

## Free Paper Session VI: Sports Medicine

### FP6.1

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#### **Two All-inside Meniscus Repair Techniques in Repair of Ramp Lesions: A Prospective Cohort Study**

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**Introduction:** Ramp lesions are longitudinal tears of the posterior horn of the medial meniscus. The classic repair method is an all-inside technique within the posterior-medial compartment using a suture hook. The reported healing rate is high (89%-95%), but the learning curve is steep. All-inside repair using pre-loaded suture anchor (eg, Fastfix) is technically simpler and faster. However, it is not reported whether the healing rate after Fastfix-repair of ramp lesion is comparable to that of the classic suture-hook method.

**Methods:** A prospective cohort study was carried out to investigate the difference in the healing rate of repair of ramp lesion between these two techniques. The choice of method of meniscus repair was not randomised. Reassessment magnetic resonance imaging were performed at a minimum of 1 year after the index operation. Primary outcome assessed was rate of healing. Secondary outcome was incidence of repeated meniscus operation.

**Results:** A total of 76 patients were recruited (38 suture-hook repair, 38 Fastfix-repair). The mean follow-up was 49 (range, 12-118) months in the suture-hook group and 65 (range, 18-115) months in the Fastfix-repair group. Patients were 65 men and 11 women with mean age 27 (range, 18-56) years. The incidence of failed healing on reassessment magnetic resonance imaging was 14% in suture-hook group and 18% in Fastfix-repair group. The rate of repeated meniscus operation was 6% and 11%, respectively.

**Conclusion:** The healing rate of repaired ramp lesion was high (82%-86%) and was probably not dependent on the technique used.

### FP6.2

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#### **Effect of Posterior Tibia Loading and Graft Tension on Patellofemoral Joint Contact Pressure and Kinematics during Anterior Cruciate Ligament Reconstruction**

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### FP6.3

## Reverse Shoulder Arthroplasty in Geriatric Population with Massive Rotator Cuff Tear: Experience in a Local Hospital

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**Introduction:** Reverse shoulder arthroplasty (RSA) is an increasingly common option to treat patients with massive rotator cuff tear with or without arthropathy. The aim of this study was to investigate the predictive factors for good surgical outcome by analysing the clinical outcomes of geriatric patients who underwent RSA.

**Methods:** Patients aged  $\geq 65$  years who underwent RSA for massive rotator cuff tear without acute fracture, acute dislocation, or previous shoulder arthroplasty were recruited. The range of motion, pain score, and functional score before and after operation were retrieved from computerised medical records and phone interviews and compared. Complications including loosening, infection, and neurovascular injury were also recorded.

**Results:** Most patients had significant improvements in range of motion, significant reductions in pain, and improvements in daily function in terms of functional score. Age, sex, and concurrent medical disease were not statistically significant factors affecting the outcome. A case of transient postoperative posterior interosseous nerve palsy with good recovery was seen.

**Conclusion:** Reverse shoulder arthroplasty gives consistent promising results for patients aged  $\geq 65$  years with massive rotator cuff tears, with a negligible complication rate. Outcomes are equally good in those aged  $\geq 80$  years. We did not identify any predictive factors of clinical outcomes, which might be because of the small sample size of current study. Yet, judging from the rapidly ascending number of operations done in our centre in the past 2 years, we can be confident that more data will be reported.

### FP6.4

## Knee Wobbling during Single-leg Squat Can Reflect Dynamic Knee Instability in Patients with Anterior Cruciate Ligament Reconstruction

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**Introduction:** Recovery of knee stability is important after anterior cruciate ligament reconstruction (ACLR). Dynamic knee instability is often presented with giving-way episode. However, there is insufficient assessment for dynamic knee stability. Because poor knee control can be visualised as knee wobbling during single-leg squat (SLS), we propose to use SLS to evaluate dynamic knee stability. The aims of this study were (1) to compare kinematics characterising knee wobbling during SLS between ACLR patient with and without giving-way episode and (2) its association with lower limb muscle strength and balance performance.

