound findings and muscle-tendon-related pain were found for the iliopsoas tendon (Rho=0.24 and p=0.02) and the gluteus medius/minimus tendons (Rho=0.35 and p=0.0004).

Conclusions:
Tendon-related abnormalities in the hip and groin region are common in patients with symptomatic hip dysplasia, and the ultrasound findings of the iliopsoas- and gluteus medius/minimus tendons are weakly to moderately correlated to muscle-tendon-related pain in these structures. Both the iliopsoas and the gluteus medius/minimus have a pronounced stabilizing role in the dysplastic hip joint and the common tendon-related abnormalities found in these patients may be caused by overuse injury or degenerative changes in the tendon tissue.
Return to sport and psychological readiness following hip arthroscopy. A Cross-sectional study covering return-rates 3-39 months after femororacetabular impingement surgery

MSc Tobias Wörner1,2, As. Prof., PhD Kristian Thorborg3, MD, PhD Anders Stålman2,4, As. Prof., PhD Kate Webster5, MSc Hanna Momatz Olsson2, As. Prof., PhD Frida Eek1

1Department of Health Sciences, Lund University, Box 157, 22100, Sweden, 2Capio Artro Clinic, Valhallavägen 91, 11427, Sweden, 3Sports Orthopaedic Research Center (SORC-C), Department of Orthopaedic Surgery, Copenhagen University Hospital, Amager-Hvidovre, Italiensvej 1, 2300, Denmark, 4Department of Molecular Medicine and Surgery, Stockholm Sports Trauma Research Center, Karolinska Institutet, Valhallavägen 91, 11427, Sweden, 5School of Allied Health, College of Science, Health and Engineering, La Trobe University, Victoria 3086, Australia

Introduction:
High rates (87%) of return to sports (RTS) are reported following hip arthroscopy (HA) for femoracetabular impingement syndrome (FAIS) (1). However, RTS is most often reported without clear definitions. This study aimed to describe RTS on a continuum, according to a recent consensus statement (2). Furthermore, the relation between psychological readiness and RTS was examined.

Material and Methods:
Patients operated for FAIS between 2014-2016 (n=209) were invited to respond to an online-survey. RTS was assessed on a continuum from (a) no return to sport, return to (b) different sport (c) previous sport at lower performance-level to (d) previous sport at the same performance-level. Psychological readiness was assessed with the HIP-Return to Sport after Injury (RSI) scale, a modified version of the ACL-RSI, and compared between RTS groups.

Results:
The final sample consisted of 127 patients [mean age: 34.3 years (SD=10.2); mean time post-HA=19.4 months (SD=10.4)]. In total, 89% of patients returned to some sort of physical activity. Yet, only 50% returned to their pre-injury sport [21.4% to same- and 28.3% to lower performance-levels] and 39% returned to participation in different sports. Eleven percent had not returned to any form of physical activity. Higher Hip-RSI scores were found with increasing level of RTS.

Conclusion:
Similar to previous reports, 89% of patients had returned to some sort of physical activity. However, assessed on a continuum it was revealed that only 50% had returned to pre-injury sports; 21% returned to previous performance-levels. Participants on higher levels of RTS reported greater psychological readiness.
Altered lumbo-pelvic control in patients with longstanding hip and groin pain compared to healthy controls

PT, MSc Anders Pålsson¹, MD Ioannis Kostogiannis¹², PT, PhD Eva Ageberg¹
¹Department of Health Sciences, Lund University, Sweden, ²Department of Orthopedics, Skåne University Hospital, Sweden

Introduction:
It is unknown whether patients with longstanding hip and groin pain (LHGP) have altered lumbo-pelvic control (LPC). Therefore, the aim of this study was to evaluate LPC in patients with LHGP in comparison to matched healthy controls.

Material and methods:
87 patients (50% women, age 18-55) with LHGP (>3 months) and 28 healthy controls, matched for gender, age and activity level, were recruited. LPC was assessed with the double-leg lowering test (DLLT) in a supine position and the standing active single leg raise (SASLR) test. During the DLLT, the hip extension angle (°) when the pelvis reached 10° anterior tilt was recorded. The mean value of three attempts served as outcome where a high value indicates better LPC. During the SASLR, the range of medial to lateral (frontal plane) and anterior to posterior (sagittal plane) pelvic tilt was measured by a tilt sensor attached to the sacrum. The mean range of three repetitions served as outcome, where a lower value indicates better LPC. The independent sample t-test was performed to assess between-group differences.

Results:
The patients showed worse LPC in DLLT (mean difference (95% CI) -11.1 (-17.2; -5.1)) and in SASLR frontal plane (mean difference (95% CI) 0.9 (0.03; 1.7)), but not in SASLR sagittal plane (mean difference (95% CI) 0.7 (-0.6; 1.9)) compared with controls.

Conclusion:
The altered LPC observed in patients with LHGP compared with healthy controls, suggests that exercises of lumbo-pelvic kinematics should be included in the treatment for this patient group.
Spondylolysis injuries approach with an elite youth sports academy (Aspire Academy)

MSc Cosmin Horobeanu, MD Juan David Pena Duque, PhD Amanda Johnson, Dr. Antonio Tramullas, MD, PhD Juan-Manuel Alonso

1 Aspire Academy Health Center (NSMP) - Aspetar, Orthopedics & Sports medicine Hospital, Qatar, 2 Sports Medicine Department - Aspetar, Orthopedics & Sports medicine Hospital, Qatar

Introduction:
Spondylolysis is a common cause of low back pain in adolescents with a higher relevance amongst athletes. For elite young athletes any restriction from skill acquisition opportunities is detrimental for their development. Common interventions include rest from sporting activity, bracing and physiotherapy modalities.

Materials and Methods:
Retrospective data analyses of confirmed (by X-ray/MRI/CT) cases of Spondylolysis within the sport medicine clinic assigned to Aspire Academy, Qatar. Three approaches: “No Brace + physiotherapy (NoB+P)”, “Brace (with total rest) with delayed physiotherapy (B+dP)” and “Brace + concomitant physiotherapy (B+cP)” were practiced. Outcomes were measured in days to pain free daily activities, jogging resumption, return to training and return to play.

Result:
All athletes (20: NoB+P 6/B+dP 5/B+cP 9) successfully returned to full training and competitions after 32(±13.36), 52(±4.87) or 32(±13.90) treatment sessions. Brace was worn for 0, 46(±15.33) or 19(±8.79) days. Daily activities were pain free at day 27(±15.33), 4(±2.49) or 19±(11.07). The youngsters restarted running at day 35(±23.14), 64(±10.19) or 29(±9.58). They returned to training activities after 63(±21.59), 91(±23.78) and respectively 51(±15.54) days. They were able to compete after 76(±26.64), 138(±65.29) or 69(±18.84) days.

Conclusion:
For elite young athletes an individualized approach including brace and concomitant structured physiotherapy seems to offer the fastest and maybe safest solution for spondylolysis injuries. Within this population time to return to sporting activity is very important and must be considered. Prospective studies are needed to confirm these preliminary data and to assess long term outcome.
The prevalence and impact of Diabetes Mellitus on the Frozen Shoulder

MD, Phd Per Hviid Gundtoft¹, MD Mikkel Attrup³, Kiropraktor Anne Krog Kristensen², MD Jette Wessel Vobbe², MD Torben Luxhøi¹, MD Flemming Rix¹, MD, Prof., DMSc Per Hölmich³, MD Lilli Sørensen²

¹Orthopedic, Kolding Hospital, Sygehusvej 24, Denmark, ²Orthopedic, Vejle Hospital, Kabbeltoft 25, Denmark, ³Copenhagen University Hospital Amager-Hvidovre, Kettegård Allé 30, Denmark

Introduction:
Diabetes Mellitus (DM) is a risk factor for Frozen Shoulder (FS). The objective of this study was to estimate the prevalence of undiagnosed DM in patients with newly diagnosed FS and study whether DM increases the severity of the FS disease.

Materials and Methods:
Patients with newly diagnosed FS were consecutively included in this case-control study. Patients not already diagnosed with DM were invited to be tested with the HbA1c blood sample test. The study population was compared with a control group, consisting of 5 individuals from the general population matched on age and sex. The passive range of motion (ROM), Oxford Shoulder Score, and Visual Analog Scale (VAS) for average and maximum daily pain was recorded for all patients.

Findings / Results:
A total of 235 patients were included of which 34 (14%) were diagnosed with DM prior to examination. Of the remaining 201 patients, 122 (61%) agreed to be tested for DM. None of the tested patients had undiagnosed DM, which was not significantly different from the prevalence in the matched control population (p= 0.09). There was no difference between patients with and without DM in average daily VAS (p= 0.46) nor maximum daily VAS (p= 0.44). The Oxford Shoulder Score was similar in the two groups (p= 0.23) and so was the ROM.

Conclusions:
The prevalence of undiagnosed DM is low in patients with FS and does not differ from the general population. DM does not seem to affect the perceived severity of a FS.
The development of data-driven diagnostic subgroups for people with patellofemoral pain using modifiable clinical, biomechanical and imaging features

PT Benjamin Drew\textsuperscript{1,2}, Prof Philip Conaghan\textsuperscript{1,2}, PhD Toby Smith\textsuperscript{3}, Prof James Selfe\textsuperscript{4}, PhD Elizabeth Hensor\textsuperscript{1,2}, MSc Bright Dube\textsuperscript{1,2}, Dr Andrew Grainger\textsuperscript{2,5}, Prof Anthony Redmond\textsuperscript{1,2}

\textsuperscript{1}Leeds Institute of Rheumatic and Musculoskeletal Medicine, University of Leeds, United Kingdom, \textsuperscript{2}NIHR Leeds Biomedical Research Centre, United Kingdom, \textsuperscript{3}School of Health Sciences, University of East Anglia, United Kingdom, \textsuperscript{4}Department of Health Professions, Manchester Metropolitan University, United Kingdom, \textsuperscript{5}Department of Radiology, Leeds Teaching Hospitals, United Kingdom

Background:
Unfavourable treatment outcomes for people with patellofemoral pain (PFP) have been attributed to the existence of subgroups within the PFP population. Subgrouping however remains underinvestigated. This study aimed to identify subgroups within PFP by combining modifiable clinical, biomechanical and imaging features and to explore the prognosis of the derived subgroups.

Methods:
Baseline data was analysed using a SPSS TwoStep cluster analysis. Applying a two-stage cluster approach, ten features were analysed initially within four health domains before being combined at the second stage. The prognosis of subgroups was explored at 12-months with subgroup changes in the Global Rating of Change Scale (dichotomised into favourable and unfavourable outcome) analysed using a logistic regression adjusted for covariates.

Results:
70 participants with PFP were included (mean age 31 years; 43 (61%) female) and four subgroups identified: ‘Strong’, ‘Pronation & Malalignment’, ‘Weak’ and ‘Flexible’. After covariate adjustment, compared to the Strong group, there were no statistical significance between groups in the odds of a favourable outcome. The Weak group (31% favourable; odds ratios [OR] 0.30; 95% confidence intervals [CI] 0.07, 1.36) were the least likely to report a favourable outcome. The Flexible group were the most likely to report a favourable outcome (63%; OR 1.24 (95% CI 0.20, 7.51).

Conclusion:
In this relatively small cohort, we identified distinct PFP subgroups with trends towards different outcomes. Further research is required to determine whether a stratified treatment approach using these subgroups would improve outcomes for people with PFP.
Test-retest reliability of forward, medial and rotational single-leg hop tests

PhD Bart Dingenen¹, PhD Alli Gokeler²
¹Rehabilitation Research Centre, Biomedical Research Institute, Faculty of Medicine and Life Sciences, UHasselt, Agoralaan Gebouw A, Belgium, ²University of Groningen, University Medical Center Groningen, Center for Human Movement Sciences, Antonius Deusinglaan 1, The Netherlands

Introduction:
Hop tests are mostly performed in the sagittal plane to evaluate functional performance during the return to sport decision-making process. However, athletes participating in pivoting sports have to move in multiple directions. The aim of this study was to examine the test-retest reliability of single-leg hop tests in the sagittal, frontal and transversal plane of motion.

Materials and Methods:
Sixteen recreational athletes (8 females, 8 males; 22.4±1.9 years) participated in the study. All athletes were tested twice (one-week interval) and performed the single-leg hop for distance (SH), triple leg hop for distance (TH), medial side triple hop for distance (MSTH) and 90° medial rotation hop for distance (MRH). The absolute hop distances for both legs were measured (cm). The maximum distance of 3 repetitions was the outcome measure. Intraclass correlation coefficients (ICC’s), standard errors of measurement (SEM) and smallest detectable differences (SDD) were calculated.

Results:
The ICC’s ranged between 0.93-0.98. The SEM’s for SH, TH, MSTH and MRH were respectively 5.7-7.1 cm, 14.1-16.3 cm, 12.0-15.4 cm and 5.9-7.0 cm (3-4% of the mean of the group). The SDD for SH, TH, MSTH and MRH were respectively 15.7-19.6 cm, 39.1-45.1 cm, 33.3-42.7 cm and 16.4-19.5 cm (7-11% of the mean of the group).

Conclusion:
The results of the current study showed excellent test-retest reliability of forward, medial and rotational hop tests. This allows clinicians to make informed interpretations of changes in hop test distances when retesting individual athletes across the return to sport process.
PAINSTORIES – exploring the challenges, barriers and self-management needs in adolescents with knee pain: a qualitative study with semi-structured interviews.

MA Simon Kristoffer Johansen¹, PhD Sinead Holden¹,², MD Negar Pourbordbari¹, Prof. Martin Bach Jensen¹, As. Prof. Michael Skovdal Rathleff¹
¹Research Unit for General Practice in Aalborg, Department of Clinical Medicine, Aalborg, Fyrkildevej 7,1, Denmark,
²SMI, Department of Health Science and Technology, Aalborg University, Fredrik Bajers Vej 7, D2, Denmark

Introduction:
Adolescent knee pain is common, and is associated with poor prognosis. One obstacle when treating adolescents is ensuring adherence to treatment, and teaching them to manage THEIR knee pain. This study investigates the challenges and barriers of adolescents with knee pain by conceptualizing self-management as problem-based. The aim is to develop a framework for designing patient education resources for this population, supporting the acquisition of self-management skills for everyday life.

Materials and Methods:
14 young adults with long-standing knee pain, that began during adolescence were recruited from the ‘APA2011’-cohort. Informants participated in a single person semi-structured interview, with a recall exercise. Data were recorded, transcribed, and analyzed using ‘The general inductive approach for analyzing qualitative data”, to extract thematic patterns.

Results:
The coding of data revealed a model of 4 main, 10 generic and 27 sub-categories organized around ‘challenges and barriers’. Further coding outlined a hierarchy of clusters, labeled ‘apprehension’, ‘knowledge’, ‘contextual’ and ‘social/value’-barriers, which constituted challenges participants had to navigate to progress towards mastery of the condition. From this, four learning objectives were identified as ‘acceptance of injury’, ‘familiarization and decision making’, ‘confrontation vs limitation’ and ‘reconceptualization’ which served as the canvas for the adolescents’ self-management at distinct stages of their knee pain.

Conclusion:
These preliminary findings indicate that a framework for patient education should not focus on a one-fits-all approach. Emphasis should be on identifying the challenges the adolescent is facing, and aligning learning objectives to these, by providing effective exercises which facilitate the learning process.
Test-retest reliability of two-dimensional video analysis of single-leg drop vertical jumps

PhD Bart Dingenen\textsuperscript{1}, Sofie Hawinkel\textsuperscript{1}, Tine Petré\textsuperscript{1}, PhD Alli Gokeler\textsuperscript{2}
\textsuperscript{1}Rehabilitation Research Centre, Biomedical Research Institute, Faculty of Medicine and Life Sciences, UHasselt, Agoralaan Gebouw A, Belgium, \textsuperscript{2}University of Groningen, University Medical Center Groningen, Center for Human Movement Sciences, Antonius Deusinglaan 1, The Netherlands

Introduction:
Two-dimensional video analysis can be used to assess multi-segmental kinematics during jump-landing tasks in daily clinical practice. The aim of this study was to examine the test-retest reliability of two-dimensional measured frontal and sagittal plane kinematics during single-leg drop vertical jumps.

Materials and Methods:
A total of 15 recreational athletes (8 females, 7 males; 22.2±1.8 years) participated in the study. All athletes performed 4 repetitions of a single-leg drop vertical jump and were tested twice with a one-week interval. Both legs were tested. Digital videos were recorded in the frontal and sagittal plane with 2 iPads (120 Hz). The outcome measures were lateral trunk motion, knee valgus, the sum of knee valgus and lateral trunk motion in the frontal plane, and hip flexion and knee flexion in the sagittal plane. All angles were drawn using freely available motion analysis software (Kinovea) during the deepest position of the initial landing. Intraclass correlation coefficients (ICC’s), standard errors of measurement (SEM) and smallest detectable differences (SDD) were calculated.

Results:
The range of ICC’s, SEM and SDD of the frontal plane angles were respectively 0.75-0.94, 1.1-2.5° and 3.1-6.8°. The range of ICC’s, SEM and SDD of the sagittal plane angles were respectively 0.75-0.87, 3.2-5.0° and 8.9-13.9°.

Conclusion:
The results of the current study showed good to excellent test-retest reliability when using 2D video analysis during a single-leg drop vertical jump. This allows clinicians to make informed interpretations of changes in kinematics when retesting individual athletes.
Patients with traumatic primary or recurrent anterior shoulder dislocation have equally poor shoulder function: a cross-sectional study

**Associate Professor Birgit Juul-Kristensen**¹, Research assistant Henrik Eshøj¹², Associate Professor Sten Rasmussen⁵⁶, Associate Professor Lars Henrik Frich³⁴, Associate Professor Steen Lund Jensen⁵, Professor Karen Søgaard¹⁴

¹Department of Sports Science and Clinical Biomechanics, University of Southern Denmark, Campusvej 55, Denmark, ²Quality of Life Research Center, Department of Hematology, Odense University Hospital, Søndre Boulevard 29, Denmark, ³Department of Orthopaedics and Traumatology, Odense University Hospital, Søndre Boulevard 29, Denmark, ⁴Department of Clinical Research, University of Southern Denmark, Campusvej 55, Denmark, ⁵Orthopaedic Surgery, Aalborg University Hospital, Hobrovej 18-22, Denmark, ⁶Department of Clinical Medicine, Aalborg University, Hobrovej 18-22, Denmark

**Introduction:**
Patients with non-operated traumatic primary anterior shoulder dislocation (PASD) are assumed to have less shoulder impairment than patients with recurrent anterior shoulder dislocations (RASD). This may impact treatment strategy. The aim was to study whether patients with traumatic PASD have less shoulder impairment than those with RASD.

**Materials and Methods:**
Patients with PASD and RASD from baseline in a randomized controlled trial of non-operative shoulder exercise treatment were used. Shoulder function was self-reported (Western Ontario Shoulder Instability (WOSI), Tampa Scale of Kinesiophobia (TSK), General Health (EQ-5D-VAS), Numeric Pain Rating Scale (NPRS)), and measured (Constant-Murley shoulder Score (CMS total), CMS - Range of Motion (CMS-ROM, CMS – strength, proprioception, clinical tests)).

**Results:**
Totally, 34 patients (28 men) and 22 (21 men) with PASD and RASD, respectively (mean age 26 years) participated. WOSI total was for PASD 1064 and for RASD 1048, and TSK above 37 (indicating high re-injury fear) was present in 33 (97%) and 21 (96%) of the groups with PASD and RASD, with no group difference. CMS total (66.4 and 70.4), CMS-ROM (28.7 and 31.5), CMS-strength (injured shoulder: 7.6 kg and 9.1 kg), proprioception and clinical tests were the same. Furthermore, 26 patients (76%) with PASD and 13 (59%) with RASD reported not to have received non-operative shoulder treatment.

**Conclusion:**
Patients with non-operated traumatic PASD do not have less shoulder impairment than patients with RASD. Both groups present with equally poor shoulder function and high fear of re-injury, why treatment is important regardless of number of previous dislocations.
Early self-efficacy and knee-extension strength predicts symmetrical knee-muscle function one year after primary anterior cruciate ligament reconstruction among young athletes

MSc Susanne Beischer1,2, MSc Eric Hamrin Senorski1,2, Christoffer Thomeé2, As. Prof Kristian Samuelsson3,4, Prof Roland Thomeé1,2
1 Unit of Physiotherapy, Department of Health and Rehabilitation, Institute of Neuroscience and Physiology, Sahlgrenska Academy, University of Gothenburg, Box 455, 405 30, Sweden, 2 Sportrehab, Stamgatan 14, SE 411 01, Sweden, 3 Department of Orthopaedics, Sahlgrenska University Hospital, Sweden, 4 Department of Orthopaedics, Institute of Clinical Sciences, The Sahlgrenska Academy, University of Gothenburg, Sweden

Introduction:
Knowledge what predict symmetrical muscle function one year after an anterior cruciate ligament (ACL) reconstruction among young athletes (15-30 years) is scarce. The purpose of this study was to investigate whether young athletes´ demographics and rehabilitation-outcomes early in the rehabilitation can predict symmetrical muscle function one year after surgery.

Materials and Methods:
Data was evaluated from patient reported outcome measures, two knee strength and three hop tests, four months and one year after ACL reconstruction. Primary outcome was achieving a limb symmetry index (LSI) of ≥90% in all five tests of muscle function one year after ACL reconstruction. Uni- and multivariable regression analysis were performed with athletes’ demographics, graft choice, level of physical activity prior to ACL injury, and data from the five muscle-function tests as independent variables.

Results:
A total of 164 athletes (mean age 21.8, SD 4.4; 53% female) were included. Increased odds for achieving an LSI of ≥90% in all five tests of muscle function at the one year follow-up were found in athletes that at the four months follow-up had a higher perceived level of present self-efficacy OR = 1.44 ([95% CI; 1.03-2.00], p = 0.033) and a more symmetrical knee-extensor strength OR = 1.69 ([95% CI; 1.08-2.65], p = 0.022).

Conclusion:
Early psychological and physical factors are important for muscle-function recovery one year after ACL reconstruction among young athletes. Therefore, clinicians should focus on optimizing both knee related self-efficacy and knee-extension strength early in the rehabilitation after ACL reconstruction.
Evaluation of the efficacy of exercise-based training interventions to reduce ankle injuries in athletes: a systematic review with meta-analysis

As. Prof. Eamonn Delahunt¹, Dr. Alan Needle², Prof. Thomas Kaminski³
¹University College Dublin, Ireland, ²Appalachian State University, USA, ³University of Delaware, USA

Introduction:
Ankle joint injuries are the most prevalent lower limb musculoskeletal injury incurred by individuals who participate in sports. As such, the prevention of ankle joint injuries is of primary importance for sports medicine and sports physiotherapy clinicians. We undertook a comprehensive and up-to-date systematic review and meta-analysis with the aim of determining the efficacy of exercise-based training interventions designed to reduce ankle injuries and ankle sprains in athletes.

Materials and Methods:
In August 2017 we undertook a computerised literature search using the PubMed database (from inception until 4 August 2017). A hand search of the reference lists of relevant articles was also conducted to identify other potentially relevant studies. The methodological quality of all included studies was evaluated using the PEDro scale. The outcomes evaluated included: [1] risk ratio; [2] risk difference; [3] relative risk reduction; [4] numbers-needed-to-treat.

Results:
Eleven studies satisfied the specific inclusion criteria; 7 of which reported specifically on ankle joint injuries whilst the remaining 4 reported specifically on ankle sprains. With respect to those studies reporting on ankle joint injuries, the risk ratio [0.65; 95% CI 0.53 to 0.78] and risk difference [-0.03; 95% CI -0.04 to -0.02] results favoured the exercise-based training interventions. With respect to those studies reporting on ankle sprains, the risk ratio [0.53; 95% CI 0.40 to 0.70] and risk difference [-0.03; 95% CI -0.04 to -0.02] results favoured the exercise-based training interventions.

Conclusion:
Exercise-based training interventions can reduce the risk of ankle joint injuries and ankle sprains.
Multiligament injuries in knees

MD Jeppe Linander Henriksen1, MD, PhD, Professor, Supervisor at University of Copenhagen. Michael Krogsgaard1,2
1University of Copenhagen, Nørre alle 20, Denmark, 2Bispebjerg Hospital, Idrætskirurgisk afdeling, Bispebjerg Bakke 23, Denmark

Introduction:
The treatment of multiligament injuries (at least two of the four major ligaments, PCL, ACL, LCL and MCL must be torn), in Zealand has been concentrated at Bispebjerg Hospital from July 2011. The aim of this study is to provide a description of an unselected population, including which ligaments have been torn, the distribution of injured ligaments, the trauma mechanism and the neurovascular damage.

Materials and methods:
The inclusion criteria were: 1. Injury to at least two ligaments of the knee and 2: Surgery for the injury at Bispebjerg Hospital, section of sports surgery since July 2011. Additionally, articles describing multiligament injuries have been found.

Results:
94 patients met the inclusion criteria. 38 were women (40.43%) and 56 men (59.57%). Distribution according to Schenk’s classification: Class I 52.1%, II 2.1%, III-L 21.3%, III-M 14.9%, IV 8.5%. Trauma mechanism was almost evenly distributed between high energy (45.7%) and low energy (53.2%). Sport was trauma mechanism in 53.2% of cases, and ADL and traffic with 24.5% and 19.1%, respectively. Number of peroneus paresis: 5/94 = 5.3%. Number of vascular injuries: 1/94 = 1.1%. We had a total of 36 combinations of ligament injuries and 34 combinations of operative treatment.

Discussion and conclusion:
With an incidence of 0.6 per 100,000 per year, multiligament injuries occur rarely. The risk of neurovascular injury was lower that described in literature. Rarely 2 cases are similar, therefore there is no standard treatment for this type of injury.
Impact of physical exercise on platelet reactivity in patients on dual antiplatelet therapy

Prof. Stefan Brunner
1
1University Hospital Munich - Cardiology, Ziemssenstrasse 1, Germany

Background and objective:
It is well known, that strenuous physical exercise may increase platelet activity. However, the effect of exercise on platelet reactivity in patients on dual antiplatelet therapy (DAPT) has not been investigated yet.

Methods:
In 20 patients with coronary artery disease (CAD) we performed a standardized exercise test using a cycle ergometer. We determined the ADP-induced platelet reactivity before and immediately after exercise testing using the Multiplate analyzer. Further, we analyzed maximal exercise capacity, maximal heart rate and an ECG at rest and during exercise.