**Methods:** Fifteen patients were recruited at 3 months after ACLR with ( $n=8$ ) or without ( $n=7$ ) giving-way episode. They were instructed to perform the SLS task, maintaining knee flexion angle of  $45^\circ$  for 10 s. Knee kinematics (range and frequency of flexion-extension, abduction-adduction and internal-external rotation) was captured by the 3-dimensional motion analysis system. Isometric muscle strength of knee flexion-extension, hip abduction, hip extension, and plantar flexion were tested by a hand-held dynamometer and balance performance was assessed by Y-balance test.

**Results:** Patients with giving-way episode demonstrated increased frequency of knee abduction-adduction when compared with those without ( $2.67 \pm 1.46$  vs  $1.43 \pm 0.42$ ;  $t=2.300$ ,  $p=0.049$ ). Correlation analysis showed that the frequency of knee abduction-adduction was negatively associated with hip abduction strength ( $r=-0.550$ ,  $p=0.034$ ). Knee kinematics were not associated with balance performance ( $p>0.05$ ).

**Conclusion:** Knee wobbling is more prominent in patients with giving-way episode, which reflects dynamic knee instability. Strengthening the hip abduction muscle may improve dynamic knee stability following ACLR.

## FP6.5

**Alteration of Quadriceps and Hamstrings Muscle Stiffness in Patients after Anterior Cruciate Ligament Reconstruction, and Its Association with Muscle Strength and Knee Function****WY Huang, X He, JTN Chan, PSH Yung, HT Leong***Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong, Hong Kong*

**Introduction:** Thigh muscle deficits are common in anterior cruciate ligament reconstruction (ACLR). In addition to muscle neuromuscular and morphological changes, the alteration of mechanical property (muscle stiffness) after ACLR remains unclear. Muscle shear modulus measured by ultrasound shear wave elastography can be used as an index of muscle stiffness. This study aimed to compare the quadriceps and hamstring stiffness between ACLR patients and healthy controls, and to investigate its correlation with knee muscle strength and function.

**Methods:** Twenty-nine participants (16 patients who underwent ACLR and 13 healthy controls) were recruited. Quadriceps and hamstring shear modulus were quantified during 30° knee flexion using ultrasound shear wave elastography. Isokinetic knee flexion/extension peak torque and total work were measured at 60°/s and 180°/s isokinetic test. Knee function was evaluated using International Knee Documentation Committee (IKDC) and Lysholm questionnaires.

**Results:** After ACLR, patients demonstrated decreased semitendinosus shear modulus when compared with their uninjured limb ( $10.41 \pm 3.26$  vs  $16.78 \pm 5.51$  kPa,  $p=0.001$ ) and decreased vastus medialis and semitendinosus shear modulus when compared with healthy controls ( $9.04 \pm 1.35$  vs  $10.7 \pm 1.37$  kPa,  $p=0.003$  and  $10.41 \pm 3.26$  vs  $16.95 \pm 4.92$  kPa,  $p=0.001$ , respectively). Correlation analysis showed lower semitendinosus shear modulus was associated with lower IKDC and Lysholm scores ( $r=0.528$ ,  $p=0.035$  and  $r=0.575$ ,  $p=0.020$ , respectively). No correlation was found between muscle strength and stiffness.

**Conclusion:** Quadriceps and hamstring stiffness was altered after ACLR. The alteration of hamstring stiffness may influence knee stability and cause worse knee function. The effect of modulation of the quadriceps and hamstring muscle stiffness to accelerate rehabilitation progress and prevent re-injury warrants future investigation.

## FP6.6

### **Preoperative Quadriceps Strength Association with Functional Recovery Following Anterior Cruciate Ligament Reconstruction: A Systematic Review**

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**Introduction:** About 35% patients cannot return to pre-injury level of sports after anterior cruciate ligament reconstruction (ACLR). Some studies proposed preoperative quadriceps strength (PRE-QS) was a predictor for functional recovery following surgery. However, it lacked clinical evidence for the associations between PRE-QS and the outcomes of ACLR.

**Methods:** Three databases (PubMed, Web of Science, Embase) were searched to identify studies that reported both PRE-QS measurements and postoperative functional outcomes of ACL reconstruction. Data were extracted regarding quadriceps strength assessment methods, PRE-QS, postoperative outcomes, follow-up time points, and the relevant results of individual study. The full report was written in accordance with PRISMA guidelines.

**Results:** Twelve prospective cohort studies (Coleman methodology score:  $64 \pm 9.35$ , range 47-78) with 1773 participants were included. Follow-up period ranged from 3 months to 2 years. Eight out of nine studies supported significant associations between PRE-QS and POST-QS. Five studies supported significant associations between PRE-QS and postoperative objective and subjective functional outcomes, which included patient-reported outcomes, single-leg hop symmetry, and Tegner activity scores. Five studies reported predictive values of PRE-QS.

**Conclusions:** Moderate evidence supports the significant association between PRE-QS and POST-QS; weak evidence supports the significant association between PRE-QS and postoperative functional outcomes. By now, there is no consensus on the predictive value of PRE-QS for achieving satisfactory outcomes after ACLR.

## FP6.7

### **Hamstring Grafts Pre-soaked with Vancomycin to Reduce the Risk of Infection after Anterior Cruciate Ligament Reconstruction: An Early Experience in a District General Hospital**

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**Introduction:** The purpose of this study was to investigate whether pre-soaking hamstring graft in a solution of vancomycin is effective way in reducing the risk of infection after anterior cruciate ligament reconstruction (ACLR).

**Methods:** We retrospectively reviewed data on 305 consecutive patients who underwent ACLR with hamstring autograft over a 7-year period. In the initial 4-year period, 185 patients (group 1) underwent ACLR with graft with preoperative intravenous antibiotic. In the subsequent 3-year period, 120 patients underwent ACLR with a vancomycin pre-soaked graft together with preoperative intravenous antibiotic. After graft harvest, the grafts were soaked in a vancomycin solution. The graft was then fastened within the graft sizing tube and wrapped by a sterile gauze also soaked with vancomycin solution.

**Results:** Three (1.6%) culture-positive joint infections were documented in group I, requiring arthroscopic debridement. In group 2 no (0%) infections were recorded. There were no reported adverse effects related to the vancomycin graft soaking, such as premature graft degeneration requiring revision surgery, allergic reaction among surgeons, or systemic vancomycin toxicity.

**Conclusion:** Soaking hamstring autografts in vancomycin after harvest and before grafting is a safe and simple method to reduce the risk of complications in ACLR. This pre-soaking of hamstring autografts in vancomycin is more effective in reducing infection rates than preoperative intravenous antibiotics alone.

**FP6.8****Scapular-focused Exercise Training Has Immediate and Short-term Effect on Pain, Function, Scapular Muscle Strength, and Subacromial Space in Patients with Rotator Cuff Tendinopathy****HT Leong, CC Ma, PSH Yung***Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong, Hong Kong*

**Introduction:** Patients with rotator cuff tendinopathy demonstrate scapular muscle deficits; unfortunately, current conservative treatment often fails to address scapular muscle deficits in patients with rotator cuff tendinopathy. This study aimed to investigate the immediate and short-term effects of 6-week scapular-focused exercise training on pain, function, scapular muscle strength, and subacromial space in patients with rotator cuff tendinopathy.

**Methods:** A total of 19 patients with rotator cuff tendinopathy (mean age, 53 years) participated in this study. The scapular-focused exercise training consists of strengthening of middle trapezius, lower trapezius and serratus anterior with two sessions per week for 6 weeks. Self-perceived shoulder pain and disability using the Shoulder Pain and Disability Index (SPADI); the peak isometric force of scapular strength measured by handheld dynamometer; and ultrasound measurement of subacromial space were assessed at 6 weeks and 3 months after intervention.