Results:
We could detect a significant increase of ADP-induced platelet reactivity after exercise in patients on DAPT (48.8 ± 6.1 U versus 38.4 ± 6.0 U; p < 0.001). ADP-induced platelet reactivity was significantly higher in patients on aspirin plus clopidogrel compared to patients on aspirin plus prasugrel both before and after exercise. The increase of platelet reactivity (ΔU) did not correlate with the maximal exercise capacity of with the duration of exercise testing.

Conclusion:
Physical exercise results in ADP-induced platelet reactivity in patients on DAPT. This effect may contribute to acute stent thrombosis occurring after physical exercise.
Return to sport rates and performance after hip arthroscopy for femoroacetabular impingement syndrome: A cross-sectional cohort study of 189 athletes

MSc Lasse Ishøi, As. Prof. Krisitan Thorborg, MD Otto Kraemer, Prof. Per Hölmich

Introduction:
High return to sport (RTS) rates in athletes following hip surgery for femoroacetabular impingement syndrome has previously been reported. However, data is lacking using a clear definition of RTS. Therefore, we aimed to determine the RTS rate in athletes following hip arthroscopy for FAIS, according to RTS consensus definitions.

Materials and Methods:
Eligible subjects were identified in the Danish Hip Arthroscopy Register. A self-report RTS questionnaire regarding preinjury and present sport and level was used to collect data. RTS was defined as playing the preinjury sport at preinjury level at follow-up. If RTS was successful, the associated self-reported sports performance was assessed as: 1) optimal performance including full sport participation, 2) impaired performance, but full sport participation, and 3) impaired performance including restricted sport participation.

Results:
350 eligible subjects were identified. Of those, 189 athletes (mean age at follow-up: 26.9±3.4 y) were included in the study at a mean follow-up of 33.1±16.3 months post-surgery. At follow-up 57.1% were playing the same sport at a preinjury level. Of those, 1/3 reported optimal sport performance. The remaining 2/3 reported impaired sports performance.

Conclusion:
Fifty-seven percent of athletes return to sport. This is considerably lower than the 82% previously reported in the literature. The lower RTS rate from the current study is most likely explained by the strict definition of successful RTS used in an athletic cohort from a nationwide register. Noteworthy, only 1/3 of the athletes who successfully returned to preinjury sport at preinjury level reported their performance to be optimal.
Efficacy of orthotic devices for the treatment of plantar heel pain: a systematic review and meta-analysis

PhD Nadine Rasenberg\(^1\), PhD Henrik Riel\(^2\), Dr. Michael Rathleff\(^2\), Prof Sita Bierma-Zeinstra\(^1\), Dr. Marienke van Middelkoop\(^1\)

\(^1\)Department of General Practice, Erasmus MC, Postbus 2040, 3000, CA, Netherlands, \(^2\)Research Unit for General Practice in Aalborg, Aalborg University, DK 9220, Denmark

Introduction:
Foot orthotics are often used to treat patients with plantar heel pain (PHP) in athletes, despite limited up-to-date level 1 evidence to support this. The objective of this systematic review was to investigate the effect of different foot orthotics on pain, function and self-reported recovery in patients with PHP and compare them with other conservative interventions.

Materials and Methods:
A systematic literature search was conducted in MEDLINE, EMBASE, Cochrane Central Register of Controlled Trials, Web of Science, CINAHL and Google Scholar up to January 2017. Randomized controlled trials comparing foot orthotics with a control intervention (defined as no intervention, sham or other type of conservative treatment) reporting on pain, function or self-reported recovery in patients with PHP were included. Meta-analyses were applied to clinically homogenous data.

Results:
Twenty studies, investigating eight different types of foot orthotics were included. Most studies had low risk of bias. Pooled data from six studies showed no difference between prefabricated orthotics and sham orthotics for pain on short term (0 – 3 months) (MD 0.26, 95%CI [-0.09;0.60]). No difference was found between sham and custom orthotics for pain on short term (MD 0.22, 95%CI [-0.05;0.50]), nor was there a difference between prefabricated and custom orthotics for pain on short term (MD 0.03, 95%CI [-0.15;0.22]). For the majority of other interventions no significant differences were found.

Conclusions:
Available evidence indicates that orthotic devices are not effective in improving pain and function compared to sham or other conservative treatments in patients with PHP.
Endoscopic fasciotomy is a good and safe primary treatment for plantar fasciitis: A randomized controlled trial

MD Finn Johannsen¹, MD Lars Konradsen², PT Robert Herzog³, Prof. Michael Krogsgaard²
¹Institute of Sports Medicine Copenhagen, Bispebjerg Hospital, University of Copenhagen, Denmark, ²Institute of sportssurgery, department of orthopedic surgery, Bispebjerg Hospital, University of Copenhagen, Denmark, ³Department of Physical and Occupational Therapy, Bispebjerg Hospital, University of Copenhagen,

Introduction:
Plantar fasciitis (PF) is a frequently diagnosed condition. Lifetime incidence of PF is 10%. Operation is normally only considered in PF that is refractory for non-surgical treatment. We hypothesized that operation is useful as primary treatment of PF.

Materials and methods:
30 consecutive patients (age 20-65 years) with PF for more than 3 months and ultrasound thickness above 4.0mm were after informed consent randomized to 1) conservative treatment with training and corticosteroid injection (best conservative treatment); 2) endoscopic 2-incision technique of partial fasciotomy and heel spur removal. Patients were evaluated at entry, 3, 6, 12 and 24 months with the Foot Function Index (FFI, range 0-230) and pain during activity on a 100 mm VAS score (VAS-activity). FFI at 6 and 12 months were defined as primary endpoints.

Results:
We found no intergroup difference at baseline or at 3 and 6 months. Endoscopic operation were significantly better for the primary endpoint at 12 months in FFI (p=0.033) compared to non-surgical treatment, and at 24 months there were still a strong tendency in favor of operation in FFI (p=0.06). VAS-activity was without intergroup differences at 12 month, but at 24 months we found a significant intergroup difference (p=0.001) in favor of operation. Both groups improved significantly over time. No severe complications were observed in any of the groups.

Conclusions:
This is the first study to prove a beneficial effect of operation for plantar fasciitis after 1 and 2 years compared to best conservative practice in a randomized controlled trial.
Aerobic exercise is not associated with any higher mortality in a mouse model of Marfan syndrome

MD Peter Tran\textsuperscript{1}, MD Tanja Skrba\textsuperscript{1}, PhD Elisabeth Wondimu\textsuperscript{2}, PhD René Svensson\textsuperscript{1}, Prof. Francesco Ramirez\textsuperscript{2}, Prof. Peter Magnusson\textsuperscript{1}, Prof. Michael Kjær\textsuperscript{1}

\textsuperscript{1}Institute of Sports Medicine, Bispebjerg Hospital and Center for Healthy Aging, Faculty of Health Sciences, , Bispebjerg Hospital, Building 8, Bispebjerg Bakke 23, Denmark, \textsuperscript{2}Department of Pharmacological Sciences, Icahn School of Medicine at Mount Sinai, E 101st St, USA

Introduction:
Patients with Marfan syndrome (MFS), a connective tissue elastin disorder due to a molecular fibrillin defect, have higher risk of cardiovascular complications (aorta aneurysm, dissection and fatal rupture) and are therefore advised to avoid vigorous exercise. In contrast, physical exercise training improves blood vessel compliance and lowers blood pressure, so maybe an optimal balance between benefits and risks in MFS patients can be achieved, but is yet undescribed. As an initial attempt to address this question we investigated mice with Marfan syndrome subjected to exercise training.

Materials and Methods:
Two different genotypes of MFS were used, one with a phenotype similar to MFS patients (n=20), and another with less severe disorders (n=20). Marfan and wild-type mice (n=20) performed either voluntarily running wheel exercise for 30 days (total n=30) or served as sedentary controls (n=30). All mice were studied after 30 days of intervention (60 days of age).

Results:
No significant difference in running activity was found between the different training groups. Further, although MFS mice had a 60% survival rate to the end of the study (and dilated aorta), this was not influenced by performing physical activity (p=0.3681). In less severe MFS mice, training demonstrated a trend towards inferior survival (p=0.0851) compared to sedentary mice.

Conclusion:
Aerobic exercise can be carried out by MFS mice, and training does not robustly influence the risk of mortality in a mouse model of MFS. This is encouraging for guidelines regarding use of physical activity in patients with Marfan syndrome.
Combination of strength training and local corticosteroid injection is superior to each of these separately in treatment of plantar fasciitis

**MD Finn Johanssen**, PT Robert Herzog, MD Nikolaj Malmgaaard-Clausen, MD Maren Hoegsberget-Kalisz, Prof. Peter Magnusson, Prof. Michael Kjaer

1 Institute of Sports Medicine Copenhagen, Bispebjerg Hospital, University of Copenhagen, Denmark, 2 Department of Physical and Occupational Therapy, Bispebjerg Hospital, University of Copenhagen, Denmark

**Introduction:**
Plantar fasciitis (PF) is a frequent injury. Corticosteroid injections has shown good short-term effect, but no beneficial long-term effect. Strength training has proven effect in many tendinopaties and also PF. We hypothesized that combined strength training and corticosteroid injections would be more effective in PF, than each of the treatments alone.

**Materials and Methods:**
We performed a randomized controlled trial. Ninety consecutive patients (aged 20-65 years) with PF for more than 3 months and ultrasound measured thickness above 4.0mm were randomized into 3 groups: a) Strength Training (ST); b) Corticosteroid injections until the fascia was below 4.0mm (Inj); c) Combination of a) and b) (ST-Inj).

Patients were evaluated at entry, 3, 6, 12 and 24 months with the Foot Function Index (FFI, range 0-230) and pain during activity on a 100 mm VAS score (VAS-activity). Primary endpoints were predefined as change from baseline until 6 months.

**Results:**
All groups improved significantly over time, but ST-Inj was significantly best at all timepoints. At primary endpoint the differences were not only significant but also clinical relevant: mean difference between ST-Inj and ST was 39.7 in FFI (95%CI: 62.8 to 16.4) and 20.0 for VAS-activity (CI: 35.0 to 4.9). Mean difference between ST-Inj and Inj was 29.4 in FFI (CI: 52.1 to 6.6) and 16.8 for VAS-activity (CI:31.6 to 2.0).

No deleterious effect of corticosteroid injections were registered.

**Conclusion:**
This is the first study to show a good short and long-term effect of Corticosteroid injections in PF if combined with strength training.
Predicting handball throwing velocity using a wrist-mounted accelerometer

BSc Sebastian Skejø1, PT, PhD Merete Møller3, MSc, PhD Jesper Bencke2, As. Prof. Henrik Sørensen1

1Section for Sports Science, Department of Public Health, Aarhus University, Dalgas Avenue 4, Denmark, 2Human Movement Analysis Laboratory, sect.247/Dep. Of Orthopaedic Surgery, sect. 333., Copenhagen University Hospital at Hvidovre, Kettegård alle 30, Denmark, 3Department of Sports Science and Clinical Biomechanics, Research Unit for Musculoskeletal Function and Physiotherapy, University of Southern Denmark, Campusvej 55, Denmark

Introduction:
A recent study showed that the development of shoulder injuries relates to sudden increases in handball training load. However, due to methodological limitations, handball training load was quantified as playing time instead of a shoulder-specific measure, such as the number and velocity of throws made by a player. The purpose of this project was to develop a predictive model for estimating throwing velocity using only a wrist-mounted accelerometer.

Materials and Methods:
We recruited 8 females and 11 males. Participants performed 25 throws of varying type and intensity. During each throw, we recorded position of the hand and ball using 3-D motion capture. We calculated throwing velocity as the slope of the ball’s time-position curve at the time of ball release. Simultaneously, an accelerometer measured the acceleration of the wrist. We constructed a linear model with log(Acceleration) as the independent variable and throwing velocity as the dependent variable. To check the model performance, we used leave-one-subject-out cross-validation. Finally, we fitted the model to the complete dataset.

Results:
The model performance was satisfying (mean error of the cross-validation = -0.0054 m/s, standard deviation = 2.3 m/s). When fitted to the complete dataset, we found a strong correlation (R² = 0.71, p < 0.001). The final model equation was: Velocity = 6.4*log(Acceleration)-4.9.

Conclusion:
The developed predictive model showed satisfying performance in estimating throwing velocity using only a wrist-mounted accelerometer, but future studies still need to determine how to count the number of throws, before the total throwing-related training load can be determined.
Modifiable Risk Factors for Patellar Tendinopathy: A Systematic Review and Meta-Analysis

PT, DPT Andrew Sprague\textsuperscript{1}, PT, DPT, OCS, SCS, ATC Angela Hutchinson Smith\textsuperscript{1}, SPT Patrick Knox\textsuperscript{1}, PT, PhD ATC Karin Grävare Silbernagel\textsuperscript{1}

\textsuperscript{1}University of Delaware - Department of Physical Therapy, 540 S. College Ave., United States

Introduction:
Patellar tendinopathy is a painful overuse injury with high recurrence rates, making effective prevention programs of interest. The purpose of this systematic review and meta-analysis was to identify modifiable risk factors for patellar tendinopathy.

Materials and Methods:
The protocol was prospectively registered (PROSPERO #: 42016052904) and completed according to PRISMA guidelines. An online search was conducted by a research librarian. All quantitative research studies comparing human subjects with patellar tendinopathy to an uninjured control group were considered for inclusion. Two reviewers completed the study selection, quality assessment and data extraction process. The Newcastle-Ottawa Scale (NOS) was used to assess risk-of-bias. When appropriate, meta-analysis was conducted ($\alpha = 0.05$). Odds ratios (OR) with 95% confidence intervals (CI) were reported.

Results:
535 studies were screened, yielding 41 articles for inclusion. The mean (range) NOS score was 4.9/9 (2-8) points. Greater body weight (OR: 1.58, 95% CI: 1.30-1.91), weekly activity (1.37, 1.10-1.70), weekly strength training (2.17, 1.14-4.12), counter-movement jump height (1.98, 1.31-3.00), standing jump work (3.08, 1.27-7.46) and average power during a 15-second rebound test (4.04, 1.64-9.95) were significant risk factors for patellar tendinopathy. Less ankle dorsiflexion range-of-motion was also significant (3.07, 1.19-7.93).

Conclusions:
Several modifiable risk factors for patellar tendinopathy were identified, and may be directly or indirectly related to increased patellar tendon loads. It may not be desirable to modify all of these factors since several relate to greater performance in jumping activity. Further research is required to determine optimal balance between athletic performance and patellar tendon health.
Bilateral quadriceps deficits are present in patients with unilateral patellar tendinopathy

PT, DPT Andrew Sprague¹, PT, DPT, OCS, SCS, ATC Angela Hutchinson Smith¹, PT, PhD, ATC Karin Grävare Silbernagel¹

¹University of Delaware - Department of Physical Therapy, 540 S. College Ave, United States

Introduction:
Patellar tendinopathy is a painful overuse injury common in jumping athletes. Arthrogenic muscle inhibition (AMI) is an inability to activate a muscle fully, in the absence of local damage. The purpose of this study was to determine if quadriceps AMI is present in patients with patellar tendinopathy, and its implications for jumping performance.

Materials and Methods:
3 (1F) subjects with a mean (SD) age of 28 (9) years, height of 180 (2.0) cm, weight of 86 (12) kilograms and a diagnosis of unilateral patellar tendinopathy were recruited. Isometric knee extension strength and quadriceps muscle activation was assessed on a dynamometer using the burst superimposition method. A quadriceps index (QI) and central activation ratios (CAR) were calculated using the peak knee extension torque and torque attributable to the stimulation. Jumping performance was assessed using the single-leg counter movement jump (CMJ) and limb symmetry indexes (LSI) were calculated for height.

Results:
Subjects had a mean (SD) symptom duration of 3.9 (3.5) months, and VISA-P score of 57.3 (11.0) points. All subjects had a QI >90%. CARs (involved:uninvolved) for subjects 1, 2 and 3 were 69.0%:62.9%, 87.9%:88.8%, and 88.0%:88.8%, respectively. LSIs for CMJ were 75.1%, 114.8% and 99.5%.

Conclusions:
Quadriceps AMI is present bilaterally in unilateral patellar tendinopathy, falls below normative values (94.8±3.6%) and cut-offs for return-to-sport (≥90%). Subjects demonstrated a normal QI and lacked a clear relationship between AMI and jump performance. Standard measures of knee extension strength and lower extremity function may not detect impaired quadriceps function in patellar tendinopathy.
The effect of orthoses, alignment adjustment and exercise for the young patient with anterior knee pain.

PT Torsten Grønbech Nielsen¹, PT Lene Lindberg Miller¹, MD Bjarne Mygind-Klavsen¹, Prof Martin Lind¹
¹Div. Sports Trauma, Orthopedic Dept., Tage-Hansens Gade 2, Denmark

Introduction:
Anterior knee pain (AKP) is a common knee problem seen in adolescents and young adults characterized by non-specific knee pain, pain when climbing stairs, riding a bike, walking and running. The purpose of the present study is to investigate the effect of a 3 months multimodal intervention including AKP-education, exercise program, footwear adjustment and foot orthoses in AKP patients.

Materials and Methods:
42 patients (Age 19 (10-32)) with the diagnosis AKP were included in a consecutive prospective cohort. The patients were educated in AKP and instructed in a 3 months exercise program focusing on hip abduction, hip external rotation and normal movement pattern. Footwear was adjusted and foot orthoses were recommended to patients with too much foot roll (pronation). Kujala-score and Pain numeric rating scale (NRS) were used to evaluate the effects of intervention. Intraarticular knee pathology was excluded by MRI and clinical examination.

Result:
The Kujala-score improve from 71=>86 after 3 months. The NRS-rest and NRS-Walk improve from 3.0=>1.3 and 6.4=>3.0 respectively. All improvement are statically significant (p<0.01). 55% of the patients have at clinical improvement (>10 points on the Kujala-score) and 57% and 74% had a clinical improvement on the NRS-rest and NRS-walk, respectively (≥2 points improvement). None of the patients have a decrease in outcome-scores after 3 months.

Conclusion:
An AKP multimodal treatment strategy focusing at footwear, orthoses and simple hip muscle exercise significantly improve functional outcome and reduce pain. Further investigation is needed to evaluate the long time follow-up.
Quality-of-life and physical activity in the first year following anterior cruciate ligament reconstruction in active youth

PT Christina Le¹², MD Catherine Hui²³, PT, PhD, As. Prof. Jackie Whittaker¹²
¹Faculty of Rehabilitation Medicine, University of Alberta, 2-50 Corbett Hall, 8205 114 Street, Canada,
²Glen Sather Sports Medicine Clinic, University of Alberta, 2C/2D Kaye Edmonton Clinic, 11400 University Avenue, Canada,
³Faculty of Medicine and Dentistry, University of Alberta, 2J2.00 Walter C Mackenzie Health Sciences Centre, 8440 112 Street, Canada

Introduction:
How physical activity and other health-related modifiable factors affect quality-of-life (QOL) in active youth with anterior cruciate ligament (ACL) tears remains unknown. This study examines associations between knee-related QOL, and moderate-to-vigorous physical activity (MVPA) and sedentary activity in the 12-months following ACL reconstruction (ACLR). Associations with knee symptoms and kinesiophobia are also assessed.

Methods:
Participants include 40 youth with a first-time, sport-related ACL tear who elect ACLR and desire to return-to-sport. The outcome variable is knee-related QOL (Knee Injury and Osteoarthritis Outcome Score QOL subscale; KOOSQOL). Exposure variables include: weekly MVPA and sedentary minutes (accelerometer), KOOS symptoms subscale (KOOSsx), and Tampa Scale of Kinesiophobia (TSK). Data was collected at baseline (pre-surgery), three, six, nine, and 12-months post-ACLR. Baseline characteristics [descriptive statistics (mean (95% CI), median (range), or proportion (exact 95% CI)], significance of baseline to 12-month change [Wilcoxon-matched pair test or minimal clinically important differences (MCID)], and associations with KOOSQOL [Spearman’s correlation coefficient (ρ)] were calculated (α=0.002).

Results:
Participant mean age was 18.0 years (95% CI 15.1, 20.5) and 65% were female. Baseline to 12-month change in KOOSQOL score [median (range); 19 (–6-69)] exceeded MCID (7.2) in 72% of participants. Statistically significant associations were found between KOOSQOL and KOOSsx scores (12-month ρ=0.72, p=0.001), and TSK scores (three-month ρ=–0.68, p<0.001; six-month ρ=–0.69, p<0.001; and nine-month ρ=–0.66, p=0.002).

Conclusion:
Preliminary analyses demonstrate improvements in knee-related QOL in the 12-months following ACLR. It may be important to consider the association of knee symptoms and kinesiophobia with QOL during ACLR rehabilitation.
Vestibulo-ocular dysfunction in adolescent rugby players with and without a history of concussion

PT Felix Leung¹, Prof Julie Hides¹, PhD Ann Rahmann², PhD Melinda Franettovich Smith², PhD M Dilani Mendis²

¹Griffith University, Nathan Campus, 170 Kessels Road, Nathan QLD 4111, Australia, ²Australian Catholic University, Banyo Campus, 1100 Nudgee Road, Banyo QLD 4014, Australia

Introduction:
Vestibulo-ocular dysfunction has been reported in adolescents after concussion, however the prevalence pre-concussion is unknown. Our study aimed to compare the prevalence of vestibulo-ocular dysfunction in a cohort of adolescent rugby union players with and without a history of concussion.

Materials and Method:
The study was conducted on 213 male school-aged (14-18 years) rugby players in Queensland, Australia. Participants completed a questionnaire regarding history of concussion (previous 12 months). Clinical assessment of vestibulo-ocular function was conducted by physiotherapists and participants wore Frenzel Goggles which recorded eye movement. Oculomotor tests included clinical assessment of smooth pursuit and gaze-hold nystagmus with vision and vision occluded. The vestibulo-ocular reflex (VOR) was assessed using the clinical-Head Impulse Test (HIT) and further assessed using the video-HIT to obtain VOR gain. Clinical measures were scored as normal or abnormal and video-HIT gain values were compared with normative data.

Results:
Twenty percent of players (43/213) reported a history of concussion. Oculomotor dysfunction was equally present in both groups (p=0.973), with dysfunction observed in 27.9% (12/43) of players with and 27.7% (47/170) of players without a history of concussion. Similarly, VOR dysfunction was equally present in players with and without history of concussion based on the clinical-HIT (4.7% in both groups, p=0.988) and video-HIT (11.6% and 15.0% for respectively, p=0.576).

Conclusion:
Vestibulo-ocular dysfunction was present in adolescent rugby players irrespective of concussion history. Interpretation of positive clinical findings post-concussion in adolescents need to be interpreted carefully and require comparison with baseline or pre-concussion assessment.
Sensorimotor system changes in adolescent rugby players post-concussion

PT Felix Leung¹, Prof Julie Hides¹, PhD Ann Rahmann², PhD Melinda Franettovich Smith², PhD M Dilani Mendis²
¹Griffith University, Nathan Campus, 170 Kessels Road, Nathan QLD 4111, Australia, ²Australian Catholic University, Banyo Campus, 1100 Nudgee Road, Banyo QLD 4014, Australia

Introduction:
A multifaceted approach to the assessment of the sensorimotor system may provide a greater understanding of the specific deficits contributing to changes seen post-concussion and guide physiotherapy intervention for safe return to sport. Our study aimed to investigate the changes in sensorimotor function in adolescent rugby players in the acute and return-to-sport period following a concussion.

Materials and Method:
285 male school-aged (14-18 years) rugby players in Queensland, Australia were assessed during preseason. Players who sustained a concussion during the season were re-assessed in the acute period (3-5 days) and after return-to-sport post-concussion (3 weeks). Assessment of sensorimotor function included balance (sway), trunk muscle size and function, vestibulo-ocular function and cervical spine proprioception (joint position sense).

Results:
20 players (7%) sustained a concussion and were assessed during the acute period, with 17 players also assessed following return-to-sport. Decreased sway on foam conditions were observed at both post-concussion assessments compared with preseason (p=0.061). Changes in trunk muscle size was also observed, with an increase in size in the acute period post-concussion (p=0.004) followed by a decrease in size after return-to-sport (p=0.005). There were no differences in vestibulo-ocular function and cervical joint position sense post-concussion, however significant variation in individual responses were noted.

Conclusion:
Changes in sensorimotor function changes were observed in the acute period post-concussion, with some persisting after return-to-sport. The observed changes in balance and trunk muscle size may reflect an altered movement strategy with reduced willingness to postural sway and increased stiffness, possibly representing a splinting/guarding response.
Preliminary Evaluation of the Impact of an Open-access Education Pamphlet on Patellofemoral Pain, Disability and Psychological Factors: a Case-Series Study

PT Liam Maclachlan¹, Professor Paul Hodges¹, Dr Natalie Collins¹, Professor Bill Vicenzino¹

¹University of Queensland, St Lucia, Australia

Introduction:
Patellofemoral pain (PFP) remains highly prevalent and often unresponsive to evidence-based treatments. For persistent musculoskeletal problems like PFP, patient education is deemed important in promoting self-management and underpinning other interventions. This study aimed to investigate the effects of an education pamphlet on patient-reported measures of pain, disability, quality of life, and psychological factors over six weeks, in people with PFP.

Materials and Method:
Seventy-four participants (50 (68%) female, 33.3 (SD 9.6) years old) with non-traumatic PFP from the greater Brisbane region provided baseline measures of pain (0-10 numerical rating scale), disability (Anterior Knee Pain Scale, Knee injury and Osteoarthritis Outcome Score), anxiety, depression, catastrophizing, kinesiophobia and pain self-efficacy. Participants were then given a published, open access education pamphlet. Six weeks post-education, participants repeated baseline measures then indicated their Global Rating Of Change (GROC) and current PFP status, including how satisfied they were with their condition. They were also asked to qualitatively evaluate the education provided.

Results:
Thirty (40.5%) participants found the education helpful; 35 (47.3%) reported GROC improvements (18 (24.3%) a little better; 12 (16.2%) better; 5 (6.7%) much better) and satisfaction with condition increased by 10% (p 0.002). Anxiety was reduced (p <0.001, Standardised Mean Difference -0.35), but other psychological measures, pain and disability all remained unchanged.

Conclusion:
Provision of a patient education pamphlet appears to positively affect the perception of the condition and anxiety levels for some individuals, even when pain and disability do not change. This supports education as a potentially important component of PFP management.
The immediate effect of foot orthoses on gluteus minimus and medius muscle activity during gait in healthy young adults

Dr. Adam Semciw¹, Viji Visvalingam¹, Professor Paul Hodges¹, Dr Natalie Collins¹
¹The University Of Queensland, School of Health and Rehabilitation Sciences, Australia

Introduction:
Foot orthoses are frequently used to manage lower limb musculoskeletal conditions such as patellofemoral pain. Multiple studies demonstrate their efficacy in reducing pain. Prescription of orthotics is often targeted to correct coronal plane lower limb alignment. However, it is not known how orthoses affect the activity of muscles that are typically used for coronal plane lower limb control, such as gluteus medius and gluteus minimus. The aim of this study was to investigate the immediate effect of foot orthoses on gluteus medius and minimus muscle activity during gait.

Materials and Methods:
Fine-wire intramuscular electromyography (EMG) electrodes were inserted into the segments of gluteus medius (anterior, middle, posterior) and gluteus minimus (anterior, posterior) of 18 healthy young adults (mean (SD) age 23 (2) years; 8 females). Data was recorded during two walking conditions: 1) sandal; and 2) sandal with prefabricated foot orthoses. All EMG activity was normalised to the peak activity recorded during the sandal condition. Median activity during stance and swing was compared between conditions using Wilcoxon signed rank tests.

Results:
Foot orthoses resulted in a significant reduction in gluteal muscle activity during stance (all segments) and swing phase (all except GMed posterior and GMin anterior).Median reduction in activity ranged from 10%-36% (p<0.05).

Conclusion:
Prefabricated, unmodified foot orthoses decrease gluteal muscle activity during gait in healthy young adults. This understanding should be tested in for people with symptomatic conditions of the lower limb to test whether similar effects are induced.
Asymptomatic elite adolescent tennis players show lateral and ventral growth plate alterations of proximal humerus on MRI.

PhD Fredrik Johansson\(^1\), PhD, MD Edin DeBri\(^4\), PhD, MD Anders Adolfsson\(^3\), PhD, MD Göran Jenner\(^3\), PhD, MD Leif Swärdh\(^5\), PhD, As Prof Eva Skillgate\(^1\), PhD, Prof Ann Cools\(^6\)

\(^1\)Musculoskeletal and Sports Injury Epidemiology Center, Institute of Environmental Medicine, Box 210, 171 77, Sweden, \(^2\)Scandinavian College of Naprapathic Manual Medicine, Kräftriket 23A, 114 19, Sweden, \(^3\)Medicinsk Röntgen AB Hötorget, Apelbergsgatan 48, 111 37, Sweden, \(^4\)Departments of Orthopaedics, Cityakuten, Olof Palmes Gata 13A, 111 37, Sweden, \(^5\)Orthocenter/IFK Kliniken, Arvid Wallgrens backe 4A, 413 46, Sweden, \(^6\)Department of Rehabilitation Sciences and Physiotherapy, University hospital Ghent, De Pintelaan 185 9000, Belgium

**Introduction:**
The cartilage of the epiphyseal plate might be 2–5 times weaker than surrounding fibrous tissue; therefore epiphyseal plates are very sensitive to their surrounding mechanical environment. Loads of distraction and torsion/rotation are substantial, and combined with the specific setting in the adolescent athlete including laxity in developing joints, open epiphyseal plates and underdeveloped muscles around the joint might increase the risk for overuse injuries.

**Materials and Methods:**
The study sample included 35 asymptomatic adolescent elite tennis players (15 male, 20 female, mean age 17.4 years ±2.7). MRI scans were evaluated according to a pre-defined protocol including measurements of epiphyseal length and epiphyseal extension subdivided into four directions; medial and lateral on the coronal oblique sequence and ventral and dorsal on the sagittal oblique sequence. The non-dominant arm was used as a control.

**Results:**
Relative reliability between the radiologists was excellent (ICC 0.78-0.96). Statistically significant differences between dominant arm and non-dominant arm in epiphyseal length (mm) laterally (DA 27.3 vs NDA 26.7) were shown. Statistically significant differences were also found in epiphyseal extension (mm) laterally (DA 36.1 vs NDA 35.1) and ventrally (DA 36.2 vs NDA 34.8). No statistically significant differences were found between dominant arm and non-dominant arm in epiphyseal extension (mm) medially (DA 31.7 vs NDA 31.7) and dorsally (DA 22.6 vs NDA 22.1).

**Conclusion:**
Significant findings assessing MRI measurements of the epiphyseal plate in the asymptomatic adolescent elite tennis player might reflect a development of consecutive alterations in the epiphyseal plate in the dominant arm.
Comparing apples and oranges in tendinopathy highlights the need for minimum reporting standards in clinical research: a narrative review.

PhD Sean McAuliffe1, PhD Rod Whiteley1, PhD Peter Malliaras2, PhD Kieran O’Sullivan1
1Aspetar Orthopaedic and Sports Medicine Hospital, Aspire Zone, Sports City Street, Qatar, 2Department of Physiotherapy
School of Primary and Allied Health Care Faculty of Medicine, Nursing and Health Science, Monash University, PO Box 527 Frankston Vic 3199, Australia

The topic of local versus widespread sensitisation in upper limb (UL) and lower limb (LL) tendinopathy has generated considerable debate in sports medicine. It has been suggested that in contrast to UL tendinopathies LL tendinopathy is not associated with widespread sensitization. This conclusion fails to appreciate the impact of clinical heterogeneity when comparing trials. To illustrate this point a narrative review of the literature investigating sensitization in tendinopathy was undertaken.

We reviewed studies investigating the presence of sensitization in UL and LL tendinopathy in the literature.

23 studies investigating sensitization in UL and LL tendinopathy were identified, the majority of these studies involved the UL. The mean age across upper limb studies was 45, whereas the mean age of the lower limb studies in the review was 33. The majority of LL tendinopathy involved athletic populations, whereas those involving UL tendinopathy did not. LL studies inconsistently reported the duration of symptoms of participants. LL tendinopathy appear to be more likely to have excluded participants with metabolic disorders or other painful regions.

Tendinopathy affects a variety of individuals, even within a single diagnostic condition, there is likely to be considerable variation between patients. Consequently, how confident can we be stating that sensitization is that different between UL and LL? Without a clear, detailed understanding of participant characteristics, it is impossible for clinicians to know a study is representative of the patient in front of them. The topic of sensitization in tendinopathy highlights the need for minimum reporting standards for tendinopathy.
Exercise specific progression criteria accelerates introduction of eccentric loading during hamstring strain injury rehabilitation

Jack Hickey¹, Dr. Ebonie Rio², Dr. Ryan Timmins¹, Nirav Maniar¹, Dr. Christian Pitcher¹, Dr. Morgan Williams³, Dr. David Opar¹

¹School of Exercise Science, Australian Catholic University, , Australia, ²La Trobe Centre for Sports and Exercise Medicine Research, , Australia, ³School of Health, Sport and Professional Practice, University of South Wales, , Wales, United Kingdom

Introduction:
Clinicians are under pressure to achieve timely return to play (RTP) and minimise re-injury risk for athletes following acute hamstring strain injuries (HSI). Whilst eccentric exercise reduces HSI risk and accelerates RTP, conventional guidelines for the introduction of eccentric loading during HSI rehabilitation, such as alleviation of pain and between-leg deficits during isometric knee flexor contractions, lack evidence. This study describes a HSI rehabilitation protocol with exercise specific progression criteria and provides data highlighting how early eccentric loading can be tolerated.

Materials and Methods:
Forty-three men with an acute HSI participated in a fully supervised rehabilitation protocol twice per week, which was progressed using exercise specific criteria. The introduction of eccentric loading was defined as the first rehabilitation session where the Nordic hamstring exercise and unilateral eccentric slider exercise were performed. Knee flexor force output measured via externally fixed dynamometry and pain rated on a 0-10 scale were reported during isometric strength assessments and eccentric exercises.

Results:
Eccentric loading was introduced in a median time of 5 (range = 1 to 17) days following acute HSI, despite concurrent pain and/or between-leg deficits <90% during isometric knee flexor strength assessments present in 39 of the 43 participants (91%).

Conclusion:
Waiting for the alleviation of pain and between-leg deficits during isometric knee flexor strength assessments may unnecessarily delay introduction of eccentric loading during HSI rehabilitation. Clinicians cognisant of timely RTP and re-injury risk mitigation should consider implementing exercise specific progression criteria to accelerate the introduction of eccentric loading during HSI rehabilitation.
Associations of training volume and pain-related measures in competitive swimmers.

PT, MSc Kevin Kuppens¹,²,³, PT, MSc Stef Feijen¹, PT, PhD Nathalie Roussel¹, PT, PhD Jo Nijs²,³,⁶, MD, PhD Patrick Cras⁴, PT, PhD Paul Van Wilgen²,³,⁵, PT, PhD Filip Struyf¹

¹Rehabilitation Sciences and Physiotherapy, Faculty of Medicine and Health Sciences, University of Antwerp, Belgium, ²Departments of Human Physiology and Physiotherapy, Faculty of Physical Education and Physiotherapy, Vrije Universiteit Brussel, Belgium, ³Pain in Motion Research Group, Belgium, ⁴Department of Neurology, University Hospital Antwerp, Belgium, ⁵Transcare, Transdisciplinary Pain Management Centre, The Netherlands, ⁶Department of Physiotherapy and Rehabilitation, University Hospital Brussels, Belgium

Introduction:
The bidirectional relationship between pain and exercise is widely studied. In this study, we aimed to describe the relationships between pain perception using static and dynamic measures of pain perception, and training volume in a group of competitive swimmers.

Materials and Methods:
An exploratory study on baseline data within a longitudinal project in competitive swimmers was performed using descriptive analyses, and correlation - and regression analyses. Training volume was captured using self-reported information. Static and dynamic measures of pain perception were measured using respectively pressure pain thresholds (PPTs) and conditioned pain modulation (CPM).

Results:
Moderate positive correlations (0.38 < r < 0.44) exist between training volume and pressure pain thresholds at distinct body areas in competitive swimmers. These results were confirmed during linear regression analysis while addressing possible influential factors such as age and selected psychosocial factors. No associations were found between training volume and conditioned pain modulation.

Conclusion:
Swim training volume is a predictor of experimentally induced pain perception using PPTs in competitive swimmers. Those swimmers who train more show higher pressure pain thresholds, indicating lower pain sensitivity. Swim training volume is not associated with endogenous pain modulatory capacity.
Impact of knee joint loading exercise on MRI-assessed articular cartilage in knee osteoarthritis: a systematic review of randomized controlled trials

MSc Alessio Bricca1, As. Prof. Carsten Juhl1,2, Prof. Martijn Steultjens3, PhD Wolfgang Wirth4,5, Prof. Ewa Roos1
1 Southern Denmark University, Campusvej 55, Denmark, 2 University of Copenhagen, Herlev and Gentofte Hospital, Denmark, 3 Glasgow Caledonian University, Cowcaddens Rd, Glasgow G4 0BA, Storbritannien, Scotland, 4 Paracelsus Medical University, Strubergasse 21, Austria, 5 Chondrometrics GmbH - Medical Data Processing, Ulrichshöglerstrasse 23, Germany

Introduction:
The impact of knee joint loading exercise on MRI-assessed articular cartilage in osteoarthritis (OA) has only been reported by individual studies. We investigated the impact of knee joint loading exercise on MRI-assessed articular cartilage in people at risk of, or with established, knee OA, by conducting a systematic review of randomized controlled trials.

Methods:
We performed a literature search with no restriction on publication year or language on five major databases up to September 2017. A narrative synthesis of the effect of knee joint loading exercise on MRI-assessed articular cartilage thickness, volume, defects, glycosaminoglycans (GAG) and collagen was performed.

Results:
We included nine trials, involving 14 comparisons of different cartilage outcomes; two included participants at increased risk of knee OA and 12 included participants with knee OA. In participants at increased risk, one comparison reported no effect on cartilage defects and one had positive effects on GAG. In participants with OA, six comparisons reported no effect of knee joint loading exercise on cartilage thickness, volume or defects; one reported a negative effect and one no effect on GAG; two reported a positive effect and two no effect on collagen.

Conclusions:
Knee joint loading exercise seems to not be harmful for articular cartilage in people at increased risk of, or with, knee OA. However, the quality of evidence was low including some interventions considered to have too low or too high a dose to positively impact on cartilage, particularly for studies evaluating cartilage volume, thickness and defects.
Examining knee control as a risk factor for lower extremity injury: A prospective study in youth football players

MSc Anu Räisänen, BM Hillevi Arkkila, MD Tommi Vasankari, PhD Kathrin Steffen, MD Jari Parkkari, MD Pekka Kannus, PhD Hannele Forsman, PhD Kati Pasanen

1 Tampere Research Center of Sports Medicine, Finland, 2 Faculty of Medicine and Life Sciences, University of Tampere, Finland, 3 UKK Institute for Health Promotion Research, Finland, 4 Oslo Sports Trauma Research Center, Norwegian School of Sports Sciences, Norway, 5 Eerikilä Sports Institute Training Center, Finland, 6 Sport Injury Prevention Research Centre, Faculty of Kinesiology, University of Calgary, Canada

Introduction:
The single-leg squat is used in clinical practice to identify faulty lower extremity movement patterns, like poor knee control as defined as knee valgus. However, the research on the association between the single-leg squat performance and the risk of future injuries is scarce. The purpose of this study was to examine the relationship between the frontal plane knee projection angle (FPKPA) during the single-leg squat and the risk of acute lower extremity injury. In addition, we investigated differences in the FPKPA between the dominant and non-dominant leg.

Materials and Methods:
A total of 570 youth football players, U11 to U14, participated in the single-leg squat and the 20-week follow-up. Injuries were registered by weekly text messaging. In case of an injury, the study physiotherapists contacted the injured player and/or parent to collect details of the injury by standardized phone interview. The FPKPA was estimated using a 2-dimensional video analysis. Generalized linear mixed model for binary data was used to analyse the potential risk factors.

Results:
During the follow-up, 289 injuries were registered. The FPKPA was not found as a risk factor for acute lower extremity injuries. The FPKPA was greater, indicating greater knee valgus, on the dominant leg compared to the non-dominant leg (P<0.001 for boys, P=0.01 for girls).

Conclusion:
In conclusion, careful attention should be paid to reducing side-to-side differences in knee control. The early introduction of injury prevention programs as part of regular training to improve knee control and reduce injuries can be valuable.
Test-retest reliability of two-dimensional video analysis during running

PhD Bart Dingenen¹, PhD Christian Barton²³, Tessa Janssen¹, Anke Benoit¹, PhD Peter Malliaras⁴
¹Rehabilitation Research Centre, Biomedical Research Institute, Faculty of Medicine and Life Sciences, UHasselt, Agoralaan Gebouw A, Belgium, ²La Trobe Sport and Exercise Medicine Research Centre, School of Allied Health, La Trobe University, Australia, ³Complete Sports Care, Hawthorn, Victoria Australia; Centre for Sport and Exercise Medicine, Queen Mary University of London, United Kingdom, ⁴Department of Physiotherapy, School of Primary and Allied Health Care, Faculty of Medicine, Nursing and Health Science, Monash University, Australia

Introduction:
The aims of this study were to examine the test-retest reliability of two-dimensional measured frontal and sagittal plane kinematics, and to determine how many steps should be included.

Materials and Methods:
Twenty-one recreational runners (12 females, 9 males; 28.1±8.3 years) participated in the study. All participants ran on a treadmill at preferred speed (10.2±1.2 km/h) and were tested twice (one-week interval). Digital videos were recorded in the frontal and sagittal plane with 2 iPads. The outcome measures were lateral trunk motion, contralateral pelvic drop, femoral adduction, hip adduction, foot and tibia inclination at initial contact, and knee flexion and ankle dorsiflexion during midstance. All angles were manually drawn using Kinovea during 10 consecutive steps for both legs. Intraclass correlation coefficients (ICC) and smallest detectable differences (SDD) were calculated. A sequential estimation method was used to determine the number of steps needed to reach and maintain a stable mean.

Results:
Lateral trunk motion, femoral adduction and foot inclination showed excellent reliability (ICC 0.90-0.99; SDD 1.1-2.1°). Tibia inclination showed good to excellent reliability (ICC 0.85-0.92; SDD 2.6-3.6°). Hip adduction and knee flexion showed good reliability (ICC 0.83-0.89; SDD 2.2-3.7°). Contralateral pelvic drop showed moderate to good reliability (ICC 0.61-0.80; SDD 2.5-2.6°). Ankle dorsiflexion showed moderate to excellent reliability (ICC 0.74-0.91; SDD 2.7-4.7°). The minimal number or steps ranged between 5.8-6.6.

Conclusion:
The results of the current study showed that two-dimensional video analysis can be reliably used to assess running kinematics, but the results differ between angles being measured. At least 6 steps should be included.
Pain-free vs pain-threshold rehabilitation following acute hamstring strain injury: A randomised controlled trial

Jack Hickey¹, Dr. Ryan Timmins¹, Nirav Maniar¹, Dr. Ebonie Rio², Dr. Christian Pitcher¹, Dr. Morgan Williams³, Dr. David Opar¹

¹School of Exercise Science, Australian Catholic University, , Australia, ²La Trobe Centre for Sports and Exercise Medicine Research, , Australia, ³School of Health, Sport and Professional Practice, University of South Wales, , Wales, UK

Introduction:
It is recommended hamstring strain injury (HSI) rehabilitation only be performed and progressed in the absence of pain, despite a lack of scientific comparison to alternative approaches. This study investigated whether performing and progressing HSI rehabilitation up to a pain-threshold altered return to play (RTP) clearance time, hamstring muscle structure and function and re-injury rates compared to remaining pain-free.

Materials and Methods:
Forty-three men with an acute HSI were randomised to a pain-free (n=22) or pain-threshold (n=21) rehabilitation group. Rehabilitation was performed fully supervised twice per week. Participants in the pain-threshold group were permitted to perform and progress rehabilitation in the presence of pain rated 4 or less on a 0-10 scale, whilst pain was avoided in the pain-free group. Biceps femoris long head fascicle length (FL) was assessed via 2-dimensional ultrasound and isometric (ISO) and eccentric (ECC) knee flexor strength were objectively measured via externally-fixed dynamometry. Participants were followed up for re-injury after RTP clearance for 6 months.

Results:
Median±IQR time to RTP clearance was no different between the pain-free (15±4 days) and pain-threshold (15±6.1 days) groups. There was a moderate between-group difference for change in ISO throughout rehabilitation in favour of the pain-threshold group (d=0.5, 95%CI=0.4-0.7). At RTP clearance, there was a large between-group difference in ECC in favour of the pain-threshold group (d=1.2, 95%CI=1.0-1.4). Four re-injuries occurred during 6 month follow-up, two in each group.

Conclusion:
This study shows rehabilitation can be safely performed and progressed up to a pain-threshold and enhance strength adaptation compared to remaining pain-free.
Medialization of the tibial tuberosity in PFP patients

MD Jens Ungermann Fredskild

Lars Konradsen, Senior Surgeon, Associated Professor, Section for Sportstraumatology M51, Bispebjerg-Frederiksberg Hospital, Denmark

Peter Lavard, Senior Surgeon, Associated Professor, Section for Sportstraumatology M51, Bispebjerg-Frederiksberg Hospital, Denmark

Introduction:
Medialization of the tibial tuberosity is considered an operative option for patients with recurrent patella dislocations but has not been recommended as a solution for patellofemoral pain (PFP). We evaluated the results of tibial tuberosity medialization in a group of patients with PFP and signs of mechanical malalignment but without a history of patella instability.

Materials and Methods:
From 2012-16 six women and three men age 14-27 years were operated with medialization of the tibial tuberosity. Inclusion criteria: PFP without a history of patellar instability and either increased patellar tilt, elongated MPFL, increased TTTG distance, or trochlea dysplasia. Physiotherapy had been tried in all cases. Follow up consisted of interviews, subjective knee scores and objective examinations.

Results:
All patients underwent medialization of the tibial tuberosity. Furthermore 3 had lateral release, 3 MPFL reconstruction, and 1 trochleoplasty. Average follow up was 1.6 years. 7/9 patients experienced considerable subjective improvement after surgery. 6/9 patients rated their decision to undergo operation as excellent. Average KOOS: Pain (70.8), Symptom (68.1), ADL (77.5), Sport (37), and QOL (37.5). Average Tegner score 3.4. Complications: 2 patients with decreased ROM, 3 with tibial screw pain, and 4 with decreased sensibility at the incision site.

Conclusion:
Though medialization of the tibial tuberosity is considered an operation for recurrent patella dislocation, approx. 80% of PFP patients with a degree of mechanical patellofemoral malalignment in this study felt considerable subjective improvement an average of 1.6 years after surgery.
Cross-cultural adaptation, Reliability, Internal Consistency and validation of the Arabic version of the (IKDC) for Arabic people with ACLR

MSc Husam Almalki{superscript}1, Dr Lee Herrington{superscript}2, Prof Richard Jones{superscript}1

{superscript}1School of Health Sciences, University of Salford, United Kingdom

Introduction:
The use of patient-reported outcome measures is to measure symptoms and limitations in function and sports activities due to knee impairment for every knee-related problem encompassing not only arthritis but also ligament injury. In order to administer this questionnaires to Arabic-speakers a rigorous process of cross-cultural adaptation and validation is required in order to reach equivalence between the original publication and target version of the questionnaire. The primary aim of the present study is to translate and culturally adapt IKDC into Arabic to suit Arabic people with Anterior Cruciate Ligament Reconstruction (ACL R).

Methods:
According to the guidelines for cross-cultural adaptation, translation and backward translation of the English version of the IKDC Subjective Knee Form were performed. After translation into the Arabic version, 35 ACLR patients were asked to complete the Arabic IKDC, KOOS, VAS and Brabd-36 (SF-36). These patients were retested one weeks later to evaluate test-retest reliability. Construct validity was analysed by investigating the correlation with KOOS subscales, VAS score and SF-36; content validity was also evaluated. Standardized mean response was calculated for evaluating responsiveness.

Results:
The test-retest reliability proved excellent with a high value for the intraclass correlation coefficient (r = 0.95). The internal consistency was strong (Cronbach’s α=0.91). Good content validity with absence of floor and ceiling effects and good convergent and divergent validity were observed.

Conclusions:
The Arabic IKDC demonstrated good measurement properties. We suggest that this instrument is an excellent evaluation instrument that can be used for Arabic patients with ACLR.
Inner range hip flexor strength profile in elite level professional rugby union players

MSc Garreth Farrell¹, PT David O’Regan², PhD Fiona Wilson², MSc Karl Denvir³
¹Leinster Rugby, Newstead Building A, UCD, Belfield, Ireland, ²Discipline of Physiotherapy, Trinity College Dublin, The University of Dublin, Ireland

Introduction:
The hip and groin (H&G) region is among the most commonly injury site in Rugby Union (RU), (5.8% of all injuries during the recent Rugby World Cup). Risk factors for this injury site include strength and range of motion (ROM) deficits. Studies of hip data have focused on abduction and adduction strength. Thus this study aimed to establish normative values of: hip flexion strength (HFS); hip ROM; HAGOS and iHOT33 in H&G injury-free professional rugby union players.

Methods:
44 professional RU players free from H&G injury were recruited. A hand-held dynamometer measured bilateral peak HFS with an eccentric break-test at 90° hip flexion and at maximal available inner range. Participants completed the HAGOS and the i-HOT33. Linear regression examined the influence of: playing position; kicking leg, and history of H & G pain, would have on hip flexion ROM and HFS.

Results:
The lowest HFS was 181.6 Nm (95% percentile range 425 Nm). The only significant finding of variables was that if a player plays as a ‘back’ position, then their inner range HFS is significantly less that a player who is a ‘backrow forward’ (p=0.018). Previous history of H&G pain was associated with significantly lower scores in 3 of 4 subsections of the i-HOT 33, and 3 of 6 subsections of HAGOS.

Conclusion:
Normative values for professional hip flexion strength and ROM are established in RU players. Player position influences these findings. Previous history of H&G injury has ongoing influence on HAGOS and iHOT reports.
Low return rates in athletes who intend to return to level-I sports after ACLR – The Delaware-Oslo ACL Cohort Study

MSc Marie Pedersen1,2, Prof. May Arna Risberg1,2,3,4, Prof. Lynn Snyder-Mackler5, PhD Hege Grindem1,2
1Department of Sports Medicine, Norwegian School of Sport Science, Sognsveien 220, 0451 Oslo, Norway, 2Norwegian Research Center for Active Rehabilitation (NAR), Sognsveien 75D, 0855 Oslo, Norway, 3Norwegian Institute of Sports Medicine (NIMI), Sognsveien 75D, 0855 Oslo, Norway, 4Division of Orthopedics, Oslo University Hospital, Kirkeveien 166, 0450 Oslo, Norway, 5Department of Physical Therapy, University of Delaware, 540 South College Avenue, USA

Introduction:
Intention of returning to level-I sports (handball, soccer, basketball and floorball) is one of the main reasons for choosing anterior cruciate ligament reconstruction (ACLR). Our aim was to assess participation in level-I sports at one, two and five years postoperatively in those who choose ACLR to enable return to level-I sport. A secondary aim was to assess the relationship between participation in level-I sports and self-reported knee function.

Materials and Methods:
Sixty patients who all stated they chose ACLR to return to level-I sport (55% women, median age 23 years [min-max:14-39]) were included in a prospective cohort study. Participants had no major concomitant injuries and participated in nonprofessional competitive level-I sports ≥2 times/week prior to injury. Sports participation and International Knee Documentation Committee Subjective Knee Form (IKDC 2000)-scores was recorded one, two and five years postoperatively.

Results:
At one, two and five years after ACLR, 29/58 (50% [95%CI:36-64%]), 30/55 (55% [95%CI:41-68%]) and 15/55 (27% [95%CI:15-39%]) participated in level-I sports, respectively (follow-up rate:92-97%). Among those who participated at one year, 7/24 (29%) had quit after two years. Six of 48 (13%) participated at all three follow-ups. Participation in level-I sports was associated with higher IKDC 2000-scores one (b=11.9;95% CI:4.4-19.3) and two years (b=9.9;95% CI:2.3-17.4) postoperatively.