**Results:** The total SPADI score decreased by 40% at 6 weeks and by 55.3% at 3 months after intervention ( $p < 0.001$ ). There was a significant increase in the normalised peak strength of the middle trapezius, the lower trapezius, and the serratus anterior at 6 weeks and at 3 months after intervention (all  $p < 0.025$ ). The subacromial space was significantly increased at 6 weeks and at 3 months after intervention ( $p = 0.016$ ).

**Conclusion:** Scapular-focused exercise programme has immediate and short-term effects on pain reduction, improving function, and preserving the subacromial space in patients with rotator cuff tendinopathy. This simple and low-cost exercise programme can be adopted into our routine clinical practice for the management of rotator cuff tendinopathy.

**FP6.9**

**Maximum Dose of Magnesium/Vitamin C Isotonic Irrigation Saline Exaggerates Postoperative Quadriceps Atrophy in Contralateral Limbs after Anterior Cruciate Ligament Reconstruction in a Rat Model**

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**Introduction:** Quadriceps atrophy is a major obstacle for recovery after anterior cruciate ligament reconstruction (ACLR). Perioperative control on knee swelling and pain may help to reduce arthrogenic muscle inhibition and thus limit the extent of muscle atrophy. We previously showed that irrigation with magnesium chloride and vitamin C (MgVc) saline during ACLR reduced knee swelling in rat model of ACLR. In the present study, we investigated the effect of MgVc irrigation on muscle atrophy.

**Methods:** Six male Sprague-Dawley rats aged 12 weeks were assigned to receive MgVc irrigation with MgCl<sub>2</sub> (90 mM) and vitamin C (15 mM) isotonic saline or normal saline (control) during unilateral ACLR according to established protocol. Assessments on locomotive behaviour by open field analysis and knee swelling were performed at before surgery and at day 1, 3, 7, and 14 after surgery. Rats were euthanised on day 15 after surgery for weighing of quadriceps muscles and histological examination.

**Results:** Knee swelling was alleviated in the MgVc group at day 1 after surgery, compared with the control group. However, the MgVc group did fewer spontaneous ambulatory activities at day 3 after surgery than did the control group. Both groups had significant weight loss in quadriceps muscles on the operated side (~23%), but the contralateral side in the MgVc group had greater weight loss than did the control group (10% vs 6%). The quadriceps muscle atrophy was attributed to a loss of large-size muscle fibres.

**Conclusion:** Our preliminary findings suggested that MgVc isotonic irrigation saline at a maximum dose for isotonic solution exerted a negative effect on quadriceps atrophy after ACLR surgery, presumably owing to lower levels of activity after surgery.

**FP6.10****Revision Anterior Cruciate Ligament Reconstruction: Medium- to Long-term Outcome****GYK Law, X He, MTY Ong, CK Lo, PSH Yung***Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong, Hong Kong*

**Introduction:** This study aimed to evaluate the medium- to long-term results and to determine factors influencing outcome of revision anterior cruciate ligament reconstruction (ACLR).

**Methods:** A total of 41 patients who had undergone revision ACLR in 2011 to 2015 were reviewed retrospectively and 30 of them were enrolled to have patient-reported outcome measures, and kinematic and functional assessments.

**Results:** The average KT-1000 side-to-side difference was 3 mm (range, 0-10.5 mm). In all, 96.6% of patients achieved stable pivot shift. The mean Lysholm and International Knee Documentation Committee (IKDC) scores were 85.5 (range, 43-100) and 83.7 (range, 48.3-100), respectively. The mean Tegner activity levels before and after the operation were 8.3 (range, 6-10) and 6.6 (range, 4-10), respectively. Of the patients, 63% returned to previous sport whereas only 37% returned to pre-injury level. The mean interval before returning to sport was 12 months (range, 6-36 months). Fear of re-injury was the most common reason of not returning to sport. Higher IKDC score, better single-leg hop distance, younger age, and use of bone patellar tendon graft were identified as positive prognostic factors of returning to pre-injury level. Higher IKDC score and better single-leg hop distance were found to be positive prognostic factors of returning to previous sport. Three (7.3%) patients got re-tear of graft and one (2.4%) patient with generalised ligamentous laxity was re-operated for persistent knee laxity.