Conclusion:
Patients considering undergoing ACLR to enable return to level-I sports should be informed of the modest likelihood of returning one to five years postoperatively. Very few sustain participation from one to five years. Participation in level-I sports is associated with better self-reported knee function.
The Semitendinosus muscle becomes shorter after harvesting for ACL-reconstruction

MSc Hanne Bloch Lauridsen¹, Senior Associate Lecturer Mette Kreutzfeldt Zebis², MD Erland Magnussen³, Prof. Per Hölmich⁴

¹Human Movement Analysis Laboratory & Sports Orthopedic Research Center – Copenhagen (SORC-C), Department of Orthopedic Surgery, Amager- Hvidovre Hospital, Kettegaard Allé 30, Denmark, ²Department of Physiotherapy and Occupational Therapy, Faculty of Health and Technology, Metropolitan University College, Hvidovre, Denmark, ³Danish Research Centre for Magnetic Resonance, Amager- Hvidovre Hospital, Kettegaard Allé 30, Denmark, ⁴Sports Orthopedic Research Center – Copenhagen (SORC-C), Department of Orthopedic Surgery, Amager- Hvidovre Hospital, Kettegaard Allé 30, Denmark

Introduction:
In Scandinavia, the most common way to reconstruct the Anterior Cruciate Ligament (ACL) after rupture is to harvest a graft from the distal tendon of the semitendinosus muscle and combine it with a tendon graft from the gracilis muscle. Since the semitendinosus muscle serves as an important ACL synergist, concern arises whether this procedure alters the muscle-tendon properties of the semitendinosus. Thus, the purpose of this study was to measure the possible muscle shortening after harvesting for ACL-reconstruction.

Materials and methods:
Five subjects (two men and three women) aged 30.6 ± 3.8 years who had undergone unilateral ACL reconstruction with semitendinosus/gracilis-graft 7.3 ± 5.8 years previously, underwent bilateral magnetic resonance imaging (MRI). MRI-scans consisted of two axial sequences performed in a 1.5T magnet (Siemens, Avanto) with a slice thickness of 5mm with 5mm gap. The muscle length of the semitendinosus was measured and the difference in mm between legs was calculated. In addition, ten control subjects (five men and five women) aged 30.5 ± 3.9 years were MRI scanned bilaterally.

Results:
The semitendinosus muscle of the harvested leg was 87 ± 56mm shorter compared to the non-harvested leg (p=0.04). The control group showed no difference (<10mm) in semitendinosus muscle length between legs.

Conclusion:
Harvesting tendon from the semitendinosus shortens the muscle and thereby changes the muscle-tendon properties of the muscle. This finding indicates that the muscle’s ability to produce force and thereby the ability to protect the ACL is impaired.
Construct validity of visual rating of the knee against 2D frontal plane projection angle in people with an ACL injury

MSc Jenny Nae¹, PhD Adam Culvenor²³, Prof. Kay Crossley³, As. Prof. Eva Ageberg¹
¹Department of Health Sciences, Lund University, Sverige, ²Paracelsus Medical University Salzburg, Institute of Anatomy, Austria, ³La Trobe Sports and Exercise Medicine Research Center, La Trobe University, Australia

Introduction:
Undesirable kinematics of the knee, such as knee abduction, is considered a risk factor for a second anterior cruciate ligament (ACL) injury and visual observation is a clinically feasible evaluation approach. The aim was to validate visual rating of the knee against two-dimensional (2D) knee abduction, measured as the frontal plane projection angle (FPPA), in ACL-reconstructed (ACLR) patients.

Materials and Methods:
Thirty-one young adults (42% women, mean 33±9 years), one year post-ACLR, performed three single-leg squats on their reconstructed leg, which were video-recorded. Pictures were extracted at 60° knee flexion and used for FPPA and visual ratings. A 2D motion analysis program was used to calculate FPPA. For visual rating, two different assessment methods were applied: 1) an overall knee score: knee relative to hip and ankle, scored good or poor, 2) a specific knee score: Knee Over Foot Position (KOFP) scored as good or Knee Medial to Foot Position (KMFP) scored as poor.

Results:
Those visually assessed as having poor overall knee score had a higher FPPA angle in all 3 squats (mean difference 7 to 10 degrees, 95% CI 3.1 to 14.2). Patients with a KMFP had a higher FPPA than those with a KOFP in one squat (mean difference 9 degrees, 95% CI 3.1 to 15), but not in the other two squats (p≥0.068).

Conclusions:
Visual assessment of the overall knee score appears more valid against 2D FPPA than the specific knee score in patients with ACLR.
Comparative effectiveness of treatments for patellofemoral pain: a protocol for a living systematic review including network meta-analysis

PhD Marinus Winters, PhD Sinead Holden, Prof. Bill Vicenzino, Prof. Nicky J Welton, PhD Deborah M Caldwell, PhD Adam Weir, Assoc. Prof. Michael Skovdal Rathleff

1 Research Unit for General Practice in Aalborg, Department of Clinical Medicine, Aalborg University, Denmark, 2 SMI, Department of Health Science and Technology, Aalborg University, Denmark, 3 School of Health and Rehabilitation Sciences: Physiotherapy, University of Queensland, Australia, 4 Population Health Sciences, Bristol Medical School, University of Bristol, United Kingdom, 5 Department of Orthopaedics, Erasmus MC University Medical Center for Groin Injuries, The Netherlands, 6 Sports Groin Pain Centre, Aspetar Orthopaedic and Sports Medicine Hospital, Qatar

Introduction:
There are many different treatment options available for patellofemoral pain (PFP). Despite this, the comparative effectiveness of these treatments has never been examined, presenting a challenge to clinicians and patients when trying to decide how to best treat PFP.
Network meta-analysis (NMA) is a new method which combines multiple treatments in one statistical model. By using direct and indirect treatment comparisons, this technique can compare treatments even when they have not been directly investigated 'head to head' in a randomised controlled trial (RCT). Based on the NMA, a ranking from “most likely to be effective” to 'least likely to be effective’ treatment can be modelled. The aim of this living systematic review is to study the comparative effectiveness of all treatments for PFP.

Materials and Methods:
We will follow the PRISMA-P and PRISMA-NMA checklists. Published and unpublished RCTs in patients with PFP are eligible for inclusion. Any treatment, control treatment, placebo, or no treatment groups will be included. The following outcomes will be included: Pain scales; patient-reported outcome measures; global rating of change scales. Conventional and grey literature sources will be searched for relevant reports. Data synthesis using NMA will be undertaken to evaluate the most effective treatment for PFP. We will check for consistency of direct and indirect evidence. The review will be updated when new data becomes available.

Results:
The first results will be available for presentation in February 2018.

Conclusion:
This review will, for the first time, allow the comparison of all treatments for PFP.
Association between patient history, physical examination and early signs of osteoarthritis in young patients with patellofemoral pain.

MSc Joost Eijkenboom\textsuperscript{1}, BSc Everlien Timmer\textsuperscript{1}, PhD Rianne van der Heijden\textsuperscript{1}, PhD Janneke de Kanter\textsuperscript{1}, As. Prof. Edwin Oei\textsuperscript{1}, Prof. Sita Bierma-Zeinstra\textsuperscript{1}, As. Prof. Marienke van Middelkoop\textsuperscript{1}

\textsuperscript{1}Erasmus MC, Wytemaweg 80, Nederland

Introduction:
Structural abnormalities associated with osteoarthritis (OA) are present in a subgroup of patients with patellofemoral pain (PFP). The aim of this study is to investigate the association between early signs of OA seen on MRI and characteristics from anamnesis and physical examination in patients with PFP.

Materials and Methods:
Data of PFP patients from a cross-sectional case-control study were used (N=64, 55% female, mean age 23.4(7.0)). All filled in an online questionnaire and underwent a physical examination and MRI of the knee. Both qualitative and quantitative measures (cartilage composition) were extracted from the MRI. Associations between characteristics from anamnesis, physical examination and early signs of OA were analyzed using logistic and linear regression models, adjusted for age, sex and BMI.

Results:
A longer symptom duration was associated with the presence of bone marrow lesions in the patella (OR 1.10; 95%CI [1.00-1.21]). Additionally, less sports participation a week was associated with patellar tendon thickening or high signal on MRI (OR 0.75; 95%CI [0.59-0.97]). Lastly, both the presence of crepitus and bilateral nature of the complaints were associated with minor cartilage defects in the patellar cartilage (OR 11.95; 95%CI [2.25-63.61] and 7.62; 95%CI [1.08-53.75] respectively). No association was found between any of the patient characteristics and cartilage composition.

Conclusion:
The presence of crepitus already seems to be associated with the early signs of OA in a young PFP population, which may distinct a subgroup of PFP patients with a high risk to develop OA.
Associations between knee alignment and early signs of OA are already present in a very young patellofemoral pain population

MSc Joost Eijkenboom¹, PhD Rianne van der Heijden¹, PhD Janneke de Kanter¹, As. Prof. Edwin Oei¹, Prof. Sita Bierma-Zeinstra¹, As. Prof. Marienke van Middelkoop¹
¹Erasmus MC, Wytemaweg 80, Netherlands

Introduction:
Young patellofemoral pain (PFP) patients show increased prevalence of patellar maltracking. The present study assessed the association between knee alignment and cartilage composition, patellar perfusion and structural abnormalities in a young population with and without PFP.

Materials and methods:
Data gathered in a previously conducted case-control study (64 PFP subjects, 70 healthy control subjects, 57% female, mean age 23.2(6.4)) were used. Alignment and shape measures conducted on Magnetic Resonance Images (MRI) included Insall-Salvati ratio, patellar translation, sulcus depth, sulcus angle, patellar tilt and tibial tuberosity trochlear groove distance. The prevalence of structural abnormalities associated with early osteoarthritis, quantified cartilage composition (T1ρ relaxation times) and perfusion were examined within the patellofemoral joint using different MRI techniques. Associations between alignment measures and abnormalities on MRI were analyzed using regression analyses, adjusted for potential confounders.

Results:
Insall-Salvati ratio was associated with the presence of bone marrow lesions in the patella (OR 48.33[95%CI 4.27-547.30]). Patellar tilt was associated with osteophytes on both patella (OR 0.91[0.84-0.98]) and anterior femur (OR 0.92[0.84-0.99]) as well as Hoffa synovitis (OR 1.08[1.01-1.16]). Sulcus depth was associated with bone marrow lesions (OR 0.45[0.22-0.93]) and sulcus angle was associated with Hoffa synovitis (OR 0.91[0.84-0.99]). T1ρ relaxation times within trochlear cartilage were associated with IS-ratio (β 5.2[0.77-9.58]) and patellar translation (β 0.36[0.08-0.64]). Bone perfusion was not associated with any of the alignment measures.

Conclusion:
Associations between knee alignment and bony and cartilaginous abnormalities linked to osteoarthritis seem to be already present in young PFP subjects, and healthy control subjects.
Long-standing patellofemoral pain is associated with impaired decending pain control, and widespread pressure hyperalgesia: a cross-sectional study in 88 females

PhD Sinead Holden1,2, Associate Professor Michael Skovdal Rathleff1,2, MSc. Christian Straszek3, PhD Kristian Kjaer Petersen1, Prof. Ewa M Roos4, Prof. Thomas Graven-Nielsen3

1SMI, Department of Health Science and Technology, Faculty of Medicine, Aalborg University, Denmark, 2Research Unit for General Practice in Aalborg, Department of Clinical Medicine, Aalborg University, Denmark, 3Center for Neuroplasticity and Pain (CNAP), SMI, Department of Health Science and Technology, Faculty of Medicine, Aalborg University, Denmark, 4Research Unit for Musculoskeletal Function and Physiotherapy, Institute of Sports Science and Clinical Biomechanics, University of Southern Denmark, Denmark

Introduction:
Patellofemoral pain (PFP) is a common and recurrent knee condition in young females. PFP is characterised by altered pain mechanisms, indicated by decreased pressure pain thresholds (PPTs), and conditioned pain modulation (CPM), a measure of decending pain control. The aim of this study was to compare pain mechanisms in young females with long-standing PFP, to those who recovered from adolescent PFP, and controls.

Materials and Methods:
This assessor blinded, cross-sectional study, included and tested 88 females; 36 with longstanding PFP (>5 years), 22 with a history of adolescent PFP but recovered from knee-pain, and 30 pain-free controls. The pre-registered primary outcome was CPM (% change in pain sensitivity from before to during a painful conditioning stimulus), assessed by cuff algometry. Secondary outcomes included pressure pain thresholds (PPTs) on the knee, shin, and forearm.

Results:
Compared with those who were recovered from knee-pain, females with current PFP displayed significantly lower CPM (mean difference -11.6%, 95%CI -3.8; -19.4; P=0.004). The current PFP group displayed widespread pressure hyperalgesia relative to controls, with lower PPTs at the knee, shin and forearm (P< 0.05). The group with current PFP were the most sensitive at the knee, with the lowest PPTs (377kPa; 95%CI 320; 435), while the control group had the highest (603kPa; 95%CI 539; 667). The recovered group was in the middle (500kPa; 95%CI 426; 573), and statistically different from both PFP and controls (P<0.0X).

Conclusion:
Young females with long-standing PFP, were characterized by widespread pressure hyperalgesia and impaired decending pain control, while those who recovered displayed increased localised pain sensitivity.
The effects of mobilisations with movement (MWMs) on the hip range of motion and power.

PT Bartosz Lelental\textsuperscript{1}, MSc Shauna Jordan\textsuperscript{1}, MSc Brian O'Rourke\textsuperscript{1}, PhD Sharon Kinsella\textsuperscript{1}

\textsuperscript{1}Institute of Technology Carlow, Kilkenny Road, Ireland

Introduction:
It is well documented that mobilisations with movement (MWMs) can improve ROM and pain measures. Limited literature exists examining more functional outcome measures such as power which is performance relevant. This research intends to document the acute and sustained effects of MWMs on hip extension and power.

Materials and Methods:
Sixty-five active participants were recruited for this study. The participants had a restricted hip extension ROM (<20\textdegree). Baseline hip extension ROM (degrees) and power (Jump height (cm)) measures were obtained. The participants were randomly stratified into groups; therapist applied MWM (N=20), self-applied MWM (N=20) or the control (N=20). The participants received treatment on the hip joint based on their respective group. Hip ROM and power measures were reassessed immediately, 24h and 48h following the treatment application.

Results:
A SPANOVA revealed significant within subjects’ time effects (F=40 [df=3, SE=156], p=0.000), indicating a change in Hip ROM between the time points. Between groups effects revealed no significant difference between the treatment methods (F=1.8 [df=2, SE=52], p=0.16). A non-significant statistical within subjects’ time effect (F=0.29 [df=2, SE=75], p=0.73), and between groups effects between the treatment methods (F=0.78 [df=2, SE=41], p=0.47) was established for hip power.

Conclusion:
To conclude the MWM and SMWM treatments produced a statistically significant increase in the hip extension ROM when compared to the baseline measures, however there is no statistically significant difference in the treatment methods when compared to the control group. It was determined that MWMs and SMWMs do not have an effect on the hip power.
Low-load training with blood flow restriction produces significant statistical and patient-rated pain reduction in anterior knee pain. A pilot RCT

PT Vasileios Korakakis¹, PT Rodney Whiteley¹
¹Aspetar, Sports Medicine Hospital, Aspire zone, Qatar

Introduction:
Exercise is an effective intervention for anterior knee pain (AKP), however pain can be a barrier to its application. We evaluated if blood flow restriction (BFR) with low-load resistance training would induce pain reduction compared to exercise alone.

Methods:
40 AKP patients were randomly allocated in the BFR or control group. We assessed the effect on pain of two interventions immediately after application, and after a physiotherapy session (45 minutes). Both groups performed four sets open chain knee extensions with load individualized according to tolerance (≤5kg). Outcome measures were pain during shallow and deep single-leg squat (SLS), and step-down test (SDT). All results were interpreted according to patient-rated pain reduction.

Results:
No significant differences were found between groups at baseline. Significant statistical and patient-rated immediate pain reductions were found in BFR group in shallow and deep SLS and SDT (p<0.001; d=1.33, d=1.12, d=0.88 respectively), but no significant pain reduction was found in control group (all p>0.017). At 45 minutes, pain reduction in BFR group was sustained in both SLSs and SDT (p<0.001; d=1.30, d=0.79, d=0.89 respectively). For the control group significant pain reduction was found only in shallow SLS following physiotherapy session (d=0.56). Significant between group differences in favor of BFR group were found only in deep SLS post interventions (d=0.61), but not after physiotherapy session.

Discussion:
A single BFR-exercise bout immediately produced significant pain reduction with large effect size allowing therapeutic exercise loading, an effect not seen without BFR. Significant patient-rated pain reduction was sustained after therapeutic loading.
Age and gender dependent differences in performance among youth football players

MSc Ida Åkerlund, MSc Hanna Lindblom, Prof Martin Hägglund

Ida Åkerlund, Linköping University, Department of Medical and Health Sciences, Division of Physioterapy, Sweden

Introduction:
The aim of this study was to evaluate age and sex differences in the results of 7 different performance tests in youth athletes.

Materials & Methods:
This cross-sectional study included eight football teams with male (n=66) and female (n=49) players aged 13-16 years (males 14±0.6, females 14±0.8 years, p=0.85). Participants were physically healthy and able to participate in testing with maximum effort.

Performance tests included two agility tests (t-test, 505 test), three hop tests (single-leg hop for distance test, side-hop test, countermovement jump), and 10 and 20 m sprint tests. Timing gates with photoelectric cells (MuscleLab 4010, Ergotest Technology a.s., Norway) were used for the agility and sprint tests. Mean differences were compared with ANOVA and effect sizes (ES) calculated using Cohen’s d.

Results:
Significant sex dependent differences, favoring the males, were found in all performance tests, ranging 9% for sprint tests (p<0.001, ES d 1.18-1.20), 8-9% for the agility tests (p<0.001, ES d 1.25-1.29), and 11-28% for the jump tests (p<0.01, ES d 0.56-1.15). An age effect was evident in males, where older players (15-16 years) performed better than younger players (13 and 14 years), particularly for the sprint and agility tests (overall effect p<0.05). No clear age effect was evident in females.

Conclusion:
Males performed better than females on the included performance tests, with effect sizes considered large to very large for sprint and agility tests, and medium to large for jump tests. Increased performance was noted with older age in males but not in females.
Throwing velocity in men elite youth handball players

Prof. Jose Saavedra¹, PhD Hafrún Kristjánsdóttir¹, PT Kristján Halldórsson¹, MA Margrét L. Guðmundsdóttir¹, MSc Sveinn Borgirson¹, Geir Sveinsson²

¹Physical Activity, Physical Education, Sport and Health Research Centre, Sports Science Department, School of Science and Engineering, Reykjavik University, Reykjavik, Iceland, 101, Reykjavik, Iceland, ²Icelandic Handball Federation (Handknattleikssamband Íslands – HSÍ), 101, Reykjavik, Iceland.

Introduction:
The purpose in team-handball (handball) is to score more goals than the opposing team. Therefore, it is necessary that handball players possess a high level of interaction between throwing technique, precision and ball throwing velocity. The objective of this study was to examine the differences in throwing velocity in men elite youth handball players in function age.

Material and methods:
A total of 62 men handball players (15-20 years old) from the Icelandic National Team participated in this study. The sample was divided into three groups: under-20 years old (n=21), under-18 (n=21) and U16 (n=20). The players completed throws from three positions with their own technique and without opposition. The three throwing positions were throwing at seven meters standing stationary, throwing at nine meters after three steps and throwing at nine meters after three steps and a jump. The ball velocity was measured with a radar gun. One-way analysis of variance (ANOVA), with a subsequent Bonferroni post-hoc test were used to examine differences in throwing among the four age groups.

Results:
There were differences (F=5.268, p<0.001) in two throwing positions: seven meters stand stationary (U20 > U18, U16) and throwing at nine meters after three steps and a jump (U20 > U18).

Conclusion:
The results showed that in this particular study there was not a clear differences in throwing velocity between teams (age). Acknowledgments. We would like to acknowledge the work in the data collection of Reykjavik University students.
Interrater reliability for assessing exercise fidelity for the injury prevention program Knäkontroll®

PT Gustav Ljunggren¹, As. Prof Martin Hägglund¹
¹Linköping University, Department of Medical and Health Sciences, Division of Physiotherapy, 581 83, Sweden

Introduction:
Exercise based injury prevention programs have been found efficacious in preventing sports injury, but few studies have evaluated exercise fidelity – the extent to which exercises are performed in accordance with instructions. The injury prevention program Knäkontroll® has been found to reduce ACL injuries by 64% in youth female football players, to date exercise fidelity has not been evaluated. The main objective of this study was to evaluate the interrater reliability of a checklist to assess exercise fidelity of Knäkontroll® in youth football players. A secondary objective was to evaluate to which extent the players performed Knäkontroll® with fidelity and if fidelity differed between male and female players.

Materials and Method:
This was an observational study. Two observers individually assessed the same exercise performance (123 player observations) as correct/incorrect, based on pre-set criteria. Male and female players (11-18 years old) from 11 teams used the Knäkontroll® program for 7-11 weeks before the observation. Agreement between observers was assessed by Kappa-statistics.

Results:
The observers agreed in their assessments for 111 of 123 (90%) observations (Kappa=0,803 – substantial agreement). The observers assessed correct performance in 50 of 111 observations (45%). There was no significant difference in exercise fidelity between male (33%) and female (48%) players (p = 0.09).

Conclusion:
The checklist used to assess exercise fidelity in Knäkontroll® had high interrater reliability, with a Kappa value considered to have substantial agreement. The exercises observed were, in general, performed with low exercise fidelity.
Education plus exercise, corticosteroid injection or control for gluteal tendinopathy on pain relief and global improvement: a randomised clinical trial

Prof. Bill Vicenzino¹, Dr. Rebecca Mellor¹, Dr. Alison Grimaldi¹, Dr. Philippa Nicholson¹, Dr. Jessica Kasza¹, Dr. Henry Wajswelner⁵, Prof. Paul Hodges¹, Prof. Kim Bennell²

¹School of Health and Rehabilitation Sciences: Physiotherapy, University of Queensland, Australia, ²Centre for Health, Exercise and Sports Medicine, Department of Physiotherapy, University of Melbourne, Australia, ³Physiotec, 23 Weller Road, Tarragindi, Australia, ⁴Epidemiology and Preventative Medicine, The Alfred Centre, Monash University, Australia, ⁵Department of Physiotherapy, La Trobe University, Australia, ⁶Arthritis Research UK Centre for Sport, Exercise and Osteoarthritis Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences (NDORMS), Botnar Research Centre University of Oxford, United Kingdom

Introduction:
Gluteal tendinopathy (GT) is the most prevalent lower-limb tendinopathy in general medical practice and affects quality of life to similar extent as end stage hip osteoarthritis. Corticosteroid injections (CSI) are commonly used with good short-term but poor long-term outcomes. Education and exercise are recommended for other tendinopathies, but evidence is lacking in GT. This study compared education plus exercise (EDX), CSI, and no treatment (control).

Materials and Methods:
204 participants with clinically- and MRI-diagnosed GT were allocated to EDX, CSI or control in a multi-site randomized clinical trial (Brisbane and Melbourne, Australia). Primary outcomes were Global Rating of Change (GROC) in hip condition on 11-point scale dichotomised to success (moderately to very much better) and non-success (very much worse to somewhat better), and pain intensity (0=no pain, 10=worst pain) at 8- and 52-weeks.

Results:
At 8 weeks, success was reported by 51/66 EDX participants, 38/65 CSI and 20/68 control. EDX and CSI were better than control (Risk Difference (95%CI): 49.1% (34.6, 63.5), 29.2% (13.2, 45.2)). EDX was better than CSI (19.9% (4.7, 35.0)). At 52 weeks, success was reported by 51/65 EDX participants, 36/63 CSI and 31/60 control, with EDX better than CSI (20.4% (4.9,35.9)) and control (26.8% (11.3,42.3)). Pain followed similar patterns of differences between treatments except there were no difference between EDX and CSI.

Conclusions:
An education and exercise program is more beneficial than CSI or no treatment for management of GT in the short term, with long term differences while still significant being less robust.
Correlation between seven different performance tests in youth football players

MSc Tania Nilsson¹, MSc Hanna Lindblom², Ass Prof Martin Hägglund²
¹Kalmar FF, Trångsundsvägen 40, Sweden, ²FF (2) Linköping University, Department of Medical and Health Sciences, Division of Physiotherapy, Sweden

Introduction:
Performance tests are often used to evaluate agility, hop and speed performance in athletes, which are important physical attributes for successful participation in team sports. The aim of this study was to evaluate results on 7 different performance tests in a cohort of youth football players, and to study the correlation between test scores.

Materials and Methods:
In total, 115 players (66 boys, 49 girls) from 8 youth teams (mean 14±0.7, range 13-16 years) participated in the study. Participants were physically healthy and able to participate in testing with maximum effort. Performance tests included two agility tests (t-test, 505 test), three hop tests (single-leg hop for distance test, side-hop test, countermovement jump), and 10 and 20 m sprint tests. Timing gates with photoelectric cells were used for the agility and sprint tests.

Results:
Mean±SD test scores were: t-test 10.2±0.9 s, 505 test 2.7±0.2 s, single leg hop 1.35±0.2 m (both legs), side-hop 33.5±12.2 (right) and 32.0±13.0 (left) jumps, countermovement jump 0.23±0.05 m, and 10 and 20 m sprint 1.9±0.1 and 3.5±0.2 s, respectively. Strong correlations were observed between all seven tests (Pearson r=0.49 to 0.94, p<0.01). There was no between-limb difference in the single leg hop test (p=0.427), while more jumps were completed on the right leg in the side hop test (p=0.007, effect size Cohen’s d 0.12).

Conclusion:
There was a strong correlation between the seven different tests, meaning that a faster time on the agility or sprint tests correlates with greater explosive hop and endurance hop capacit
The association between physical activity and 3-15 year history of sport-related intra-articular knee injury: A matched cohort design

PhD Clodagh Toomey¹,5, As. Prof. Jackie Whittaker²,3,1, As. Prof. Patricia Doyle-Baker¹,5,6, Prof. Carolyn Emery¹,4,5

¹Faculty of Kinesiology, University of Calgary, , Canada, ²Department of Physical Therapy, Faculty of Rehabilitation Medicine, University of Alberta, , Canada, ³Glen Sather Sport Medicine Clinic, University of Alberta, , Canada, ⁴Cumming School of Medicine, University of Calgary, , Canada, ⁵The Alberta Children’s Hospital Research Institute, Cumming School of Medicine, University of Calgary, , Canada, ⁶Faculty of Environmental Design, University of Calgary, , Canada

Introduction:
Much injury literature has focused on successful return-to-sport in the two-years following traumatic knee injury. However, little is known regarding physical activity (PA) participation in the post-rehabilitation period (3-15 years later), which may be a stronger determinant of future health and risk of joint disease.

Materials and Methods:
A sub-sample of the Alberta Youth PrE-OA cohort wore a waist-mounted accelerometer device (ActiGraph wGT3X-BT) for 7-days. This cohort was comprised of individuals with a 3-15 year history of sport-related intra-articular knee injury and age, sex and sport-matched uninjured controls. Descriptive statistics [mean within-pair difference (95%CI)] were used to compare moderate-to-vigorous PA (MVPA) between pairs. Multivariable linear regression was used to explore the association between MVPA and Knee Injury and Osteoarthritis Outcome Score (KOOS) subscales (scored /100), controlling for injury history.

Results:
Seventy-six participants were recruited (38 injured and 38 matched-controls; 16-28 years; 63% female). Previously injured participants were a median of 8.2 years since injury and spent significantly less time in daily MVPA compared to matched-controls [-13 minutes (95%CI -24, -2)]. There was a significant association between MVPA and two of the KOOS subscales, sport and recreation (β=0.68, 95%CI 0.1,1.3) and quality-of-life (QOL; β=0.89, 95%CI 0.1,1.7) that was not modified by injury history.

Conclusion:
Youth and young adults spend less time in MVPA 3-15 years after sustaining a traumatic knee injury compared to matched-controls. This may be partly explained by a perceived reduction in knee function related to sport and recreational activities (e.g. running/jumping) and QOL (e.g. lifestyle modification).
Magnetic Resonance Imaging in General Practice for Patients with Traumatic Knee Complaints; A One-Year Randomized Controlled Non-Inferiority Trial

MSc Nynke Swart1, MD Kim van Oudenaarde2, Prof Sita Bierma-Zeinstra1-3, Prof Hans Bloem2, PhD Wilbert van den Hout4, PhD Paul Algra3, Prof Patrick Bindels1, Prof Bart Koes1, Prof Rob Nelissen6, Prof Jan Verhaar3, PhD Monique Reijnierse2, PhD Pim Luijsterburg1

1Department of General Practice, PO box 2040, The Netherlands, 2Department of Radiology, PO box 9600, The Netherlands, 3Department of Orthopedics, PO box 2040, The Netherlands, 4Department of Medical Decision Making, PO box 9600, The Netherlands, 5Northwest Clinics, PO box 9600, The Netherlands, 6Department of Orthopedics, PO box 9600, The Netherlands

Introduction:
Whether (or not) MR imaging in patients with traumatic knee complaints should be introduced in primary care depends on its non-inferiority to usual care (UC) regarding knee function and the influence on subsequent management. Therefore, the objective of this study was to determine whether MR imaging requested by the GP was not worse than UC in patients with traumatic knee complaints regarding knee function during 1-year follow-up.

Materials and Methods:
This was a multi-center, non-inferiority randomized controlled trial. Eligible patients (18-45 years) consulted a GP with knee complaints due to a trauma during the previous 6 months. Patients allocated to the MR group received MR examination and patients in the UC group received information on the course of knee complaints, and a referral to a physiotherapist or orthopedic surgeon when indicated. The primary outcome was knee function measured with the Lysholm scale (0-100; 100=excellent function) during 1-year, with a non-inferiority margin of 6 points.

Results:
356 patients were included and randomized to MR imaging (n=179) or UC (n=177). MR imaging was non-inferior to UC concerning knee function over 1-year follow-up, for the intention-to-treat (overall adjusted estimate: 0.33; 95% CI -1.73 to 2.39), and per-protocol (overall adjusted estimate: 0.06; 95% CI -2.08 to 2.19) analysis. There were no differences between both groups in the referrals to other healthcare providers.

Conclusion:
MR imaging in general practice in patients with traumatic knee complaints was not worse than UC regarding knee function during 1-year follow-up and it did not influence subsequent management.
Ocular metrics in concussion: An analytical prospective cohort study to examine the effects of concussive injury on the retina.

A.R.T.C Ben Hunt¹, DPT Clare Lodge¹, FRCOphth David Kent²

¹Institute of Technology Carlow, Kilkenny road, Ireland; ²The Vision Clinic, Kilkenny, Ireland

Introduction:
Concussion diagnosis remains an informed clinical decision for healthcare providers aided by various tools e.g. the Sport Concussion Assessment Tool (SCAT3). These tools remain largely subjective in nature. There is currently no objective gold standard for concussion diagnosis. The retina is an extension of the brain. Structural retinal findings have been indentified in other central neurological conditions such as dementia using Optical Coherence Tomography (OCT). It is therefore logical to explore the effects of concussion on the retina.

Materials and Methods:
Participants (N = 161) 15 – 34 yrs old athletes. Ethical approval and informed consent were obtained prior to recruitment of participants. OCT measures of Retinal Nerve Fibre Layer (RNFL) and Ganglion Cell Layer (GCL++) were taken using a Topcon DRI OCT Triton plus (Tokyo, Japan). Normative/baseline values were establised for a healthy cohort. Following suspected concussion, the injured individual reported for a follow-up 48hrs, 14-days and 2-months post-injury to investigate effects of concussion on the retina. These measures were correalted with changes in SCAT3 measures.

Results:
Data collection is ongoing. It is hypothesised that: 1. Concussive injury will cause a thinning of the RNFL and GCL++. 2. These changes will correlate with changes in the SCAT3.

Conclusion:
Potential identifiable structural changes in the retina could add new physiological biomarkers for concussion assessment.
Greater long-term deterioration of outcome scores for patients with concomitant intra-articular lesions at index surgery compared to isolated ACL injury

MD Sadesh Balasingam¹, PT, PhD Ninni Sernert¹, MSc Henrik Magnusson², MD, PhD Jüri Kartus¹
¹Department of Research and Development, NU Hospital Group, Sweden, ²Division of Physiotherapy, Department of Medical and Health Sciences, Linköping University, Sweden

Introduction:
Clinical outcomes after ACL reconstruction 5- and 10-years post-surgery were analysed using Knee Injury and Osteoarthritis Outcome Score (KOOS) subscales as clinical indicators in patients with and without concomitant intra-articular lesions at the index surgery.

Materials and Methods:
Physicians completed a web-based protocol for baseline and surgical data. Patients registered KOOS preoperatively and at 5- and 10-years post-surgery. A linear mixed model analysis of changes in KOOS subscales for pain, symptoms, function in sport and recreation and quality of life was used.

Result:
A deterioration in KOOS subscales for patients with concomitant meniscus injury was seen for pain (p = 0.015), symptoms (p = 0.005), sport and recreation (p = 0.011) and knee-related quality of life (p = 0.03) compared to patients with isolated ACL injury. Correspondingly, KOOS subscale deterioration was seen for combined concomitant cartilage and meniscus injuries for pain (p = 0.005), symptoms (p = 0.009), sport and recreation (p = 0.006) and QoL (p < 0.001). The largest deterioration were found in sport and recreation (-5.9 points) and QoL (-6.5 points) subscales for patients with concomitant meniscal and cartilage injuries. The corresponding was not seen between patients with concomitant cartilage injury and isolated ACL-injury.

Conclusion:
Concomitant meniscus injuries at the index operation, either in isolation or in combination with cartilage lesions, render a deterioration of KOOS outcome subscales for pain, sport and recreation and quality of life in long-term follow-up of ACL reconstructed patients. No such deterioration was seen for patients who had isolated ACL-injury.
Body composition and history of physical exercise associated with sports-related injury among adolescents in Danish boarding school

PT Charlotte Raadkjær Lykkegaard

1Department of Sports Science and Clinical Biomechanics, University of Southern Denmark, Campusvej 55, Denmark

Introduction:
Each year, about 20% of all adolescents in Denmark commence a Danish boarding school specialized in sports. The aim of this study was to investigate the associations between early sports-related injury and body composition, previous injury, and history of physical exercise.

Materials and methods:
From the beginning of the schoolyear 2016, all adolescents from a boarding school were monitored over a two-month period. Coaches recorded dates of any injury affecting participation. Baseline data were collected by use of physical examination and a self-reported questionnaire. Data were analyzed by means of Cox regression.

Results:
The study included 162 adolescents aged 15-17.5 years, of whom 43% were injured; mostly overuse injuries (86%). Among girls (46%), age-adjusted high risk of injury was associated with BMI (HR 1.18 (CI95% 1.04-1.37)) and bodyfat percentage (HR 1.08 (CI95% 1.01-1.16)). Moreover, both high (>8) and low (<3.5) average weekly exercise hours during six months before starting school were associated with higher risk of injury (HR 4.38 (CI95% 1.22-15.75) respectively HR 2.062214 (CI95% 0.48-8.69)) compared to the median 5-6 hours. Among boys, age-adjusted high risk of injury was associated with decreasing weekly exercise hours during the previous three months before starting school (HR 2.10 (CI95% 1.12-4.28)). Previous injury was not significantly associated with risk of subsequent injury in any of the sexes.

Conclusion:
The risk of early sports-related injury among adolescents in a Danish sports boarding school is high. Risk factors depend on sex. The strongest risk factors were BMI, bodyfat percentage and history of exercise.
Modified iliotibial tract autograft for ACL reconstruction: A clinical prospective pilot study

MD Daniel K. Munch1, As. Prof Lars Konradsen1, MD, PhD Salameh Eljaja1

1Section for Sportstraumatology, Bispebjerg Hospital, Bispebjerg Bakke 23, Danmark

Introduction:
In the 1980s part of the iliotibial tract (ITB) was popular as a graft for ACL reconstructions. However, from a mechanical aspect, the graft was considered too weak to withstand ACL stresses. With the development of newer fixation techniques, we devised an operative technique that could provide sufficient mechanical graft strength. Furthermore, it could be seen as a functional advantage that neither the hamstring function nor the extensor mechanism of the knee was hampered by graft harvesting. Finally, the ITB tenodesis could provide an ALL function to the reconstruction.

Materials and methods:
Clinical prospective cohort study. Ten patients (♀=4, ♂=6), median age 25 (20–40 years) who underwent ACL-R with a modified ITB graft from July 2014 - March 2015. Preoperative, at 1-year and 2-years follow-up patients were mechanically examined, performed functional tests, and completed the KOOS and Tegner scores. Furthermore, grade of satisfaction and donor site complications were recorded.

Results:
2-year post-op, no re-rupture had occurred. Instrumented Lachmann showed significant improvement in mean side difference: Pre-op: 3,3mm [±1,33];  2-years post-op: 1,9mm [±1,1] (p=0.005).
Functionally, all ten patients reached LSI>90. Tegner score increased from mean 2,8 pre-op to 6,4 post-op (p<0,001). None did however reach pre-injury Tegner score or sports level. KOOS was increased significantly in four of the five subscales. All patients were satisfied or very satisfied.

Conclusion:
The modified ITB autograft showed mechanical stability results and functional outcomes comparable to standard ACL-R methods. However, cosmetic inconvenience and donor site pain was reported in two out of ten patients.
Clinical and radiological characteristics of subgroups of patients with chronic ankle instability in general practice

MD Adinda Mailuhu¹, MD, PhD Edwin Oei², MD, PhD John van Ochten¹, Prof. Patrick Bindels¹, Prof. Sita Bierma-Zeinstra¹, PhD Marienke van Middelkoop¹

¹Department of General Practice, Erasmus MC University Medical Center, Wytemaweg 80, Netherlands, ²Department of Radiology, Erasmus MC University Medical Center, Wytemaweg 80, Netherlands

Introduction:
Patients can experience chronic ankle instability (CAI) after an ankle sprain. The model of Hiller (2011) describes subgroups of patients with CAI and was applied to data from patients with an ankle sprain in general practice to investigate differences in clinical and radiological characteristics between proposed subgroups.

Materials and Methods:
206 patients who visited their general practitioner with a sprain 6-12 months prior to inclusion completed a questionnaire and underwent a physical and radiological (radiography and Magnetic Resonance Imaging) examination. Participants were classified following the Hiller model (2011) into three subgroups: mechanical instability (MI), perceived instability (PI) and recurrent sprains (RS). Regression analyses were applied to evaluate differences in characteristics between subgroups.

Results:
59 participants were classified having MI, 145 having PI, 30 having RS and 39 could not be classified following the model. Participants with RS and PI were more often sport participants (OR 6.83;95%CI 1.35-34.56 and OR 4.44;95%CI 1.06-18.63, respectively) than participants without RS and PI. Participants with MI more often had a painful palpation of the anterior talofibular ligament during physical examination (OR 4.09;95%CI 1.91-8.72) and a KL-score≥1 in the talonavicular joint on their x-ray (OR 2.24;95%CI 1.09-4.58), than participants without MI.

Conclusion:
It seems that a CAI model can be applied in general practice. However, the model does not seems to distinguish in patient characteristics between the subgroups. More research seems needed to evaluate the possible presence of more CAI subgroups and the prognosis of patients with CAI in order to target future interventions.
The Achilles tendon elongates 6 months after surgical repair regardless of loading-paradigm the first 8 weeks. A randomized controlled trial.

MSc, PhD Pernilla Eliasson¹,², PT, MSc Anne-Sofie Agergaard¹,³, PT, PhD Christian Couppé¹,², PhD René Svensson¹, PT Rikke Hoeffner¹,³, PT, PhD Susan Warming¹,³, MSc Nicholas Warming¹, MD Christina Holm¹, PT Mikkel Jensen¹, MD, PhD Michael Krosggaard⁴, MD, DMSc Michael Kjaer¹, PT, DMSc S. Peter Magnusson¹,³

¹Institute of Sports Medicine Copenhagen, Department of Orthopedic Surgery, Bispebjerg-Frederiksberg Hospital and Center for Healthy Aging, Faculty of Health Sciences, University of Copenhagen, Denmark, ²Department of Clinical and Experimental Medicine, Linköping University, Sweden, ³Department of Physical Therapy, Bispebjerg-Frederiksberg Hospital, Denmark, ⁴Section for Sports Traumatology, Department of Orthopedic Surgery, Bispebjerg-Frederiksberg Hospital, Denmark

Introduction:
Considerable variation in the treatment strategy for Achilles tendon rupture exists and clinical outcome may depend on the magnitude of tendon elongation after surgical repair.
Aim: To examine if tendon elongation (primary outcome), mechanical properties and functional outcomes during rehabilitation of surgically repaired acute Achilles tendon ruptures were influenced by different rehabilitation regimes during the early post-surgical period.

Materials and Methods:
Seventy-five patients with acute Achilles tendon rupture underwent surgical repair and had tantalum beads placed in the tendon. Thereafter, the patients were randomized into three groups: Immobilization (no weight bearing until week 7), Range of motion (no weight bearing until week 7 and ROM exercises week 3-6) or Control (partial weight bearing from day one, full weight bearing from week 5 and ROM exercises week 3-6). All patients received the same instructions in self-training guidelines starting from week 9. Patients were assessed at 2, 6, 12, 26 and 52 weeks postoperatively.

Results:
The rehabilitation regime in the initial 8 weeks did not significantly influence any of the measured outcomes including tendon elongation. Achilles tendon elongation and tendon compliance continued for up to 6 months post-surgery and muscle strength, endurance, and patient reported functional scores did not reach normal values at 12 months.

Conclusion:
Differences in rehabilitation loading pattern in the initial 8 weeks after the repair of an acute Achilles tendon rupture did not measurably alter any of the outcomes. The time to recover full function after an acute Achilles tendon rupture is at least 12 months.
Load management and progressive strengthening in 151 young adolescents with patellofemoral pain: a prospective cohort with 12 months follow-up

**As. Prof. Michael Skovdal Rathleff**\(^1\), MSc Kasper Krommes\(^3\), MSc Lukasz Winiarski\(^4\), Prof. Thomas Graven-Nielsen\(^2\), Prof Per Holmich\(^5\), As. Prof. Kristian Thorborg\(^5\)

\(^1\)SMI, Department of Health Science and Technology, Faculty of Medicine, Aalborg University, Denmark, \(^2\)Center for Neuroplasticity and Pain (CNAP), SMI, Department of Health Science and Technology, Faculty of Medicine, Aalborg University, Denmark, \(^3\)Research Unit for General Practice in Aalborg, Department of Clinical Medicine, Aalborg University, Denmark, \(^4\)Department of Occupational Therapy and Physiotherapy, Aalborg University Hospital, Denmark, \(^5\)Sports Orthopedic Research Center-Copenhagen (SORC-C), Department of Orthopaedic Surgery, Copenhagen University Hospital, Amager-Hvidovre, Denmark

**Introduction:**
Current exercise-focused treatments are only effective for 30% of adolescents with patellofemoral pain (PFP). Adolescents with PFP report severe knee pain, have strength deficits of the lower limb, and reductions in knee function. Despite this, they continue with high sports participation. This highlights the need for interventions which help adolescents to manage their sports loads, while addressing functional deficits. The aim of this study was to investigate the effect of load management and progressive strengthening in adolescents with PFP.

**Material and methods:**
This pre-registered prospective cohort study included 151 adolescents with PFP (10-14 years, median pain duration 18 months). The intervention lasted 12 weeks and included four visits with a physiotherapist. It included activity modification (week 0-4) to reduce loading of the patellofemoral joint using an activity ladder paradigm including pain monitoring, progressive strengthening exercises (week 4-12), and a return-to-sport model (week 4-12). Primary outcome was self-reported improvement at 3 months with additional follow-up at 6 and 12 months.

**Results:**
After the 12-week intervention, 87% completed the questionnaire, and 86% (95%CI: 79-91%) had a successful outcome which was maintained at 6 months (79%, 95%CI: 70-85%) and 12 months (83%, 95%CI: 75-89%). 68% were back playing sport after 3 months, 79% at 6 months and 81% at 12 months. 90% were satisfied with the results of treatment and 95% would recommend it to a friend with similar problems.

**Conclusion:**
Load management, progressive hip and knee strengthening exercises and return-to-sports following a progression model appears highly effective in adolescents with PFP.
Capturing patient-reported area of knee pain: A concurrent validity study using digital technology in patients with patellofemoral pain

Mark Matthews1,2, Michael Rathleff3,4,5, Prof Bill Vicenzino1, As. Prof Shellie Boudreau5

1School of Health and Rehabilitation Sciences, University of Queensland, Australia, 2School of Sport, Ulster University, Northern Ireland, 3Department of Clinical Medicine, Research Unit for General Practice in Aalborg, Denmark, 4Department of Occupational Therapy and Physiotherapy, Aalborg University Hospital, Denmark, 5Center for Neuroplasticity and Pain (CNAP), Centre for Sensory Motor Interaction (SMI), Department of Health Science and Technology, Faculty of Medicine, Aalborg University, Denmark

Introduction:
Patients often describe patellofemoral pain as diffuse pain at the front of the knee during knee-loading activities. A patient’s description of pain location and distribution is commonly drawn on paper by clinicians. This introduces a potential interpretation bias by the clinician, with the drawn information difficult to quantify, report or compare within and between patients. To overcome these limitations patients can draw their pain using digital platforms, such as personal computer tablets. This study assessed the validity of using computer tablets to acquire self-reported knee pain drawings as compared to paper-based records in patients with patellofemoral pain.

Materials and Methods:
Thirty-five patients completed knee pain drawings on identical images of the knee as displayed on paper and a computer tablet in a random order. Pain area expressed as pixel density, was calculated as a percentage of the total drawable area. Bland-Altman plots, Pearson’s correlation coefficients and one-sample tests were used in data analysis.

Results:
No significant difference in pain area was found between the paper and digital records of pain area (mean difference = 0.002% (95%CI: -0.159; 0.157; P=0.98)). There was a strong linear correlation (R2=0.87) between the two methods. Limits of agreement showed less than ±1% difference in pain area between paper and digital drawings.

Conclusion:
Pain drawings acquired using paper and computer tablet are equivalent in terms of total knee pain area. The advantages of digital recording platforms include easier quantification of pain location and distribution. These advantages could be realized in both research and clinical settings.
Pain, sports participation and physical function in 252 young adolescents with Patellofemoral Pain and Osgood Schlatter: A cross-sectional study

As. Prof. Michael Skovdal Rathleff¹,²,³, MSc Lukasz Winiarski³, MSc Kasper Krommes²,⁴, Prof. Thomas Graven-Nielsen⁵, Prof. Per Holmich⁵, PhD Jens Lykkegard Olesen²,⁶, PhD Sinead Holden²,⁴, As Prof Kristian Thorborg⁵

¹SMI, Department of Health Science and Technology, Faculty of Medicine, Aalborg University, Denmark, ²Research Unit for General Practice in Aalborg, Department of Clinical Medicine, Aalborg University, Denmark, ³Department of Occupational Therapy and Physiotherapy, Aalborg University Hospital, Denmark, ⁴Center for Neuroplasticity and Pain (CNAP), SMI, Department of Health Science and Technology, Faculty of Medicine, Aalborg University, Denmark, ⁵Sports Orthopedic Research Center - Copenhagen (SORC-C), Department of Orthopaedic Surgery, Copenhagen University Hospital, Amager-Hvidovre, Denmark, ⁶Institute of Sports Medicine, Department of Orthopaedic Surgery M, Bispebjerg Hospital, Denmark

Introduction:
Despite the commonality of patellofemoral pain (PFP) and Osgood Schlatter disease (OSD) in adolescents, there is a lack of data describing their effect on adolescents’ physical activity and function. The aim of this study was to characterise pain, physical activity and knee function in adolescents diagnosed with PFP or OSD, compared to pain–free controls.

Material and Methods:
This age and sex matched cross-sectional study included 252 adolescents (aged 10-14 years); 151 with PFP, 51 with OSD and 50 pain-free controls. Self-reported questionnaires were used to describe pain, physical activity, knee function, and quality of life. Hip and knee strength were objectively measured by handheld dynamometry.

Results:
OSD and PFP groups reported an average pain duration of 21 months. Over 98% of adolescents with PFP or OSD participated regularly in sports prior to their knee pain. More than 50% reduced their sports participation as a result of their knee pain. Adolescents with PFP or OSD scored 23-57 points lower in the Knee Osteoarthritis Outcome Score (KOOS) subscales compared with controls, with the lowest scores in the ‘sport & recreation’ and ‘quality of life’. The OSD group had large knee strength deficits compared to controls (26-37%), whereas for the PFP group, girls displayed decreased (15-17%) hip and knee strength, but boys did not.

Conclusion:
Adolescents with PFP or OSD are characterised by reduced knee function and strength, relative to pain-free controls. Despite high sports participation prior to knee pain, one in every two reduces their activity due to knee pain.
Load management and progressive knee strengthening in 51 young adolescents with Osgood schlatter: a prospective cohort study

As. Prof. Michael Skovdal Rathleff, MSc Lukasz Winiarski, MSc Kasper Krommes, Prof Thomas Graven-Nielsen, Prof Per Holmich, PhD Jens Lykkegard Olesen, PhD Sinead Holden, As. Prof. Kristian Thorborg

SMI, Department of Health Science and Technology, Faculty of Medicine, Aalborg University, Denmark, Center for Neuroplasticity and Pain (CNAP), SMI, Department of Health Science and Technology, Faculty of Medicine, Aalborg University, Denmark, Research Unit for General Practice in Aalborg, Department of Clinical Medicine, Aalborg University, Denmark, Department of Occupational Therapy and Physiotherapy, Aalborg University Hospital, Denmark, Sports Orthopedic Research Center-Copenhagen (SORC-C), Department of Orthopaedic Surgery, Copenhagen University Hospital, Amager-Hvidovre, Denmark, Institute of Sports Medicine, Bispebjerg Hospital, Denmark

Introduction:
Osgood Schlatter Disease (OSD) is extremely common, affecting one in ten adolescents, and particularly the sports active. Severe knee pain, lower-limb strength deficits, and reduced knee function are cardinal findings in OSD. Despite this, adolescents continue with high sports participation. This highlights the need for interventions which address functional deficits, while helping adolescents manage their sports load. The aim of this study was to investigate the effect of load management with progressive knee strengthening in adolescents with OSD.

Material and methods:
This pre-registered (NCT02799394) prospective cohort study included 51 adolescents (51% female; aged 10-14 years) with OSD. Adolescents underwent a 12-week intervention, initially (week 0-4) utilising an activity ladder paradigm designed to manage patellar tendon loading and pain. Subsequently, participants initiated progressive strength exercises (week 4-12), with a gradual return to sport (week 4-12). Primary outcome was self-reported improvement at 12 weeks, evaluated on a 7-point Likert-scale. Successful outcome was pre-specified as reporting “much improved” or “improved”.

Results:
Adolescents reported an average 21 months (12.5) pain duration. At 12 weeks, 88% completed the questionnaire with 80% reporting a successful outcome, which increased to 87% at 6 months. At 12 weeks, 40% participated in regular physical activity with 16% back playing sport, these numbers increased to 78% and 64% at 6 months. 71% were satisfied with result of treatment and 96% would recommend it to a friend.

Conclusion:
Load management combined with progressive knee strengthening has potential as a treatment for adolescents with OSD and should be explored further.
Acute effect of isometric versus isotonic exercise versus walking on pain in individuals with plantar fasciopathy: A randomized crossover trial

PhD student Henrik Riel¹, Prof. Bill Vicenzino², Prof. Martin Bach Jensen¹, Ass. Prof. Jens Lykkegaard Olesen¹,³, Post.doc. Sinead Holden¹,⁴, Ass. Prof. Michael Skovdal Rathleff¹,⁴,⁵

¹Research Unit for General Practice in Aalborg, Department of Clinical Medicine, Aalborg University, Fyrkildevej 7, 1. Denmark, ²The University of Queensland, School of Health and Rehabilitation Sciences: Physiotherapy: Sports Injury Rehabilitation and Prevention for Health, St Lucia 4072, Australia, ³Institute of Sports Medicine, Bispebjerg Hospital, Bispebjerg Bakke 23, Denmark, ⁴Center for Sensory-Motor Interaction (SMI), Department of Health Science and Technology, Faculty of Medicine, Aalborg University, Fredrik Bajers Vej 7D, Denmark, ⁵Department of occupational therapy and physiotherapy, Aalborg University Hospital, Hobrovej 18-22, Denmark

Introduction:
Plantar fasciopathy has a lifetime prevalence of 10%, and is characterised by a sharp pain under the heel. Isometric exercise is commonly recommended for inducing analgesia in lower limb tendinopathies, despite that this effect has only been evaluated in patellar tendinopathy. Due to the similarities between plantar fasciopathy and tendinopathies, the aim of this study was to investigate the effect of isometric exercise on acute pain, compared to isotonic exercise, and walking in individuals with plantar fasciopathy.