**Conclusion:** Revision ACLR remains challenging with less predictable result. However, with proper graft choice and comprehensive rehabilitation, especially on the functional and psychological aspects, returning to sport can still be achieved.

**FP6.11****Inflammatory Cells and Markers in Human Chronic Tendinopathy: A Systematic Review****CK Kwan,<sup>1</sup> G Jomaa,<sup>2</sup> SC Fu,<sup>1</sup> SKK Ling,<sup>1</sup> C Rolf,<sup>2</sup> PSH Yung<sup>1</sup>***<sup>1</sup>Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong, Hong Kong**<sup>2</sup>Division of Orthopaedics and Biotechnology, Karolinska Institute, Sweden*

**Introduction:** The controversiality of the presence of inflammation in chronic tendinopathy may be a reason leading to suboptimal clinical outcomes using anti-inflammatory drugs. We aimed to assess whether tendinopathy involves an on-going inflammatory process, in terms of the presence of inflammatory cells or increased expression of inflammatory markers.

**Methods:** In this systematic review, studies were included that mentioned either the presence of inflammatory cells or inflammatory markers in tendon specimens from human patients clinically diagnosed with tendinopathy. Quality assessment was performed with the CASP tool. The full report was compiled in accordance with the PRISMA guidelines.

**Results:** The search yielded 53 studies in total. In all, 39 out of 53 studies suggested the presence of inflammation in tendinopathic tendons, and the presentation of inflammation was not limited any locations nor ruptured tendons. The most frequently reported cell types were macrophages, mast cells, and t-cells. Inflammatory markers increased in tendinopathy included interleukins, cyclooxygenases, transforming growth factor- $\beta$ , and tumour necrosis factor- $\alpha$ . Studies which reported an absence of inflammation shared a common feature of only using haematoxylin-eosin staining to assess for the presence of inflammatory cells.

**Conclusion:** Chronic inflammation is observed in tendinopathic tendons, while reported absence of inflammation maybe due to non-specific staining techniques. Results support the use of anti-inflammatory treatment in management of chronic tendinopathy. Suboptimal clinical outcome with the current strategy may be due to the lack of focus to the causes leading to chronic inflammation, or the side-effects of failed tendon healing from the inhibition of inflammation.

**FP6.12**

**Smartphone Applications Effect on the Adherence and Outcome of Postoperative Rehabilitation after Anterior Cruciate Ligament Reconstruction: A Randomised Controlled Trial**

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**Introduction:** Rehabilitation after anterior cruciate ligament (ACL) reconstruction is essential for good outcomes. Smartphone health-related applications have been shown to improve the therapy adherence rates of patients. This study investigated the effect of a health-related smartphone application in promoting treatment adherence and outcome of rehabilitation after ACL reconstruction.

**Methods:** A smartphone application was designed for ACL rehabilitation. Patients were recruited and randomised into two groups, the treatment group with the installation and the control group without the installation of the smartphone application. International Knee Documentation Committee (IKDC) scores, arthrometric measurements (KT-1000), isokinetic muscle strength assessments, and psychological measurements were recorded at baseline and at 2 and 4 months after ACL reconstruction surgery.

**Results:** A total of 94 patients were initially recruited, and the treatment group had a significantly lower dropout rate than the control group. Sixty-three patients completed the final assessments, with 31 in the treatment and 32 in control group. There was no significant difference between the two groups for IKDC, muscle strength, and KT-1000. For the control group, perceived behavioural control, subjective norm and intention, and behavioural adherence were significantly lower at 4 months ( $p > 0.01$ ) compared with baseline. There was no significant difference in adherence between the two groups. Adherence correlated with better muscle strength. The adherence frequency at 4 months after surgery was significantly correlated with peak torque flexion in the treatment group.