Materials and methods:
We recruited 20 individuals with plantar fasciopathy for this participant-blinded, randomised crossover study (clinicaltrials.gov: NCT03264729). Participants attended three exercise sessions (isometric, isotonic or walking) in a randomised order, within a two-week period. Exercises were performed standing with the forefoot on a step bench, while walking was performed barefoot. The primary outcome was pain (measured on a 0-100mm VAS) during a pain-aggravating activity. Secondary outcomes included pressure pain threshold (PPT) under the heel and plantar fascia thickness (PFT). All outcomes were measure before and after each exercise session.

Results:
There were no significant differences between the three exercise conditions on pain (P=0.753), PPTs (P=0.837) or PFT (P=0.718). The mean change in pain, from before to after isometric and isotonic exercise and walking, were 2.7mm (95%CI: -12.2; 6.8), -3.4mm (95%CI: -5.0; 11.8), and 1.6mm (95%CI: -16.1; 12.9), respectively.

Conclusion:
Contrary to expectations, isometric exercise was no better than isotonic exercise or walking at reducing pain in individuals with plantar fasciopathy. In fact, isometric exercise did not induce any analgesic effect.
Epidemiology of Hip- and Groin Injuries in Swedish First Football League – A Five Years Cohort Study

MSc, RPT Filip Lundgårdh¹, PhD-student, RPT Kjell Svensson², Prof., RPT Marie Alricsson³

¹Swedish Winter Sport Research Centre, Department of Health Sciences, Mid Sweden University, Sweden, ²Stockholm Sports Trauma Research Centre, Department of Molecular Medicine and Surgery, Karolinska Institutet, Sweden, ³Department of Sports Science, Linnaeus University, Sweden

Background:
There is limited research on seasonal variations in hip/groin injury rates of professional football.

Aim:
To investigate the incidence, pattern and burden of hip/groin injuries in Swedish professional male football players over five consecutive seasons.

Material and Methods:
Injury history from sixteen football teams in the Swedish first football league were evaluated during five consecutive seasons. Team medical staff recorded team exposure and time-loss injuries prospectively between 2012 and 2016.

Results:
In total, 467 time-loss injuries located to the hip/groin was recorded among 1687 professional male football players with an overall incidence and burden of 0.82/1000 h respectively 15.6/1000 h. There appears to be an increased risk of hip/groin injuries, however the difference was not statistically significant (p=0.24). Recurrent injury rate was relatively low (14%) and overuse injuries accounted for the majority of both injuries and absence days. Muscle injuries were the main injury type while kicking and sprinting/running were the primary cause of injury. Goalkeepers were at lowest risk of injury while defenders sustained the most severe injuries.

Conclusions:
Hip/groin injuries is a substantial problem in football, but does not seem to be an increasing phenomenon in the Swedish first football league. Index and overuse injuries are the main cause of injury and preventing hip/groin injuries should be focused on to lower the injury rate.

Keywords:
Epidemiology, hip, groin, injuries, football, professional.
Characteristics of Responders and Non-responders to Diagnostic Intra-articular Injection in Patients With Long-standing Hip and Groin Pain

PT August Estberger⁴, PhD Ioannis Kostogioannis¹², MSc Anders Pålsson¹, As. Prof Eva Ageberg¹
¹Department of Health Sciences, Lund University, Sweden, ²Department of Clinical Sciences, Lund University, Sweden

Background:
Longstanding hip/groin pain (LHGP) is a diagnostic challenge. Intra-articular injection of anesthetics has been reported to have high diagnostic accuracy when compared to arthroscopic findings of intra-articular pathology. The aim was to compare patient characteristics, x-ray and clinical examination findings, and patient-reported outcome measures (PROMs) of responders and non-responders to guided intra-articular injection of anesthetics to the hip joint in patients with LHGP.

Methods:
Participants were recruited from an orthopedic department. Exclusion criteria were previous hip surgery, hip or lumbar pathology. The patients completed the HAGOS and were assessed with a digital inclinometer for hip ROM and the FADDIR test. The alpha angle was calculated in a Lauenstein projection x-ray. Participants received a guided intra-articular injection, confirmed by injection of 1-2ml of contrast agent prior to the injection of local anesthetics. Pain was recorded before injection and after 1, 2 and 4 hours. >50% decrease in pain at some point during the 4 hours after injection was considered a responder.

Results:
Responders had higher baseline pain (p=.024) and less ROM in internal rotation with the hip in a neutral position (p=.007). No differences were observed between groups for age, BMI, the HAGOS subscales, alpha angle, FADDIR or other ROM.

Conclusions:
Responders to intra-articular injections have higher baseline pain and less internal rotation in a neutral hip position. Demographic factors, other ROM tests, FADDIR, HAGOS subscales, and alpha angle may not differ significantly between responders and non-responders.
Identification of prognostic factors for patient outcomes during exercise intervention for Achilles tendinopathy: a systematic review and meta-analysis

MSc Kenneth Färnqvist, MSc Amit Chauhan Anuj, PhD Dylan Morrissey, PhD Peter Malliaras

1 Haninge rehab, Dalarövägen 6, Sweden, 2 Centre for Sports and Exercise Medicine, Queen Mary, University of London, Mile End Road, UK, 3 Faculty of Medicine, Nursing and Health Science, Monash University, Frankston Vic 3199, Australia

Introduction:
Achilles tendinopathy (AT) is common among athletes and non-athletes and can impact physical function. Progressive rehabilitation is a common treatment and there is large variation in response both between individuals and studies. This systematic review aimed to synthesise current evidence on prognostic factors in AT exercise management.

Materials and Methods:
Studies investigating prognostic factors during exercise intervention for AT were included. Risk of bias was assessed, effect sizes were calculated and where there was clinical homogeneity, data were pooled in meta-analyses.

Results:
Of 19 studies included average score for methodological quality was 6.4/12. Abnormal imaging did not predict returning to preinjury status (RR 1.38 [0.91, 2.08]). Absence of doppler signal did not predict better patient satisfaction SMD 0.27 [-0.10, 1.08], VISA MD 6.05 [-0.99, 13.10], or VAS outcomes SMD 0.22 [-0.18, 0.63]. Other ultrasound and MRI parameters in single studies did not predict outcome, including focal intratendinous lesion RR 1.02 [0.49, 2.15], focal lesion with high-intensity center RR 1.30 [0.36, 4.68], spindle shape RR 1.39 [0.72, 2.67]. Only heterogeneous tendon structure predicted worse VAS outcome for pain during activity VAS SMD 0.54 [0.28, 0.79] and VAS palpation SMD 0.44 [0.35, 0.52]. Male gender was associated with greater reduction in VAS SMD 0.75 [0.46, 1.03] but overall gender showed conflicting evidence. There was strong evidence that age and duration of symptoms were not associated with outcome.

Conclusion:
One out of eight imaging measures predictive value. No psychosocial predictors were investigated and this is a gap in current knowledge.
The long-term effect of high volume image-guided injection in the chronic non-insertional Achilles Tendinopathy: a prospective case series

PT Lene Lindberg Miller\textsuperscript{1,2}, PT Torsten Grønbech Nielsen\textsuperscript{1,2}, MD Bjarne Mygind-Klavsen\textsuperscript{1,2}, Prof. MD Martin Lind\textsuperscript{1,2}

\textsuperscript{1}Div. Sports Trauma, Orthopedic Dept., Aarhus University Hospital, Tage-Hansensgade 2, Denmark, \textsuperscript{2}Department of Physiotherapy and Occupational Therapy, Aarhus University Hospital, Denmark

Introduction:
This present study evaluated the long-term effect of high volume image-guided injection (HVIGI) for chronic non-insertional Achilles Tendinopathy (AT).

Materials and Methods:
Patients with resistant non-insertional AT who failed to improve with a 3-month eccentric loading program were included in the study. Maximal tendon thickness and neovascularisation was assessed with ultrasound and power Doppler. All the tendinopathic Achilles tendons were injected, ultrasound guided, with 10 mL of 0.5\% Marcaine, 0.5 mL Triamcinolonacetonid (40 mg/mL) and 40 mL of 0.9\% NaCl saline solution under real time ultrasound guidance. All outcome measures were recorded at baseline and after one year follow-up. A standardized eccentric loading rehabilitation protocol was prescribed after HVIGI-treatment. Clinical outcome was assessed with the Victorian Institute of Sports Assessment-Achilles tendon (VISA-A) questionnaire.

Results:
Fifty-three HVIGI procedures were performed in the period 2013-2016. The study included a series of 40 procedures in 32 patients (25 men, 7 women). Mean age 44.2 (range 16-63). Mean duration of symptoms before HVIGI was 36 months. The baseline VISA-A score of 48±14 (range 14-74) improved to 63±21 (range 35-94) by 1 year (p=0.015). 53\% of the patients had more than a 10 point improvement at the VISA-A score after one year. Eleven patients (34\%) did not respond to treatment with continued pain and had surgery (2 patients) or additional HVIGI treatment (9 patients/11 procedures) before 1-year follow-up.

Conclusion:
HVIGI-treatment for chronic non-insertional AT significantly improved function and reduced pain (VISA-A) at long-term follow-up. 34\% of the patients did not respond to a single HVIGI treatment.
Isometric exercise or wait-and-see on pain, disability and global improvement in patients with lateral epicondylalgia: A randomized clinical trial

PT Viana Vuvan¹, Prof. Bill Vicenzino¹, Dr. Rebecca Mellor¹, Dr. Luke Heales²,³, Dr. Brooke Coombes³
²School of Health and Rehabilitation Sciences, The University of Queensland, Australia, ³School of Health, Medical, and Applied Sciences, Central Queensland University, Australia, ³School of Biomedical Sciences, The University of Queensland, Australia

Introduction:
There is evidence of benefit for multimodal treatments including exercise in the management of lateral epicondylalgia (LE), but little is known of the effects of isometric exercise alone. We investigated the effect of an 8-week home program of graded isometric exercise compared to wait-and-see on clinical outcomes in people with unilateral LE.

Methods:
Forty patients with LE were randomised to either wait-and-see (n = 19) or an 8-week home exercise program (n = 21). During a single session, patients assigned to exercise were instructed to complete a standardised daily program of isometric wrist extension with weekly increase in exercise volume. Primary outcomes were global rating of change (GROC) and Patient-rated Tennis Elbow Evaluation (PRTEE) at 8 weeks. Secondary outcomes were pain on an 11-point numerical rating scale, pain-free grip force, and thermal and pressure pain thresholds as a measure of nervous system sensitization at 8 weeks.

Results:
The home exercise group had lower PRTEE scores at 8 weeks compared to the wait–and-see group (standardized mean difference: 0.86, 95% confidence interval 0.2 to 1.5). No significant differences were observed between groups for all other measures.

Conclusion:
Compared to wait-and-see, a home program of graded isometric exercise improved a validated measure of pain and disability for patients with LE. Success rates in both groups for the 8-week trial were comparable to wait-and-see in previous clinical trials, suggesting exercise alone may be insufficient in improving GROC. Isometric exercise may not have an effect on nervous system sensitisation in patients with LE.
The long-term effect of high volume image-guided injection in the chronic Patella Tendinopathy: a prospective case series

PT Lene Lindberg Miller\textsuperscript{1,2}, PT Torsten Grønbech Nielsen\textsuperscript{1,2}, MD Bjarne Mygind-Klavsen\textsuperscript{1,2}, Prof. MD Martin Lind\textsuperscript{1,2}

\textsuperscript{1}Sports Trauma, Orthopedic Dept. Aarhus University Hospital, Tage-Hansensgade 2, Denmark, \textsuperscript{2}Department of Physiotherapy and Occupational Therapy, Aarhus University Hospital, Denmark

Introduction:
This present study evaluated the long-term effect of high volume image-guided injection (HVIGI) for chronic Patella Tendinopathy (PT).

Materials and Methods:
Patients with resistant PT who failed to improve with a 3-month heavy slow resistance program were included in the study. Maximal tendon thickness and neovascularisation was assessed with ultrasound and power Doppler. All the tendinopathic patella tendons were injected, ultrasound guided, with 10 mL of 0.5\% Marcaine, 0.5 mL Triamcinolonacetonid (40mg/mL) and 40 mL of 0.9\% NaCl saline solution under real time ultrasound guidance. All outcome measures were recorded at baseline and after one year. A standardized heavy slow resistance protocol was prescribed after HVIGI-treatment. Clinical outcome was assessed with the Victorian Institute of Sports Assessment-Patella tendon (VISA-P) questionnaire.

Results:
Thirty-six HVIGI procedures were performed in the period 2013-2016. The study included a series of 24 procedures in 22 patients (20 men, 2 women). Mean age 31,9 (range 18-52). Mean duration of symptoms before HVIGI was 44 months. The baseline VISA-P score of 39±16 (range 15-67) improved to 65±22 (range 20-94) by 1 year (p=0,001). 73\% of the patients had more than a 10 point improvement at the VISA-P score after one year. Eleven patients (31\%) did not respond to treatment with continued pain and referred to surgery (5 patients) or additional HVIGI treatment (6 patients/7 procedures) before 1-year follow-up.

Conclusion:
HVIGI-treatment for chronic PT significantly improved function and reduced pain (VISA-P) at long-term follow-up. 31\% of the patients did not respond to a single HVIGI treatment.
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Thank God for Stretch Jeans
MSc Matilda Elfgaard¹, PhD Anna Hafsteinsson Östenberg²
¹Department of Sports Science, Linnaeus University, Sweden

Introduction:
As an athlete, your body can be your best friend and your worst enemy. Whatever your relationship to your body, it is still your most important tool for succeeding in your sport. The athlete works hard, but society has its own criteria for the “perfect” body, which sometimes may contradict the ideal of the sport. The aim of this study was to investigate Swedish female throwers’ views of their bodies and how they look at the paradox of the body ideal of society against that of the sport.

Materials and Methods:
Eight female throwers (age 20–41) were interviewed using two focus groups: F1 (age 20–22) and F2 (age 26–41). Results were analysed using Higgins Self-discrepancy Theory (1987) and Social Comparison Theory by Festinger (1954)

Result:
Results show that although athletes had made their choice of putting the Performance body before the Appearance body, they sometimes felt like “anomalies” or outsiders in society as well as in the world of athletics.

Conclusion:
This study should drive the discussion on body image and help to create a modern supportive, equal and open climate in athletics and other sports, where all body types are welcomed, understood, appreciated and valued, not just the those in line with the predominant beauty ideals of society.
Diagnoses and disability in 325 consecutive patients with shoulder pain in an orthopedic secondary care setting

MSc Mikkel Bek Clausen1,2,3, MD Adam Witten1, As. Prof. Karl Bang Christensen4, PhD Mette Kreutzfeldt Zebis2, MD Morten Foverskov1, As. Prof. Ann Cools5, Prof. Per Hölmich1, As. Prof. Kristian Thorborg1,3

1 Sports Orthopaedic Research Center – Copenhagen, Department of Orthopedic Surgery, Copenhagen University Hospital, Amager-Hvidovre, Kettegård Allé 30, Denmark, 2 Department of Physiotherapy and Occupational Therapy, Faculty of Health and Technology, Metropolitan University College, Sigurdsgade 26, Denmark, 3 Physical Medicine and Rehabilitation Research-Copenhagen (PMR-C), Copenhagen University Hospital, Amager-Hvidovre, Kettegård Allé 30, Denmark, 4 Department of Biostatistics, University of Copenhagen, Øster Farimagsgade 5, Denmark, 5 Department of Rehabilitation Sciences and Physiotherapy, Ghent University, De Pintelaan 185, Belgium

Background:
Shoulder disorders are common in secondary care. It is, however, unknown how patient-reported shoulder function and pain differs between shoulder diagnoses. This study aims to explore this, in a secondary care setting.

Methods:
325 consecutive patients with shoulder disorders were included. Shoulder Pain And Disability Index (SPADI, 0-100), Quick Disability of the Arm, Shoulder and Hand (Q-DASH, 0-100) and pain-last-week (NRS:0-10) were collected before diagnostic examination by an orthopedic specialist blinded to test results. Based on clinical and paraclinical findings, patients were categorized as having subacromial impingement (SIS), adhesive capsulitis, complete rotator-cuff tear, glenohumeral injury (GH-injury) or other diagnoses. Q-DASH, SPADI and pain-last-week in patients with SIS were compared to scores in patients with adhesive capsulitis, complete rotator-cuff tear or GH-injury, respectively.

Results:
SIS was the most common diagnose (64%), followed by labral injury or glenohumeral dislocation sequelae (GH-injury, 9%), adhesive capsulitis (7%) and complete rotator-cuff tear (4%). Patients with adhesive capsulitis scored significantly worse on SPADI and pain-last-week compared to patients with SIS (n=209) (p<0.05). Q-DASH was not significantly different. Patients with GH-injury scored significantly better in SPADI, Q-DASH and pain-last-week compared to patients with SIS (p<0.05). Patients with complete rotator-cuff tear did not score significantly different from those with SIS (p>0.05).

Conclusion:
Patients with adhesive capsulitis reported higher pain-levels and lower function compared to patients with SIS, whereas patients with GH-injury reported better values. This illustrates a continuum of severity with adhesive capsulitis being the most severe followed by SIS, while GH-injury seems to be less severe.
Good midterm results after hip arthroscopy for femoroacetabular impingement: 6-8 years follow up.

MD Niels Christian Kaldau1,3, Dr., PhD., MD Stig Brorson2, Prof., Dr., MD Per Hölmich3, MD Bent Lund1,4
1Aleris-Hamlet Hospital Aarhus, Department of Orthopedic Surgery, Brendstrupgaardsvæj 21, Denmark, 2Department of Orthopedic Surgery, Copenhagen University Hospital, Herlev & Gentofte Hospital, Herlev Ringvej 70, Denmark, 3Sports Orthopedic Research Center - Copenhagen, Department of Orthopaedic Surgery, Copenhagen University Hospital, Amager & Hvidovre Hospital, Kettegaard Allé 30, Denmark, 4Department of Orthopedic Surgery, Horsens Regions Hospital, Sundvej 30, Denmark

Introduction:
Short-term outcome after hip arthroscopy for femoroacetabular impingement (FAI) shows improvements in hip function and decrease of hip pain. Few mid and longer-term studies have been published. The objective was to report the midterm results in a consecutive cohort and investigate the relationship between cartilage lesions and the conversion rate to total hip arthroplasty (THA).

Materials and Methods:
Eighty-four FAI patients were retrospectively followed for 6–8 years. The conversion rate to THA, the perioperative findings, and the patient-reported outcome measures (PROM) were assessed.

Results:
Fifteen of 84 (18 %) patients were converted to THA. The 5-year hip survival rate was 83.9 % (CI 75.1 %–91.5 %).
The THA group was significantly older, with a mean age of 46.9 years (CI 42.8; 50.8) compared to 39.0 years (CI 36.6; 41.6) in the non-THA group (p=0.011). In the THA group, 13 of 15 patients were 40 years or older (p=0.005). A high-grade acetabular or femoral cartilage lesion was associated with a higher risk of conversion to THA (p=0.017 and p<0.0001). Sixty-four patients of 69 (93 %) were willing to repeat the arthroscopy.

Conclusion:
The midterm results of arthroscopic hip-preserving surgery show high patient satisfaction, and good functional outcome. The conversion rate to THA was18 %. High-grade cartilage lesions and an age of 40 years and older are risk factors for conversion to THA.
Is greater midfoot mobility associated with a successful outcome with foot orthoses compared to hip exercises in managing patellofemoral pain?

Mark Matthews¹,², Michael Rathleff³,⁴,⁵, Dr Andrew Claus¹, Prof Tom McPoil⁶, As. Prof Robert Nee⁷, Prof Kay Crossley⁸, Jessica Kasza⁹, Prof Bill Vicenzino¹

¹School of Health and Rehabilitation Sciences, The University of Queensland, Australia, ²School of Sport, Ulster University, Northern Ireland, ³Department of Clinical Medicine, Research Unit for General Practice in Aalborg, Denmark, ⁴Department of Occupational Therapy and Physiotherapy, Aalborg University Hospital, Denmark, ⁵Centre for Sensory Motor Interaction (SMI), Department of Health Science and Technology, Faculty of Medicine, Aalborg University, Denmark, ⁶Regis University, USA, ⁷Pacific University, USA, ⁸La Trobe University, Australia, ⁹Monash University, Australia

Introduction:
Improving treatment outcomes for patients with patellofemoral pain is a priority. Patients with different characteristics may respond differently to different treatments. Preliminary evidence suggests that a greater change in midfoot width mobility is associated with a successful outcome with foot orthoses. Foot orthoses and hip exercises are two evidence-based treatments, but which of these treatments are better remains unknown. The aim was to (i) evaluate if midfoot width mobility is associated with success with foot orthoses compared to hip exercises, and (ii) compare the treatment efficacy between foot orthoses and hip exercises.

Materials and Methods:
218 participants with patellofemoral pain were recruited into a two-arm parallel, multi-centre randomised superiority clinical trial conducted in Australia and Denmark (pre-registered: ACTRN12614000260628). Eligible participants were stratified into subgroups based on their presenting midfoot width mobility and randomised to wear foot orthoses or four weeks of physiotherapist-supervised hip exercises (3 times/week). Primary outcome was a 7-point Likert global rating of change scale at 12 weeks, dichotomized as successful (much better or better) or not successful.

Results:
No significant differences in success rates were found between subgroups stratified on their foot mobility and treatment (p=0.19), or between foot orthoses and hip exercises (p=0.67). There was a 49% success rate regardless of treatment or strata.

Conclusion:
Midfoot width mobility does not predict a superior success rate with foot orthoses compared to physiotherapist-supervised hip exercises. Both treatments have comparable success rates in the management of patellofemoral pain. These findings aid clinicians in making treatment decisions with patients.
A nationwide follow-up on the effectiveness of an implemented neuromuscular training program to reduce severe knee injuries in football players

PT Malin Åman, Professor Karin Larsén, As.Prof. Magnus Forssblad, PhD Markus Waldén, As.Prof. Martin Hägglund

1GIH, The Swedish School of Sport and Health Sciences, Lidingövägen 1, Sweden, 2Stockholm Sports Trauma Research Center, Karolinska Institutet, Box 5605, Sweden, 3Linköping University, Sandbäcksgatan 7, pl 3, Sweden

Introduction:
The Swedish Knee Control Program (KCP) was systematically implemented nationwide by the Swedish Football Association (FA) after being found efficacious to prevent ACL injuries in youth female football players. The aim of this study was to evaluate the effectiveness of the KCP in reducing acute knee and cruciate ligament (CL) injuries at a national level.

Materials and Methods:
National insurance data from the insurance company covering all licensed football players in Sweden included more than 17,500 knee injuries, reported to the insurance company between 2006 and 2015. By matching the number of licensed players with the number of reported injuries each year, the annual knee and CL injury incidence was calculated. To evaluate the spread of KCP countrywide, a questionnaire was sent to all 24 district FAs with questions regarding KCP education and workshops. The number of downloads of the KCP mobile App. was also calculated.

Result:
Between 46-79% of the district FAs had performed KCP educations/workshops each year, and there were 101236 downloads of the KCP App. during the study period. When comparing the injury incidence before and after the nationwide implementation, there was a decreased in CL injuries with 7% in males and 14% in females. Knee injury incidence decreased with 8% in males and 21% in females. The decrease corresponds to a reduction of 100 CL injuries each year.

Conclusion:
The Swedish KCP is implemented nationwide and the incidence of knee and CL injuries have decreased in both sexes, at a national level.
Biomechanics of a supination ankle sprain: a kinematic comparison of two identical awkward landings with and without Spraino

MSc, PhD-Student Filip Gertz Lysdal1,2, MD Thor Buch Grønlund2, Prof., PhD Uwe Gustav Kersting1
1Center for Sensory-Motor Interaction, Department of Health Science and Technology, Aalborg University, Fredrik Bajers Vej 7D, Denmark, 2Spraino ApS, Nørre Allé 41, Denmark

Introduction:
Ankle sprains are the most-common musculoskeletal injuries making up 30% of all sports injuries. Up to 90% of these are ligamentous sprains to the lateral ligament complex. A novel approach to prevent this injury is to reduce friction on the lateral edge of the shoe using Spraino®. Previous studies have shown that this does not affect performance and safety in typical sports movements. In this study, the effect of Spraino® was tested in an injury-promoting situation.

Materials and Methods:
One male participant (age: 26y, height: 1.74m, mass: 75.5kg) performed 66 lateral cutting movements aiming to land with an initially inverted foot – a known initiator of a lateral ankle sprain. Ground reaction forces were collected at 1000Hz (AMTI OPT464508HF-1000). Kinematics were recorded at 500Hz (Qualisys Oqus300+). The first 65 trials were completed with Spraino® attached. The subsequent 66th trial was considered a control trial with no shoe-attachments.

Results:
No injuries were sustained during the first 65 trials while wearing Spraino®. The 66th control-trial resulted in a grade 1 sprain to the ATFL. A complete change in ankle joint kinematics in the frontal plane is evident when comparing this injury trial to a Spraino® trial with identical kinematics. The foot was further supinated in the injury trial and realigned to proper position when using Spraino®. In addition, ankle joint kinetics revealed a complete lack of inversion moment at initial contact when using Spraino®.

Conclusion:
Reducing friction on the lateral forefoot appears a promising solution in preventing non-contact lateral ankle sprains.
Normative values for shoulder isometric strength: Pre- and mid-season measures for youth elite handball players with no shoulder symptoms

MSc Behnam Liaghat1, PhD Jesper Bencke2, PhD Mette K. Zebis3, Prof. Grethe Myklebust4, As. Prof. Henrik Sørensen5, Prof. Niels Wedderkopp6, Martin Lind7, PhD Merete Møller1

1Department of Sports Science and Clinical Biomechanics, Research Unit for Musculoskeletal Function and Physiotherapy, University of Southern Denmark, , Denmark, 2Human Movement Analysis Laboratory, Copenhagen University Hospital, Amager-Hvidovre, , Denmark, 4Department of Physiotherapy and Occupational Therapy, Faculty of Health and Technology, Metropolitan University College, , Denmark, 4Department of Sports Medicine, Oslo Sports Trauma Research Center, Norwegian School of Sport Sciences, , Norway, 5Department of Public Health, Section for Sport Science, Aarhus University, , Denmark, 6Sports Medicine Clinic, Orthopaedic dep. Hospital of Lillebaelt, Institute of Regional Health Service Research, University of Southern Denmark, , Denmark, 7Div. of Sportstraumatology, Aarhus University Hospital, , Denmark

Introduction:
Glenohumeral strength deficits are considered risk factors for developing shoulder problems in overhead athletes. The aim was to assess normative data for rotator cuff (RC) strength in youth elite handball, and examine whether changes occur over a competitive season.

Materials and Methods:
Two physiotherapists, one for each assessment parameter, assessed 542 youth (14-18 years) players (45% girls) without shoulder symptoms pre- and mid-season. Assessment of IR and ER strength (neutral position and 30° IR in supine with 90° shoulder abduction) and abduction strength in ‘full-can’ supraspinatus test-position were performed using hand-held dynamometry. Outcome variables of interest were RC strength normalized to body weight (N/kg), ER/IR ratios, abduction side differences, and changes during the season.

Results:
The main finding demonstrates that there were no clinically significant changes from pre- to mid-season in any of the strength variables (mean differences -0.25–0.15 N/kg, 95% CIs: -0.33–0.18 N/kg). Male players were significantly stronger than female players (means 1.41–2.27 ± SDs 0.30–0.59 N/kg for males vs. means 1.13–1.91 ± SDs 0.24–0.42 N/kg for females, p<0.001), but no gender differences were found in neither ER/IR ratios (means 0.84–0.88 ± SD 0.19–0.20 for males vs. means 0.82–0.87 ± SD 0.16–0.19 for females, p>0.295) nor abduction side differences (mean 0.08 ± SD 0.15 vs. mean 0.08 ± SD 0.12 for males and females, respectively, p>0.977).

Conclusion:
Normative strength variables did not change from pre- to mid-season. Calculation of side differences and intermuscular ratios are key points in risk factor assessment and clinical evaluation in youth elite handball.
Consumer Testing of Bicycle Helmets

As. Prof. Helena Stigson¹
¹Folksam Research, 10660, Sverige, ²Chalmers University of Technology, , Sweden

Introduction:
Current bicycle helmet standards do not include angular acceleration, for certification even though it is known that it is the dominant cause of brain injury. The objective of this study was to develop an improved test method, including oblique impacts, to evaluate helmets sold on the European market.

Materials and Methods:
Four physical tests were conducted, shock absorption with straight perpendicular impact and three oblique impact tests. Computer simulations were made to evaluate injury risk. In total, 11 conventional helmets were included.

Results:
All helmets except four showed a linear acceleration lower than 180 g, which corresponds to a low risk of skull fracture. The simulations indicated that the strain in the grey matter of the brain during oblique impacts varied between helmets from 13% to 36%, where 26% corresponds to 50% risk for a concussion. Helmets equipped with Multidirectional Impact Protection System (MIPS) performed better than the others. However, all helmets need to reduce rotational acceleration more effectively.

Conclusion:
Helmets should be designed to reduce the translational acceleration as well as rotational energy. A conventional helmet that meets current standards does not prevent a cyclist from getting a concussion in case of a head impact. Helmets need to absorb energy more effectively.
Testing Spraino in a novel speed test for evaluation of badminton specific movements

MSc, PhD-Student Filip Gertz Lysdal¹,², PhD Christian Møller Madsen³, Jeroen van Dijk⁴, Roos Bulthuis²,⁵, Rémi Delas²,⁶, Prof., PhD Uwe Gustav Kersting²

¹Spraino ApS, Nørre Alle 41, Denmark, ²Center for Sensory Motor Interaction, Department of Health Science and Technology, Aalborg University, Fredrik Bajers Vej 7D, Denmark, ³Stenhus Gymnasium, Stenhusvej 20, Denmark, ⁴BEC Centre of Excellence, Badminton Europe, Stenhusvej 20, Denmark, ⁵Faculty of Science and Technology, Biomedical Engineering, University of Twente, Drienerlolaan 5, The Netherlands, ⁶Polytec Lyon, Claude Bernard University Lyon 1, 43 Boulevard du 11 Novembre 1918, France

Introduction:
The ankle joint is by far the most-frequently injured bodypart in Badminton accounting for 23.5% of all injuries. 86.5% of these are classified as ligamentous sprains with the vast majority affecting the lateral ligament complex. A novel approach in preventing this common injury is to reduce friction on the lateral edge of the shoe using Spraino®. Previous studies have shown no changes in performance and safety during typical indoor sports movements. In this study, the effect of Spraino® on performance was tested in a novel speed test for evaluation of badminton specific movements designed to simulate match-play.

Materials and Methods:
Twenty-one international elite badminton players (eight females) (age: 21.9y ±3.4, height: 1.69m ±0.24, mass: 64.5kg ±16.3) participated in this randomized cross-over study. Each participant completed a familiarization trial followed by four maximum-effort trials in the novel speed test of Madsen et al. (2016). The speed test comprises of four sensors placed in each corner of a singles court. Each participant would hit each sensor five times in a randomized order. Whole-body kinematics were recorded at 500Hz using 15 infrared cameras (Qualisys Oqus 700+) and a 62-retro-reflective marker setup.

Results:
A paired samples t-test revealed no statistically significant difference in the performance of the participants between the two conditions. The participants completed the speed test in 31.0s (± 2.2) while wearing Spraino® and in 31.5s (± 2.4) without Spraino®.

Conclusion:
Reducing friction on the lateral edge of the forefoot does not affect movements or performance in simulated badminton match-play.
10-year risk-factors of knee function after anterior cruciate ligament reconstruction - a study from the Swedish National Knee Ligament Register

PT, MSc Eric Hamrin Senorski¹, MD Eleonor Svantesson², MD, PhD Kurt Spindler³, MD, Prof. Jón Karlsson²,4, MD, As. Prof. Kristian Samuelsson²4

¹Department of Health and Rehabilitation, Institute of Neuroscience and Physiology, the Sahlgrenska Academy, University of Gothenburg, , Sweden, ²Department of Orthopaedics, Institute of Clinical Sciences, the Sahlgrenska Academy, University of Gothenburg, , Sweden, ³Cleveland Clinic Sports Health Center, , USA, ⁴Department of Orthopaedics, the Sahlgrenska University Hospital, , Sweden

Introduction:
Long-term individual prognosis and risk factors for quality of life and disability following ACL reconstruction remain unknown. To determine 10-year predictors of knee function after anterior cruciate ligament reconstruction.

Material and Methods:
Prospectively collected data were extracted on patients who underwent ACL reconstruction between January 2005 and January 2007 from the Swedish National Knee Ligament Register. Patients who had no 10-year follow-up of the Knee injury and Osteoarthritis Outcome Score (KOOS) were excluded. Conditional multivariable regression modeling was used to assess 10-year patient-related and surgery-related risk factors across all KOOS subscales including KOOS4.

Result:
In total, 874 patients with a median age of 27.5 years (11.2-61.5) at ACL reconstruction were included. No patient-related or surgery-related predictor was significant across all subscales of the KOOS. The presence of a concomitant articular cartilage injury resulted in decreased odds OR = 0.639-0.796 (p < 0.05) for every two-step increase of ICRS grade in four KOOS subscales. A higher preoperative KOOS pain increased the odds of having a favorable KOOS in the subscales of pain, symptom, sport and KOOS4. In a sub-analysis, a higher preoperative body mass index proved to be a significant risk factor in four out of the six KOOS subscales studied.

Conclusion:
This 10-year risk factor analysis identified several factor than can effect long-term knee function after ACL reconstruction. Most of the risk factors were surgery-related and unfortunately non-modifiable. Nevertheless, this information can be helpful to physicians counseling patients’ expectations of outcome after ACL reconstruction.
The risk of kicking-related injury in professional Rugby Union

MSc Stephanie Lazarczuk, Dr Thomas Love, Dr Matt Cross, Dr Keith Stokes, Dr Sean Williams, Aileen Taylor, Dr Colin Fuller, Dr John Brooks, Dr Simon Kemp, Dr Neil Bezodis

1Swansea University, United Kingdom, 2Premiership Rugby, United Kingdom, 3University of Bath, United Kingdom, 4Karabati Ltd, United Kingdom, 5Colin Fuller Consultancy, United Kingdom, 6St. George’s, University of London, United Kingdom, 7Rugby Football Union, United Kingdom

Introduction:
Injury incidence in Rugby Union is traditionally reported per 1000 player-hours. It has been demonstrated that risk associated with discrete events (e.g. kicking) may be underestimated if analyses include all players rather than the predominant population at risk. This study therefore aims to quantify kicking injury risk using alternative approaches.

Materials and Methods:
Match injuries directly attributable to kicking were identified from 12 seasons of the Rugby Football Union’s Professional Rugby Injury Surveillance Project. The total number of kicks performed over one complete season of English Premiership matches was determined, with the player’s position identified for every kick. Injury incidence was calculated per 1000 player-hours for all players, and for just the backs. Injury propensity was determined as the number of injuries per 1000 kicks.

Results:
Seventy kicking injuries occurred in matches over the 12 seasons. Based on the recorded match exposure (93,658 total hours), incidence was 0.75/1000 all player-hours. When modified to just the backs (who performed 98.7% of all kicks) incidence was 1.60/1000 player-hours. Based on 9,377 kicks being performed during a single season (135 matches), injury propensity was estimated at 0.62 injuries per 1000 kicks, equating to one kicking injury every 23 matches.

Conclusion:
Reporting modified incidence or propensity values provides a more informative reflection of kicking injury risk and accounts for the number of players typically exposed to kicking. However, these figures may still be conservative for specific players as kicking load is not equally distributed across all backs.
Adolescent football-active females with a previous knee injury history have a high level of knee pain

PT, MSc Louisa Wilquin¹, MSc, PhD Mette Kreutzfeldt Zebis¹, PT, MSc Mikkel Bek Clausen¹, Prof., PhD, MSc Peter Krstrup², Prof., Dr., MD Per Hølmich³, Prof., Dr., MD Niels Wedderkopp⁴, Prof., PhD, MSc Lars Louis Andersen⁵, PT, PhD, As.Prof. Kristian Thorborg³

¹Metropolitan University College, Sigurdsgade 26, Danmark, ²Department of Sports Science and Clinical Biomechanics, University of Southern Denmark, Campusvej 55, Denmark, ³Sports Orthopedic Research Center – Copenhagen (SORC-C), Department of Orthopaedic Surgery, Copenhagen University Hospital, Amager-Hvidovre, Kettegård Allé 30, Denmark, ⁴Institute of Regional Health Services Research and Center for Research in Childhood Health, IOB, University of Southern Denmark, Campusvej 55, Denmark, ⁵National Research Centre for the Working Environment, Lersø Park Allé, Denmark

Introduction:
In football, the level of knee pain experienced by adolescent female players, who have returned to sport after knee injury, has not previously been investigated. Thus, the aim of the present study was to evaluate knee pain intensity in a cohort of adolescent football-active females with and without a knee injury history.

Materials and Methods:
During the Danish 2012 football season a web-survey was e-mailed to 498 participating adolescent female football players (15-18 years), and 400 players (80%) completed the web-survey. According to knee injury history, players were allocated into one of three groups: 1) previous ACL and/or meniscus injury, 2) another kind of knee-injury within the last year or 3) no-knee-injury within the last year. Knee pain intensity experienced within the last month (NPRS:0-10) is presented as median [IQR] for each group.

Results:
Forty-five players (11%) reported a previous ACL and/or meniscus injury, 118 (30%) players reported a knee-injury within the last year and 237 (59%) players reported no-knee-injury within the last year. Knee pain intensity in the group with no-knee-injury history (0 [0;2]) was significantly lower than in the group reporting a knee-injury within the last year (5 [2;7],p<0.0001) and in the group with a previous ACL/meniscus injury (5 [2;7],p<0.0001), respectively.

Conclusion:
The reported pain intensity of ‘5 out of 10’ in both the knee-injury group and the ACL/meniscus group in football-active female players is worrying and calls for an increased focus on the short as well as long-term consequences of knee injuries in adolescent female football.
The preventive effect of an adductor strengthening programme on groin problems among male football players: A cluster-randomised controlled trial

PT Joar Harøy¹, PhD Ben Clarsen¹, PT Espen Guldahl Wiger¹, PT Mari Glomnes Øyen¹, PhD Andreas Serner²,³, As.Prof Kristian Thorborg², Prof Per Hölmich³, Prof Thor Einar Andersen¹, Prof Roald Bahr¹

¹Oslo Sports Trauma Research Center, Department of Sports Medicine, Norwegian School of Sport Sciences, Norway, ²Sports Orthopedic Research Center - Copenhagen, Department of Orthopedic Surgery, Copenhagen University Hospital, Denmark, ³Aspetar, Orthopaedic and Sports Medicine Hospital, Qatar

Introduction:
Groin problems are highly prevalent in male football players. Previous groin-specific prevention programs have shown no effect on groin injury rates. However, a single-exercise approach targeting hip adduction strength has not been tested previously.

Aim:
Evaluate the effect of a single-exercise approach, based on the Copenhagen Adduction exercise, to reduce the high prevalence of groin problems in male players.

Materials and Methods:
35 semi-professional Norwegian senior football teams were cluster-randomised (18 teams, 339 players in the intervention group, 17 teams 313 players in the control group) and followed for 1 full season. An adductor strengthening programme, with three progression levels, was introduced to the intervention group to perform 3 times weekly during pre-season and once weekly during the competitive season. The main outcome measure, prevalence of groin problems, was measured weekly for 28 weeks during the competitive season using the Oslo Sports Trauma Research Center Overuse Injury Questionnaire.

Result:
The average prevalence of groin problems during the season was 13.5% (95% CI: 12.3% to 14.7%) in the intervention group, and 21.3% (95% CI: 20.0% to 22.6%) in the control group. This corresponds to a 41% (OR 0.59, 95% CI 0.40 to 0.86, p=0.008) lower risk of reporting groin problems for players performing the adductor strengthening programme.

Conclusion:
The adductor strengthening programme reduced the prevalence and risk of groin problems among male football players, and should therefore be implemented in male football teams.
The use of knee injury prevention exercises programmes in Danish youth handball: An investigation of key implementation components

BA (Hons) Sheree Bekker¹, PHD Mette Kreutzfeldt Zebis², Prof Grethe Myklebust³, Prof Niels Wedderkopp⁴, Prof Martin Lind⁵, As. Prof Henrik Sørensen⁶, PhD Merete Møller⁷

¹Australian Centre for Research into Injury in Sport and its Prevention (ACRISP), Faculty of Health, Federation University Australia, Australia, ²Department of Physiotherapy and Occupational Therapy, Faculty of Health and Technology, Metropolitan University College, Denmark, ³Department of Sports Medicine, Oslo Sports Trauma Research Center, Norwegian School of Sport Sciences, Norway, ⁴Sport Medicine Clinic, Orthopaedic dep. Hospital of Lillebaelt, Institute of Regional Health Service Research, Centre for Research in Childhood Health, IOB, University of Southern Denmark, Denmark, ⁵Div. of Sportstraumatology, Aarhus University Hospital, Denmark, ⁶Section for Sports Science, Department of Public Health, Aarhus University, Denmark, ⁷Department of Sports Science and Clinical Biomechanics, Research Unit for Musculoskeletal Function and Physiotherapy, University of Southern Denmark, Denmark

Introduction:
The efficacy of knee injury-prevention exercise programs (IPEPs) for handball has been established, however their implementation in Danish youth handball is unknown. This study aimed to assess key IPEP implementation components in Danish youth handball, including coach and player attitudes, beliefs, and experiences.

Materials and methods:
678 youth (14-18 years) handball players (372 boys, 307 girls) were surveyed about their use of IPEPs. A subgroup of players (n= 473) and coaches (n=33) were subsequently surveyed about their attitudes and beliefs around IPEPs. Additionally, 5 coaches and 3 players were interviewed about their IPEP experiences.

Results:
Players reported performing some of the IPEP exercises (62%), however only 3% implemented the full IPEP. The majority performed these exercises once weekly (51%), while 17% did the exercises 3 times a week. Players recognize their high risk of injury (80% agree), and are willing to implement IPEPs if these reduce injury risk (84% agree) and enhance performance (88% agree). Coaches agreed that IPEPs are an important part of coach education (100%), and are the coach’s responsibility to implement (87% agree). There is high agreement amongst players (73%) and coaches (87%) that coach motivation has a key influence on player motivation to participate in IPEPs. Qualitative interviews suggest that players and coaches felt that established IPEPs did not contain enough handball-specific exercises, and do not enhance performance.

Conclusion:
Danish youth handball players and coaches recognize the importance of IPEPs. They generally have positive attitudes towards injury prevention, however adherence to established IPEPs is low.
The Lower Limb Kinematics Difference Between Legs and Across a Sport Season

MSc Msaad Alzhrani¹,², Dr. Lee Herrington², Prof. Richard Jones²
¹Majmaah University, , Saudi Arabia, ²University of Salford, , United Kingdom

Introduction:
Assessing the lower limb movement to evaluate the risk of non-contact knee injuries has been studied recently. Current practice examines only one leg or both legs simultaneously. Also, they do the screening at one occasion at the pre-season. However, the kinematics performance might be different between legs and over time, which is goal of this study to examine.

Materials and Methods:
Ninety male professional footballers have participated to assess the kinematics performance of Frontal Plane Projection Angle (FPPA) and hip adduction angle (HADD) for both legs. The 2D technique was used assess the kinematics while participants are doing Single Leg Landing (SLL) task. The screenings have been done three times throughout the sport season (pre-season, start-season, end-season). The differences of individual lower-limb kinematics (FPPA and HADD) between legs, and between screening times have been studied.

Results:
The dominant legs FPPA were significantly (p < .001-.008) larger than the non-dominant legs in all screening times, while the HAAD were smaller in dominant legs (p < .02-.03) in all-screening times except pre-season screening where no difference found (p < .33). Also, there were significant changes of performance throughout the season for both dominant and non-dominant FPPA (p < .01-.0005), and HADD (p < .003-.0005).

Conclusion:
The difference of lower limb kinematics between legs in FPPA and HAAD during SLL suggests that examining the lower-limb kinematics to assess the risk of non-contact knee injuries should be done on both legs independently, and should be done regularly throughout the sport.
Factors Associated with Back Injuries in Youth Floorball and Basketball: A Prospective Three-Year Follow-Up Study

MSc, PT Marleena Rossi1,3, As.Prof, PT Kati Pasanen1,2, Prof. Ari Heinonen3, MD. Phd. Pekka Kannus4, MD. Phd. Tommi Vasankari4, MD. Phd. Jari Parkkari1

1Tampere Research Center of Sports Medicine, UKK Institute, Finland, 2Sport Injury Prevention Research Centre, Faculty of Kinesiology, University of Calgary, Canada, 3Faculty of Sports and Health Sciences, University of Jyväskylä, Finland, 4Injury and Osteoporosis Research Center, UKK Institute, Finland

Introduction:
In Finland, nearly half of adolescents take part in organized sports, floorball and basketball being among the most popular sports. To date, prospective data of risk factors for low back injuries (LBI) in youth floorball and basketball players are limited in numbers. The objective of this study was to investigate the associations between flexibility factors and low back injuries.

Materials and Methods:
In this prospective study 396 adolescents were observed prospectively for 1 to 3 years. Total of 586 athlete-years were recorded. At baseline athletes (mean age 15.8±1.9) performed physical tests and completed a baseline questionnaire. During the follow-up, all time-loss non-contact back injuries were registered weekly. Athletic exposure was recorded for every player individually for 1 to 3 years.

Results:
Altogether 61 back injuries were reported by 51 players (13 %). The incidence for back injuries was 87/1000 athlete-years. Hamstring flexibility (HR 0.99; 95 % CI 0.97 to 1.01), Beighton Horan laxity index (HR 1.02; 95 % CI 0.41 to 2.18) or genu recurvatum (HR 0.95; 95 % CI 0.94 to 1.11) were not significantly associated with overuse LBI in young floorball and basketball players.

Conclusions:
13 % of the players reported at least one time-loss back injury during the follow-up. The aforementioned flexibility factors were not statistically significantly associated with low back injuries.
Hidden lateral meniscal ramp lesion in a child

**MD Martin Rathcke¹, MD Philip Hansen², Prof., PhD, MD Mikael Boesen², Prof., PhD, MD Michael Krogsgaard¹**

¹Dept. of Orthopaedics, Section of Sporttraumatology, Bispebjerg-Frederiksberg Hospital, Bispebjerg Bakke 23 - 2400 NV, Denmark, ²Dept. of radiology, Bispebjerg-Frederiksberg Hospital, Bispebjerg Bakke 23 -2400 NV, Denmark

**Introduction:**
Meniscal ramp lesion is a disruption of the menisco-tibial ligament posterior to the meniscus. It results in hypermobility of the posterior meniscal horn, which increases anterior and rotational laxity of the knee. Therefore, repair is recommended.
Ramp lesions are difficult to detect on MRI, and a subtle fluid signal between the posterior horn and the posterior capsule may be the only sign.
Lateral ramp lesions are much less common than medial, and have not been reported in skeletally immature children.

**Aim:**
To report a MRI-negative lateral ramp lesion in a child with periodically locked knee.

**Materials and methods:**
An 11-year old boy had a knee injury. During the following ½ a year he had persistent knee pain and episodes of locking. MRI was normal. Because of the locking-episodes he was arthroscoped, and a lateral ramp lesion and a radial lesion into zone 2 in the posterior, lateral horn were sutured.
The preoperative MRI was inconspicuous, and operation was on clinical indication alone.

**Results/Discussion:**
Causes of knee locking, the mechanism of lateral ramps lesions, the diagnostic pitfalls and the technical difficult procedure of repair are discussed.

**Conclusion:**
Arthroscopy is indicated with mechanical symptoms like locking after a knee trauma, even if the MRI is considered non-pathological. Operation should be performed early to avoid further meniscal damage, in this case a radial lesion. The low sensitivity of MRI in detections of ramp lesions may relate to the extended position of the knee during scanning.
Coronal plane hip biomechanics in young adult male athletes with symptomatic femoroacetabular impingement (FAI) – a case-control laboratory study.

BSc Leon Han Pay¹,², PhD, MSc, PT Paulina Kloskowska², PhD, MSc, PT Dylan Morrissey²
¹Imperial College School of Medicine, Imperial College London, Exhibition Road, SW7 2AZ, United Kingdom, ²Centre for Sports and Exercise Medicine, Barts and the London School of Medicine and Dentistry, Queen Mary University of London, Mile End Hospital, 275 Bancroft Road, E1 4DG, United Kingdom

Introduction:
Femoroacetabular impingement (FAI) is a morphological hip joint deformity associated with hip symptoms and early degenerative changes. Cam-FAI is prevalent in young male athletes, biomechanical deficiencies have been associated with symptomatic FAI (sFAI), but little is known about hip muscle function during dynamic tasks. Our study aimed to: (1) compare coronal-plane hip biomechanics and strength during movement tasks in sFAI hips against healthy controls and (2) investigate the effect of hip internal rotation range of motion (ROM) on these outcomes.

Methods:
11 sFAI hips and 24 well-matched healthy control hips from 18 young adult male athletes were recruited. Weight-normalised hip abductor and adductor isometric maximal voluntary contraction torques were quantified with handheld dynamometry. Gluteus medius and adductor longus activation and hip coronal-plane angles were obtained with motion-capture and electromyography (EMG) during single-leg-squat and sit-to-stand tasks.

Results:
During the sit-to-stand ascent phase, significantly more hip abduction (F=4.93, p=0.03) was observed in sFAI hips (13.06±3.16) compared to controls (10.16±3.72). When hip internal rotation ROM was controlled for, significantly higher gluteus medius:adductor longus sEMG activation ratio (F=4.32, p=0.046) was observed in the same phase in sFAI hips (0.16±0.34) compared to controls (-0.11±0.31). No significant findings were found for single-leg-squat phases.

Conclusion:
sFAI hips demonstrate significantly altered coronal-plane muscle activation and hip movement patterns when ascending from seated positions compared to controls. Between-group differences in hip internal rotation ROM seem to have some influence on findings. These findings should be considered when planning rehabilitation and future biomechanical research in the sFAI population.
Epidemiology of neck injuries accompanying 3,040 pediatric sport concussions in Colorado over a 13-year period in a university-based healthcare system.

Dr. Joel Carmichael¹, MSTC Elizabeth Staton², PhD Patrick Blatchford³, MPT, PhD Jennifer Stevens-Lapsley⁴

¹The Center for Spine, Sport & Physical Medicine, 9556 PARK MEADOWS DRIVE, SUITE 300, United States, ²University of Colorado School of Medicine | Department of Family Medicine, 12631 E. 17th Avenue | AO1, 3rd Floor, Room 3403, United States, ³Colorado School of Public Health | Department of Biostatistics & Informatics, 13001 E. 17th Avenue | Mail Stop B119, United States, ⁴University of Colorado School of Medicine | Physical Therapy Program, 13121 E. 17th Avenue | Mail Stop C244 Room 3118, United States

Introduction:
The same trauma producing a cerebral concussion may also produce a cervical whiplash injury. The signs of concussion and cervical strain injury are similar. Symptoms after head injury do not accurately discriminate between cerebral and cervical injury. To the authors’ knowledge there have been no studies to date that have examined the epidemiology of neck injury among sport-concussed youth. This study describes neck injury rates among sport-concussed youth from 5 to 21 years sustaining sport-related concussion, including characteristics by type of age, sex, and sport.

Materials and Methods:
This descriptive epidemiological study used aggregate data from University-based electronic health records over 13 years to analyze rates and characteristics of neck injuries among youth from 5 to 21 years-old sustaining a sport-related concussion. Neck injury rates were calculated per 100 diagnosed concussions.

Results:
A total of 3,040 sport-related concussions in youth from age 5 to 21 were analyzed. Of these, 220 were accompanied by a neck injury, with peak incidence at age 14 and neck injury rates of 15.8, 13.5, and 14.3 neck injuries per 100 concussions for females, males, and both sexes respectively. The top 3 sports for concussions in both sexes were American football, soccer and equestrian sports. However, neck injury rates, calculated per 100 concussions, were highest in swimming, equestrian, snowboarding and volleyball.