**Conclusion:** The smartphone application showed a positive effect on the psychological parameters of the patients but this did not translate into a corresponding change in behaviour or adherence.



**FP6.14****Risk of Contralateral Anterior Cruciate Ligament Tear and Ipsilateral Graft Rupture at 10 Years after Anterior Cruciate Ligament Reconstruction****CK Lo,<sup>1</sup> MTY Ong,<sup>2</sup> PSH Yung<sup>2</sup>**<sup>1</sup>*Department of Orthopaedics and Traumatology, Prince of Wales Hospital, Hong Kong*<sup>2</sup>*Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong, Hong Kong*

**Introduction:** Anterior cruciate ligament (ACL) reconstruction produces reliable outcomes, but also places patients at increased risk for both ipsilateral graft rupture and contralateral ACL tear, which is a devastating potential outcome after successful ACL reconstruction. The aims of this study was to investigate the failure rate of ACL reconstruction, in order to identify the risk factors and optimise rehabilitation so as to decrease the incidence of second ACL injury.

**Methods:** Patients who underwent ACL reconstruction in 2008 were surveyed to determine the number of ACL graft rupture and tears of ACL in the contralateral knee at 10-year follow-up examination. Age, sex, laxity, graft choice, age at first operation, and level of sport activity were evaluated as possible risk factors leading to a second ACL surgery.

**Results:** Data were retrospectively reviewed for a total of 166 patients. The mean age at 10-year follow-up was 27.6 years. In all, 86% of patients were male. There were 13 ligament disruptions which included eight ACL graft ruptures (4.8%) and five tears of the intact ACL in the contralateral knees (3.0%). Younger age at first operation and return to contact sports increased the chance of both an ipsilateral graft tear and contralateral ACL injury.

**Conclusion:** These results show that incidence of ACL graft rupture was slightly higher than that of contralateral ACL injury. This information would be useful in counselling patients with regard to the expected outcome of ACL reconstruction. Further studies are needed to identify modifiable risk factors for these injuries and optimise rehabilitation to prevent further ACL injuries.

## FP6.15

### **Psychological Factors in Patients with Rotator Cuff Tendinopathy: A Systematic Review**

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**Introduction:** Psychological elements play a vital role in the recovery of individuals with rotator cuff tendinopathy. The aims of this systematic review were to summarise the psychological factors that may be related to rotator cuff tendinopathy and to determine if these psychological factors affect patient-reported outcomes including pain, function, and quality of life.

**Methods:** Studies reporting the psychological factors associated with rotator cuff tendinopathy and patient-reported outcomes were searched with appropriate keywords via Embase, Medline/PubMed, CINAHL, and Web of Science from inception to September 2018. Search results were reviewed to yield relevant clinical studies according to the inclusion criteria.

**Results:** Of 1628 relevant studies, nine were included in the final analysis. Moderate evidence suggests that depression, anxiety, and sleep disturbance were associated with rotator cuff tendinopathy. Moderate evidence showed that depression, anxiety, distress, fear of pain, pain catastrophising, expectation, emotion, and mental health were associated with pain in patients with rotator cuff tendinopathy. Moderate evidence showed that depression, anxiety, distress, expectation, and mental health were associated with functional abilities in patients with rotator cuff tendinopathy. Moderate evidence showed that depression, anxiety, and expectation were associated with quality of life in patients with rotator cuff tendinopathy.

**Conclusion:** Depression, anxiety, and sleep disturbance were associated with rotator cuff tendinopathy, and various psychological factors may affect patient-reported outcomes in patients with rotator cuff tendinopathy. In clinical practice, biopsychosocial interventions may be incorporated in the management for rotator cuff tendinopathy and these warrant further investigations.

## FP6.16

### **Anterior Cruciate Ligament Reconstruction Prevents Posteromedial Osteoarthritis and Lateral Osteoarthritis: An 11-23-Year Follow-up Study of 110 Patients**

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