Conclusion:
Neck injuries frequently accompany sport-related concussions in youth. Future studies examining age-related disparities in neck strength by age and sex may provide additional insights in the prevention of sport-concussions among youth.
Biomechanical characteristics in asymptomatic individuals with femoroacetabular impingement (FAI) – a systematic review with meta-analysis.

BSc Leon Han Pay$^{1,2}$, PhD, MSc, PT Paulina Kloskowska$^2$, PhD, MSc, PT Dylan Morrissey$^2$

$^1$Imperial College School of Medicine, Imperial College London, Exhibition Road, SW7 2AZ, United Kingdom, $^2$Centre for Sports and Exercise Medicine, Barts and the London School of Medicine and Dentistry, Queen Mary University of London, Mile End Hospital, 275 Bancroft Road, E1 4DG, United Kingdom

Introduction:
Femoroacetabular impingement (FAI) is a morphological hip joint deformity associated with hip symptoms and early degenerative changes. Young male athletes have the highest prevalence of cam-FAI, although majority are asymptomatic and undiagnosed but may still have higher future injury risk. While biomechanical deficiencies have been demonstrated in symptomatic cam-FAI (sFAI-cam) individuals, corresponding literature in asymptomatic cam-FAI (aFAI-cam) individuals have not been reviewed. Our study aimed to synthesise and appraise literature reporting hip muscle function, range of motion (ROM) and joint kinematics in aFAI-cam individuals, contrasting findings with sFAI-cam individuals and healthy FAI-free controls.

Methods:
PubMed, Embase, CINAHL and Web of Science were systematically searched for studies investigating biomechanical characteristics in aFAI-cam individuals. Study quality was evaluated with a modified Downs and Black checklist. Standardised mean differences were calculated from extracted data and meta-analysis performed where possible.

Results:
12 studies (9 high-quality) met the inclusion criteria and 6 studies were quantitatively analysed. Strong evidence indicated that aFAI-cam individuals demonstrate significantly less hip ROM than healthy controls and significantly more hip ROM than sFAI-cam individuals. Limited evidence showed that aFAI-cam individuals exhibit significantly increased hip strength compared to both comparison groups.

Conclusion:
Overall, aFAI-cam individuals have biomechanical deficiencies compared to healthy controls, although to a smaller extent than sFAI-cam individuals, which may influence functional and athletic performance. Quantifying deficit magnitudes may aid in differentiating sFAI, aFAI and FAI-free individuals. However, this review was limited by methodological heterogeneity and paucity of included studies. More biomechanical research in this under-studied population is needed.
Biceps femoris long head proximal aponeurosis and muscle anatomy in athletes susceptible to hamstrings strain injury: a retrospective injury study

Dr. Thomas Balshaw¹², Dr. Thomas Maden-Wilkinson³, Dr. Garry Massey¹, As. Prof. Pui Wah Kong²⁴, Prof. Jonathan Folland¹²

¹ Loughborough University, School of Sport, Exercise, and Health Sciences, United Kingdom, ² Nanyang Technological University, Institute for Sports Research, Singapore, ³ Sheffield Hallam University, Faculty of Health and Wellbeing, United Kingdom, ⁴ Nanyang Technological University, National Institute of Education, Singapore

Introduction:
Biceps femoris long head (BFlh) proximal aponeurosis (APO) size is highly variable (and unrelated to muscle size) among healthy young men. Consequently, a relatively small APO may increase hamstrings strain injury (HSI) risk. However, this has not been investigated in athletes with repeated HSI history. The purpose of this study was to retrospectively compare BFlh APO and muscle size between athletes with and without HSI history.

Materials and Methods:
Thirty-four male athletes participated in the study: seventeen with repeated HSI history (INJ; ≥1 clinically verified BFlh injury); and seventeen with no HSI history (matched for sport and body mass; CON). Axial MRI T1 thigh images (3.0-T) were anonymized and manually segmented to assess BFlh muscle volume (VOL), maximum anatomical cross-sectional area (ACSAmax), APO area, and APO/muscle area ratio. Prone unilateral isometric knee flexion maximum voluntary torque (MVT) was also assessed.

Results:
MVT (INJ: 176±44 Nm; CON: 170±39 Nm), BFlh-VOL (INJ: 256±43 cm³; CON: 257±55 cm³) and BFlh-ACSAmax (INJ: 15.4±2.2 cm²; CON: 15.4±3.0 cm²) did not differ between groups (0.653≤P≤0.996). The INJ group tended to have smaller BFlh-APO area (-14%; 38.1±7.3 cm² vs. 44.5±12.7 cm²; P=0.081; Effect size [ES]=0.62) and BFlh-APO/muscle area ratio (-16%; 2.49±0.46 vs. 2.98±1.00; P=0.078; ES=0.62) compared to CON.

Conclusion:
The BFlh-APO was 14-16% smaller for HSI athletes compared to their HSI-free counterparts. This is the first empirical evidence that a smaller APO may be a risk factor for HSI. A large-scale prospective injury study now seems warranted to confirm the importance of BFlh APO size.
Can a knowledge translation implementation strategy improve the management of ankle sprains by Canadian Armed Forces physiotherapists?

Dr. Eric Robitaille\textsuperscript{1,2}, Maj Marsha MacRae\textsuperscript{1}, LCol Peter Rowe\textsuperscript{1}, Dr. Alice Aiken\textsuperscript{2}
\textsuperscript{1}Physiotherapy Section, Canadian Armed Forces Health Services, 4th Can Div Trg Centre, 112 Valour Rd, Canada, \textsuperscript{2}Dalhousie University, 4th Floor, Forrest Building 5869 University Avenue, Canada

Introduction:
Lateral Ankle Sprains (LAS) are the 3rd most common musculoskeletal injury among military members, resulting in considerable time loss and a substantial rehabilitation workload. The operational relevance of these consequences to the Canadian Armed Forces (CAF) should be minimized through the use of evidence based practices. The purpose of this research project was to use a comprehensive Knowledge Translation (KT) implementation strategy tailored for CAF Physiotherapists to improve their knowledge and use of the rehabilitation interventions and outcome measures recommended in the management of LAS.

Materials/Methods:
All CAF Physiotherapists were sent an email invitation to complete an online questionnaire investigating their knowledge and use of rehabilitation interventions and outcome measures recommended in the management of LAS. An active, multi-component KT intervention including; summarized research, practice tools and guided interaction, was then delivered to them via a distance learning platform. The primary outcome was the median change reported on the online questionnaire prior to and 3 months following the intervention.

Results:
Response rate to the online questionnaire was 75% (n=67/89). Respondents reported excellent knowledge and use of rehabilitation interventions recommended in LAS management between baseline & 3 months, and reported a change from poor to good or excellent knowledge and use of outcome measures recommended in LAS management between baseline & 3 months. Respondents reported a KT intervention preference for summarized research.

Conclusion:
Our findings suggest that a KT implementation strategy tailored for CAF Physiotherapists can improve their knowledge of and use of outcome measures recommended in LAS management.
Low prevalence of impaired bone health in professional ballet dancers

MSc Sarah Staal\textsuperscript{1}, Prof. Anders Sjödin\textsuperscript{1}, MSc Ida Lysdahl Fahrenholtz\textsuperscript{1}, MD, PhD Henrik Aagaard\textsuperscript{2}, PhD Anna Melin\textsuperscript{1}

\textsuperscript{1}Department of Nutrition, Exercise and Sports, University of Copenhagen, Rolighedsvej 26, Denmark, \textsuperscript{2}The Royal Danish Ballet, August Bournonvilles Passage 2-8, Denmark

Introduction:
Ballet dancers are reported to have an increased risk for persistent low energy availability (EA) closely related to metabolic, and endocrine perturbation with a potential increased risk for injuries and premature osteoporosis. We aimed to evaluate the prevalence of suppressed resting metabolic rate (RMR) as a recognized objective biomarker for low EA, low bone mineral density (BMD) and injuries and their interrelated associations in professional ballet dancers.

Materials and methods:
Female (n=20) and male (n=20) dancers, 19-35 years of age were enrolled. Measured (m) RMR was assessed by respiratory calorimetry (ventilated hood) and predicted (p) RMR was determined using the Cunningham equation. A ratio between mRMR and pRMR (RMR\text{ratio}) <0.90 was considered as suppressed RMR. The protocol further included assessment of BMD by DXA scan and prevalence of injuries the past year by questionnaire.

Results:
The prevalence of suppressed RMR was 80\% in males and 100\% in females. The prevalence of low BMD was 5\% for both genders, while 45\% of male and 35\% of female dancers reported to have had an injury during the past year. There were no associations between the prevalence of injuries and RMR\text{ratio}, between BMD and RMR\text{ratio} or between the prevalence of injuries and BMD for either gender.

Conclusion:
Despite a high prevalence of suppressed RMR, the prevalence of impaired bone health was low in this group of professional dancers suggesting that ballet has a protecting effect on bone mass.
Alterations in tendon mechanical properties in individuals with lower limb tendinopathy: a systematic review and meta analysis.

PhD Sean McAuliffe¹, Dr Helen Purtill², Dr Stephen Pearson³, Dr Peter Malliaras⁴, Dr Kieran O'Sullivan¹

¹Aspetar Orthopaedic and Sports Medicine Hospital, Aspire Zone, Sports City Street, Qatar, ²Department of Mathematics and Statistics, University of Limerick, Castletroy, Ireland, ³University of Salford, Allerton Building Frederick Road Salford, United Kingdom, ⁴Monash University, School of Primary and Allied Health Care Faculty of Medicine, Nursing and Health Science, Australia

Previous research indicates that tendinopathy may also alter a tendon’s mechanical properties. Mechanical properties of a tendon such as stiffness and strain play an important role in the storage and release of energy during stretch shortening cycle tasks.

A systematic search of the following databases was undertaken using an agreed set of keywords. Studies comparing tendon mechanical properties (stiffness, strain, stress, young’s modulus) between individuals with Achilles or patellar tendinopathy, and the uninjured side or asymptomatic controls were considered for inclusion. The review was registered in the PROSPERO database (CRD42017071051). The PRISMA statement for systematic reviews was used to reporting of this review. Risk of Bias was assessed with Joanna Briggs Institute Critical Appraisal Checklist.

Pooled meta-analysis revealed reductions in tendon stress (Hedges' g: 0.65; 95% C.I. -0.44, 1.74) and young’s modulus (Hedges' g: 0.73; 95% C.I. -1.04, 2.50) in symptomatic group. Sub group analysis revealed 1) large reductions in stiffness in Achilles (Hedges' g: 1.02; 95% C.I. 0.68, 1.35), with small reductions in patellar tendinopathy (Hedges' g: 0.34; 95% C.I. -0.22, 0.89). 2) Increased strain in both Achilles (Hedges' g: -1.09; 95% C.I. 1.55, -0.65) and Patellar tendinopathy (Hedges' g: -0.01; 95% C.I. -0.61, .60) compared to controls. Remaining variables for shear wave elastography, elongation, deformation, and hysteresis could not be pooled for meta analysis and demonstrated inconsistent effect sizes.

Individuals with Achilles or Patellar tendinopathy display alterations in tendon mechanical properties. The implications of these findings may have important clinical implications in the management of lower limb tendinopathy.
The acute effects of hip and knee exercises on pain ratings in young adult females with long-standing patellofemoral pain

MSc Christian L. Straszek1, PhD Michael S. Rathleff1,2, Prof. Thomas Graven-Nielsen3, PhD Kristian K. Petersen2, Prof. Ewa M. Roos4, PhD Sinead Holden1,2

1Research Unit for General Practice in Aalborg, Department of Clinical Medicine, Aalborg University, Aalborg, Denmark,

2SMI, Department of Health Science and Technology, Faculty of Medicine, Aalborg University, Aalborg, Denmark,

3Center for Neuroplasticity and Pain (CNAP), SMI, Department of Health Science and Technology, Faculty of Medicine, Aalborg University, Aalborg, Denmark,

4Research Unit for Musculoskeletal Function and Physiotherapy, Institute of Sports Science and Clinical Biomechanics, University of Southern Denmark, Denmark,

Introduction:
Patellofemoral pain (PFP) is a common musculoskeletal complaint. Exercise is the cornerstone of treatment, with evidence supporting combining local knee exercises, with hip exercises. In chronic pain, patients exercising non-painful regions experience an analgesic effect. On the other hand, exercising painful joints may cause acute pain flares. The aim of this analysis was to compare the acute effect of hip versus knee exercises on self-reported knee-pain in young females with long-standing PFP.

Materials and Methods:
Twenty-nine females (age 23 range: 21-24) who had PFP (median duration 8 years; range: 5-12) participated. Participants performed hip and knee exercise sessions, in a randomised order. Each exercise session consisted of 3 sets of 12 hip or knee exercises, with an elastic band providing resistance. Self-reported change in knee-pain was assessed on a numeric pain rating scale (NRS) before and immediately after each set. An increase or decrease in pain of 2 NRS points was considered clinically relevant.

Result:
There were no significant differences in change in pain (p=0.122) between hip and knee exercises. With an average increase of 0.7 (IQR: 0-1.3) and 1.1 (IQR: 0-1.7) during the hip and knee exercise respectively, neither exercise session induced a clinically relevant change in pain. An increase above 2 NRS points occurred in 26 of 58 sessions (hip: 10, knee: 16), (chi2 (1) = 1.3568, p=0.244).

Conclusion:
Despite experiencing PFP for 1/3 of their life, knee exercises was not found to cause clinically relevant greater or more acute pain flare compared to hip exercises.
Evaluating clinical recovery of dynamic balance in athletes with sports concussion using a multiple hop test: a prospective, cohort study.

PT Fionn Büttner¹, PhD Cailbhe Doherty¹, PhD David Howell², Prof. John Ryan², As. Prof. Catherine Blake¹, As. Prof. Eamonn Delahunt¹

¹UCD School of Public Health, Physiotherapy & Sports Science, Health Sciences Centre, University College Dublin, Ireland, ²Sports Medicine Center - Children’s Hospital Colorado, 13123 East 16th Avenue, Aurora, United States of America, ³St. Vincent’s University Hospital, Elm Park, Ireland

Introduction:
Deficiencies in postural balance performance increase the risk of sustaining musculoskeletal injuries. Whilst static postural balance performance recovers within 3-5 days following sport-related concussion, few studies have evaluated the natural time-course of recovery of dynamic postural balance performance. Thus, this prospective, case-control study aimed to investigate the recovery of dynamic postural balance among amateur athletes diagnosed with a sport-related concussion.

Materials and Methods:
Sixteen amateur athletes with a diagnosed sport-related concussion, as well as 16 sex-, age- and activity-matched controls participated. Participants attended a clinical assessment session on 3 separate occasions [within 7 days post-concussion; prior to return-to-sport; 2 weeks following return-to-sport; controls were assessed at matched time-points]. As part of this assessment participants were required to perform the multiple hop test, which is a clinically oriented assessment of dynamic postural balance. Standardized criteria are utilised to determine the number of errors made by participants when performing the test. A mixed-methods ANOVA was used to evaluate participants’ performance on the multiple hop test. The independent variables were: [1] group; [2] time. The dependent variable was the number of errors made whilst performing the multiple hop test.

Results:
Significant main effects for group (F = 12.17, p < 0.01, partial eta squared = 0.37) and time (F = 3.54, p < 0.05, partial eta squared = 0.14) were observed.

Conclusions:
The multiple hop test, a clinically oriented assessment of dynamic postural balance can identify latent deficits in dynamic postural balance performance in amateur athletes with a recent sport-related concussion.
Risk factors for patellofemoral pain: A systematic review & meta-analysis

MSc Bradley Neal¹,², PhD Simon Lack¹,², PhD Nienke Lankhorst³, Andrew Raye¹, PhD Dylan Morrissey¹,², As. Prof. Marienke Van Middelkoop¹

¹Sports and Exercise Medicine, Queen Mary University of London, , United Kingdom, ²Pure Sports Medicine, United Kingdom, ³Department of General Practice, Erasmus MC University Medical Centre, Netherlands, ⁴Physiotherapy Department, Barts Health NHS Trust, United Kingdom

Introduction:
Patellofemoral pain (PFP) is common amongst active individuals and has significant negative impact upon quality of life. In order to reduce PFP incidence, an improved understanding of risk factors is essential.

Materials and Methods:
Medline, Web of Science and SCOPUS were searched for prospective studies analysing at least 1 potential risk factor for PFP development. Two independent assessors graded study quality and data were pooled where appropriate.

Results:
18 studies were included, involving 4818 participants. 483 participants developed subsequent PFP, an incidence of 11%. 3 distinct homogenous subgroups were identified; including military recruits (incidence 11%), adolescents (incidence 11%) and recreational runners (incidence 6%). Moderate quality evidence indicates that low baseline quadriceps strength, measured concentrically or normalised anthropometrically using an isokinetic dynamometer, is a risk factor for PFP development in military recruits (SMD -0.69, CI -1.02, -0.35). There is moderate quality evidence that higher baseline hip abduction strength, measured with a hand-held dynamometer, is a risk factor for PFP development in adolescents (SMD 0.71, CI 0.39,1.04). Multiple variables of interest, including participant height, weight, BMI, body fat percentage, age and Q-angle, were not found to be risk factors for PFP development in any cohort.

Conclusion:
This review identifies multiple variables that do not predict PFP development, but shows quadriceps weakness in military recruits and increased hip strength in adolescents are risk factors for PFP. Large-scale prospective studies, perhaps involving novel study designs, are urgently warranted in the light of the consistently poor long-term outcomes of clinical trials.
Changes in isokinetic strength and single-leg hop test performance following arthroscopic meniscus surgery: A Cohort Study

PT Nathan Cardy¹, As.Prof Jonas Thorlund², Dr. John Quinlan⁴, Dr. Niall Hogan³, PT Aisling Brennan⁵, PT Kate McNulty⁶, As. Prof Fiona Wilson¹

¹Department of Physiotherapy, School of Medicine, Trinity College Dublin, Trinity Centre for Health Sciences, St.James’s Hospital, Ireland, ²Department of Sports Science and Clinical Biomechanics, University of Southern Denmark, University of Southern Denmark Campusvej 55 DK-5230 Odense M, Denmark, ³Department of Orthopaedics, St. James’s Hospital, Ireland, ⁴Department of Orthopaedics, Tallaght Hospital, Ireland, ⁵Department of Physiotherapy, Tallaght Hospital, Ireland, ⁶Department of Physiotherapy, St. James’s Hospital, Ireland

Introduction:
The benefit of arthroscopic meniscal surgery has been questioned, based primarily on patient reported outcome measures. Less is known about objective performance in patients who undergo meniscus surgery. The Trinity Meniscus Study investigated changes in objectively measured performance in a cohort of patients from before, to 6 months after arthroscopy.

Materials and Methods:
Participants were recruited from scheduled elective surgical lists at 2 orthopaedic departments in Dublin, Ireland over a 6 month period. 53 participants were tested pre-operatively. 43 were available for follow up at 6 months. Objective measures of isokinetic strength (60 deg/sec quadriceps and hamstrings: concentric/concentric) as well as single leg hop for distance (SLH) were measured at both appointments. Patients underwent standard care of home exercises following surgery.

Results:
Pre-operatively, there were significant deficits in the injured leg in all performance measures (p<0.05). At 6 months, deficits persisted in all tests compared to the contralateral leg; quads strength: Mean Difference (MD) 20.99Nm (95%CI; 12.85, 29.12. p<0.001), hamstring strength MD 4.83Nm (1.19,8.48. p=0.013), SLH MD 12.28cm (4.33,20.44. p<0.005). When comparing change over time in injured and contralateral leg performance, no significant difference was found between legs. MD in change score for quads strength was 6.35Nm (-14.06,1.35. p= 0.114), hamstring strength was 1.22Nm (-5.23,2.79. p=0.61), and SLH was 6.81cm (-13.73,0.10. p=0.063).

Conclusion:
Following arthroscopic meniscus surgery, deficits in strength and objective performance are still present at 6 months when compared to the contralateral leg. As performance improves in both legs similarly, current management does not eliminate performance deficits.
Lateral and medial patellofemoral joint retinacula are thicker in individuals with patellofemoral pain

PhD Simon Lack\textsuperscript{1,2}, Luke Anthony\textsuperscript{1}, Dr James Noake\textsuperscript{2}, Dr Kay Brennan\textsuperscript{2}, PhD Dylan Morrissey\textsuperscript{1,3}  
\textsuperscript{1}Centre for Sports and Exercise Medicine, Queen Mary University of London, Mile End Hospital, United Kingdom, \textsuperscript{2}Pure Sports Medicine, , United Kingdom, \textsuperscript{3}Physiotherapy Department, Bart’s Health NHS Trust, , United Kingdom

Introduction:  
Repeated loading, through altered patellofemoral joint mechanics, has been purported to drive patellofemoral pain (PFP). The consequential overload of the medial and lateral retinacula may elicit structural changes within these tissues that may be pertinent to the pathogenesis of the condition and are associated with functional deficits.

Materials and Methods:  
Medial and lateral patellofemoral joint retinacula of 32 knees (16 with PFP, 16 asymptomatic) were assessed using ultrasound imaging, in 3 sites 0.5cm apart, starting from the medial and lateral border of the patella respectively. PFP participants completed a Kujala questionnaire and both controls and PFP groups had their performance of 5 single leg squats assessed.

Results:  
Both the lateral (LR) and medial (MR) retinaculum where significantly thicker in individuals with PFP (group mean LR = 2.98mm, MR = 4.56mm) compared with controls (group mean LR = 2.56mm, MR = 3.8mm)(LR; p = 0.032, MR; p = 0.007). No significant correlation between retinacula thickness and either Kujala (LR; p = 0.9, MR; p = 0.9) or single leg squat performance (LR; p = 0.3, MR; p = 0.5) was observed.

Conclusion:  
A significant difference in both lateral and medial retinacula thickness between those with and without PFP indicates structural change that may be associated with the pathogenesis of the condition. The absence of significant correlation between retinacula thickness and function questions either the sensitivity of these measures to identify structural change or the association with structural change and functional deficits.
Jumping performance and muscle-tendon characteristics of the Maasai people

As. Prof. Jens Bojsen-møller¹,², Prof. Per Aagaard², Prof. Olivier Seynnes¹, MSc Herman Hernæs¹, MSc. Andreas Refsdal¹, Prof Peter Magnusson⁴, As. Prof Dirk Lund Christensen³

¹Norwegian School of Sport Sciences, Sognsveien 220, Norway, ²Institute of Sports Science and Clinical Biomechanics, University of Southern Denmark, Odense, Denmark, Campusvej 55, Denmark, ³Section of Global Health, University of Copenhagen, Øster Farimagsgade, Denmark, ⁴Institute of Sports medicine Copenhagen, Bispebjerg Hospital, Denmark

Introduction:
Understanding the mechanisms that underlie performance in maximal jumping has relevance for elite sports. One approach is to examine individuals that are known for superior jumping performance, and the purpose of the present study was to measure jumping capacity in Maasai jumpers, and to examine underlying anatomical and biomechanical characteristics in this population known for jumping performance.

Materials and methods:
A field study was carried out in Tanzania where 22 male Maasai jumpers (and 12 Norwegian controls) performed maximal and repetitive jumping on a force plate. Kinematic and kinetic data were obtained during jumping, and neural activation was recorded by use of electromyography. Stiffness of the Achilles tendon was evaluated by use of ultrasonography, and anthropometric characteristics were obtained.

Results:
The Maasai had shorter and more proximal calf muscles compared to controls, and longer Achilles tendons (gastrocnemius medialis tendon: 23.2+/−0.7 vs. 19.8+/−0.6 cm, P<0.05). Achilles tendon stiffness was greater in controls (241+/−15 vs 311+/−22 N/mm, P<0.05). Maximal jump height was similar between groups (46.5+/−4.3 vs 46.5+/−6.1 cm), but relative to body mass the Maasai jumped 20% higher. Jump execution was faster for the Maasai: eccentric deceleration phase (114+/−29 vs. 172+/−22 ms, P<0.05), concentric phase (213+/−38 vs 286+/−43 ms, P<0.05) allowing more shallow jumps with greater force, power, and rate of force development (150%).

Conclusion:
Although similar maximal jump height was observed between groups, the Maasai jumped comparable to highly explosive type elite jumpers. Significant anatomical and anthropometric differences may contribute to the highly efficient jumping technique of Maasai jumpers.
The importance of shoulder function for the risk of shoulder injuries differs between female and male adolescent elite handball players

PhD-student Martin Asker1,2, PhD Lena W Holm1, PhD Henrik Källberg1, PhD, MD Markus Waldén3, PhD Eva Skillgate1,2
1Karolinska Institutet, IMM, Musculoskeletal & Sports Injury Epidemiology Centre, , Sweden, 2Naprapathögskolan, Scandinavian College of Naprapathic Manual Medicine, , Sweden, 3Division of Community Medicine, Department of Medical and Health Sciences, Linköping University, , Sweden

Introduction:
Shoulder injuries are common in handball and shoulder strength, scapular dyskinesis and shoulder range of motion (ROM) are associated with these injuries. However no study has investigated potential gender differences in these associations.

Methods:
In total, 463 (50% females) uninjured elite adolescent handball players were measured for isometric external rotational (IER), internal rotational (IIR), abduction (IABD) and eccentric external rotational (EER) shoulder strength, ROM, shoulder joint position sense (JPS) and scapular dyskinesis during the pre-competitive period of either the 2014/15 or 2015/16 season. Players were thereafter monitored weekly during the competitive season regarding handball exposure and shoulder injuries using an online questionnaire. Hazard rate ratios (HRRs) were calculated using multivariable Cox proportional hazard models with an extensive confounding control.

Results:
In total, 48 new shoulder injuries were reported. In female players, low IER strength was a risk factor (HRR 2.94, 95% CI 1.11-7.85) and the same tendency was seen for IIR (HRR 2.64, 95% CI 0.91-7.69), whereas for male players low IABD strength tended to be a risk factor (HRR 2.21 95% CI 0.91-5.43). In male players, scapular dyskinesis was associated with a higher rate (HHR 3.43, 95% CI 1.44-8.05), whereas no such association was seen in female players (HRR 1.65 95% CI 0.40-7.10). No associations with shoulder injury were identified for ROM or JPS.

Conclusions:
Low rotational strength in the shoulder seems to be a risk factor for shoulder injuries in female players and scapula dyskinesis seems to be a risk factor in male players.
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